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**BANKING DEVELOPMENT AND THE ECONOMIC IMPACT OF NATURAL
DISASTERS: FROM SHORT TO LONG TERM EFFECTS**

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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 examines the economic effects of natural disasters, specifically earthquakes, on local economies in Italy, focusing on the roles that financial development and banking structures play in shaping recovery and resilience. Using municipal-level data across all Italian seismic events from 2008 to 2022 we provide a refined analysis of post-disaster economic dynamics. Our findings reveal that while the immediate impact of earthquakes on employment is limited, the number of enterprises initially declines, followed by significant recovery and growth over the long term. The presence of banking institutions, particularly cooperative banks, plays a crucial role in facilitating this recovery, underscoring their importance in stabilizing local economies.

Keywords: Natural disasters; Financial development; Banking structure; Economic development.

JEL codes: Q54, G21, G38.

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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 (Albala-Bertrand, 1993; Skidmore and Toya, 2002; Crespo et al., 2008; Porcelli and Trezzi, 2019). 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. 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 indicate that earthquakes have a differential impact on the number of workers and enterprises, with positive effects emerging in municipalities with a banking presence. In the medium and long term, the presence of general and cooperative banks appears to enhance economic resilience, supporting both employment and business growth following a seismic event. In contrast, municipalities lacking cooperative bank branches exhibit delayed or weaker recovery, underscoring the unique role cooperative banks play in the post-disaster context. The analysis of banking activity post-earthquake reveals a significant decline in both deposits and loans for the overall banking sector, potentially reflecting persistent economic challenges or conservative lending practices in response to increased credit risk in affected areas. By contrast, cooperative banks show a more robust positive response, with significant and sustained increase in loan volumes across the short, medium, and long term. This highlights the pivotal role of cooperative banks in providing essential financial support to local communities in the aftermath of a disaster. Finally, the sectoral analysis uncovers heterogeneous effects, with sectors such as construction showing marked recovery and expansion, while others, like accommodation and food services, experience prolonged negative impacts. These findings emphasize the sector-specific pathways through which banking support facilitates recovery, especially in more vulnerable industries.

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 growth effects are often mixed. For instance, Felbermayr and Groschl (2014) show that while disasters frequently cause substantial short term losses, growth rates generally return to pre-disaster levels over time. In Italy, Porcelli and Trezzi (2019) report minimal post-earthquake reductions in output and employment, with reconstruction efforts sometimes even offsetting initial losses. By contrast, Aguirre et al. (2023) document a sustained 10% decline in economic activity in Chilean municipalities eight to nine years after the 2010 earthquake, underscoring the long term challenges some regions face in recovery. 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, Cortes 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 and historical earthquakes, outlining the impact of these events on local economies. 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. Section 5 concludes.

2 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 enterprises. Moreover, understanding these dynamics is especially important due to the central role that the banking system plays in Italy’s economic development (Guiso et al., 2004; Alessandrini et al., 2009; D’Onofrio et al., 2019; Coccoresse and Shaffer, 2021). Banks are the primary source of financing for businesses, providing essential funds for investments and growth, a role that becomes even more critical during periods of crisis, such as after natural disasters (Peruzzi et al., 2023). In such times, access to financial resources is vital for recovery, enabling businesses to rebuild, rehire, and stabilize local economies. Therefore, analyzing the influence of banking development on post-disaster economic outcomes offers valuable insights into how financial institutions can support long-term resilience in the face of seismic risks.

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.

The data on seismic events come 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 (M_w), which measures the total energy released by an earthquake. While the M_w 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.¹ Based on this criterion, 535 municipalities were classified as treated, having experienced at least one earthquake of this intensity between 2008 and 2022.

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 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., 2019; 2021; Peruzzi et al., 2023). The

¹Our results remain robust when this threshold is raised, defining treated municipalities as those experiencing an earthquake with a Mercalli intensity of at least 6.

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. 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, 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):

$$Y_{it} = \alpha_i + \alpha_t + \beta D_{it} + \epsilon_{it} \quad (1)$$

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} is a dummy variable equal to one for each year after municipality i is exposed to the earthquake, and zero otherwise (i.e., if the municipality has not yet experienced the earthquake in year t or never experiences it); and ϵ_{it} is the error term. Our DiD coefficient β captures the change in the (log) number of workers and enterprises in municipalities exposed to the shock, compared to changes in outcomes among those not (or not yet) exposed. 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.²

4 Results

In this section, we discuss our main findings. First, we present the core results on the impact of earthquakes on the number of workers and enterprises, and the role played by banking development (4.1). Then, we perform a set of robustness checks (4.2) and analyze the impact of seismic events on banking activity, specifically examining how earthquakes influence the volume of loans extended and deposits obtained by banks (4.3). Finally, we explore the

²In both approaches, standard errors are robust and clustered at the province (NUTS-3) level.

differential effects of earthquakes on workers and enterprises across various sectors, recognizing that different industries may be affected differently by natural disasters (4.4).

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 (Panels A, B, and C). The analysis is performed on the full sample of municipalities, as well as on various subsamples classified according to the presence of bank branches and cooperative bank (CB) branches.

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. In municipalities without CB branches, the impact of earthquakes is more negative, particularly in the short term. In the 3-year window, there is a significant reduction in enterprises, with an average treatment effect of -0.0085 (statistically significant at the 90% level), indicating that business activity is more severely affected in these areas. The effect on workers is negative but not significant. In the long-term, however, the effect on the number of enterprises turns positive, with an increase of 1.2% in the (log) number of businesses (statistically significant at the 95% level).

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. Conversely, in areas without CB branches, the effects of earthquakes are generally negative, particularly in the short 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 faster and 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 and in those without CB branches.

4.2 Robustness checks

To test the robustness of our findings, in this section we re-estimate our baseline regressions using a matched sample of municipalities. The matching process allows us to create a more comparable set of treated and untreated municipalities by accounting for several observable characteristics. This approach helps address potential biases that could arise from differences between the two groups. More specifically, to implement the matching, we first estimate a probit model where the dependent variable is a dummy equal to one for treated municipalities, and zero otherwise. This probit regression includes 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*). Moreover, it requires a tolerance level for the maximum propensity score distance (caliper) between the treatment and the control groups equal to 0.001 (Murro and Peruzzi, 2019). Once the treatment and control groups are formed, we rerun the baseline regression in Equation (1).

The results, as reported in Table 3, confirm the robustness of our findings. In the matched sample, the impact of earthquakes on the number of enterprises remains significant across different time windows (3-year, 5-year, and 10-year), particularly in municipalities with a banking presence. Specifically, the positive effect on the number of enterprises persists, with an even stronger magnitude observed in the medium and long term. These results reinforce the importance of banking development in facilitating economic recovery after earthquakes. Additionally, the impact on workers shows a consistent pattern with the baseline results, with positive effects becoming more prominent in the medium and long term, especially in municipalities with bank and CB branches. This suggests that the presence of banking institutions continues to play a crucial role in stabilizing employment levels over time.

In Appendix Tables A3 and A4, 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 A3). 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 the set of municipality-specific controls used in the matching approach (population size, number of bank branches per inhabitant, distribution of population by age groups, share of enterprises by industry, and municipal area) into our baseline regressions (Table A4). Even with these additional controls, the positive effect of earthquakes on enterprises persists, except in municipalities without CB branches (columns 7-8), across the short, medium and long term, further reinforcing our main results.

4.3 Earthquakes and banking activity

The results discussed above underscore a positive medium and long term impact of earthquakes on the number of workers and enterprises in municipalities with a banking presence, both general and cooperative banks. By contrast, municipalities without CB branches generally experience negative effects, especially in the short term. This variation highlights the crucial role that financial institutions play in the recovery phase, where they seem to support and, in some cases, facilitate local economic growth after a natural disaster. The finance literature shows 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, 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.

In this section, we seek to gain deeper insights into the role of banks following earthquakes by examining the impact on banking operations. We are unable to test the hypothesis of recovery lending directly, i.e. whether banks provide increased loans to aid the recovery process after a natural disaster. However, we can provide suggestive evidence on this from by examining how banking activity, in terms of loans extended and deposits obtained, changes after an earthquake. By analyzing these variables, we gain insights into whether banks are playing a supportive role in post-disaster recovery. The results of these analyses are presented in Table 4, where we test the impact of earthquakes on the volume of loans and deposits (per 1,000 inhabitants) in the overall banking sector³ (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.

³The results remain consistent when the analysis is conducted exclusively on loans and deposits from non-cooperative banks.

4.4 Heterogeneous effects: Industry sectors

In this section, we explore the impact of earthquakes on various sectors of economic activity, focusing on construction, accommodation and food services, services, and manufacturing. The effects of earthquakes can differ greatly across sectors due to variations in their operational structures, reliance on local infrastructure, and vulnerability to economic disruptions. Moreover, the development of the banking sector plays a critical role in shaping the speed and strength of recovery, as access to financial resources, essential during the post-disaster rebuilding phase, varies across industries, influencing the resilience of each sector.

The results of these analyses are presented in Tables from 5 to 8, 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 5 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, although it loses significance in the 3-year window for enterprises in municipalities without cooperative bank branches. These findings align with the immediate demand for rebuilding damaged infrastructure, homes, and commercial properties, and highlight the pivotal role played by cooperative 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 6, 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 7 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 8, 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.

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, plays a crucial role in mitigating short term negative effects and promoting long term economic resilience. Cooperative banks demonstrate a unique ability to stabilize local economies post-disaster by sustaining lending and supporting business growth, emphasizing their central position in economic recovery. 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.

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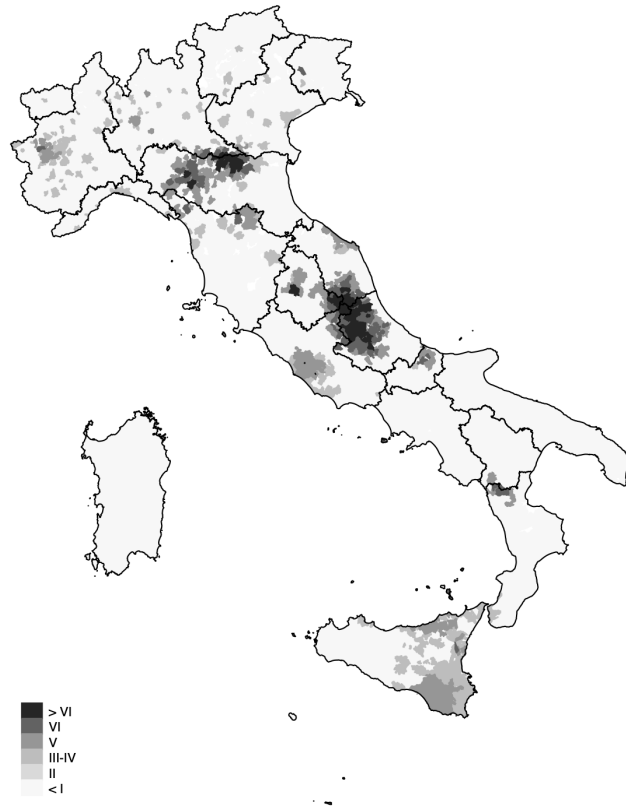
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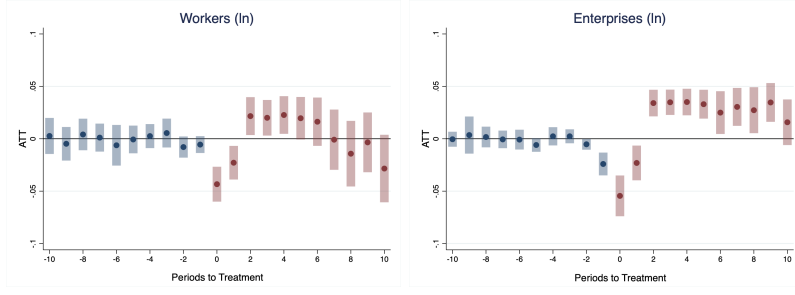
Tables and Figures

Figure 1
Major earthquakes in Italian municipalities (2008-2022)

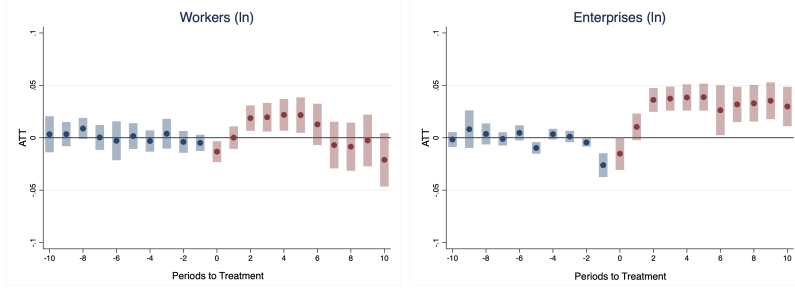


Notes: The map displays seismic events across Italian municipalities from 2008 to 2022, categorized according to the Mercalli intensity scale, as shown in the legend. In municipalities where multiple events occurred, the highest Mercalli intensity recorded has been selected.

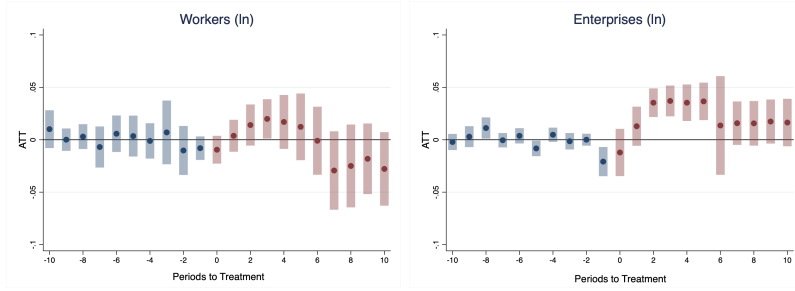
Figure 2
Banking development and the economic effects of earthquakes



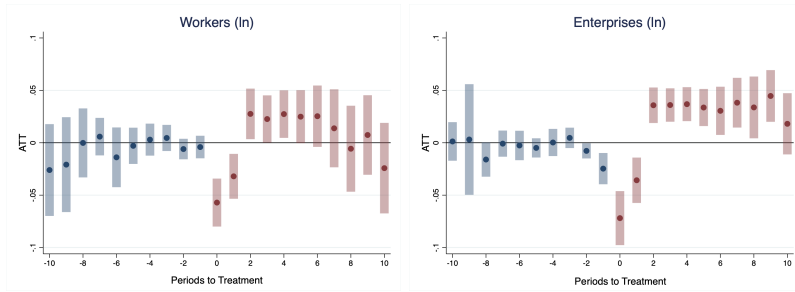
(a) Full sample



(b) Subsample of municipalities with bank branches



(c) Subsample of municipalities with cooperative bank branches



(d) Subsample of municipalities without cooperative bank branches

Notes: 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. Subfigure (d) plots the results for the subsample of municipalities without 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.

Table 1
Summary statistics

	Full sample			Treated		Untreated		t-test
	Obs.	Mean	Std. Dev.	Mean	Obs.	Mean	Obs.	
Workers	118431	2167.003	16700.655	9449.167	8025	1637.689	110406	-11.547
Enterprises	118431	610.030	4327.206	2509.497	8025	471.965	110406	-11.735
Bank branch (0/1)	126336	0.688	0.463	0.794	8560	0.680	117776	-24.950
CB branch (0/1)	126336	0.331	0.471	0.352	8560	0.330	117776	-4.051
Bank loans	126452	196806.481	4632990.479	1583467.868	8560	96122.622	117892	-7.790
Bank deposits	126452	149564.144	2767082.055	1016033.937	8560	86650.788	117892	-8.206
CB loans	126336	17214.385	106451.734	44095.143	8560	15260.683	117776	-7.556
CB deposits	126336	16062.727	82830.270	36752.024	8560	14559.021	117776	-7.920
# Bank branches	126327	0.445	0.490	0.469	8560	0.443	117767	-5.788
Population	126327	7596.150	42099.966	26096.078	8560	6251.467	117767	-12.680
% Population 0-24 years	126327	0.219	0.039	0.213	8560	0.219	117767	13.923
% Population 25-44 years	126327	0.245	0.037	0.244	8560	0.245	117767	3.010
% Population 45-64 years	126327	0.294	0.027	0.291	8560	0.294	117767	12.080
% Population +65 years	126327	0.243	0.057	0.252	8560	0.242	117767	-15.830
Municipal area	122576	38.046	50.606	64.139	8368	36.135	114208	-29.419

Notes: 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.

Table 2
Baseline results

Dependent variable	Full sample				Municipalities with bank branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
Model	DiD	CS	DiD	CS	DiD	CS	DiD	CS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A: 3-year window</i>								
ATT	-0.0076 (0.0059)	-0.0056 (0.0045)	-0.0095*** (0.0036)	-0.0053 (0.0036)	0.0027 (0.0046)	0.0029 (0.0028)	0.0019 (0.0026)	0.0065** (0.0028)
<i>Panel B: 5-year window</i>								
ATT	-0.0017 (0.0051)	0.0008 (0.0047)	-0.0026 (0.0032)	0.0036 (0.0035)	0.0057 (0.0040)	0.0063* (0.0033)	0.0053** (0.0023)	0.0121*** (0.0031)
<i>Panel C: 10-year window</i>								
ATT	-0.0032 (0.0046)	-0.0009 (0.0061)	-0.0007 (0.0029)	0.0098** (0.0043)	0.0044 (0.0036)	0.0033 (0.0044)	0.0055*** (0.0021)	0.0159*** (0.0039)
Dependent variable	Municipalities with CB branches				Municipalities without CB branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
Model	DiD	CS	DiD	CS	DiD	CS	DiD	CS
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>Panel A: 3-year window</i>								
ATT	-0.0001 (0.0071)	0.0022 (0.0043)	0.0048 (0.0038)	0.0077** (0.0037)	-0.0092 (0.0080)	-0.0078 (0.0061)	-0.0141*** (0.0050)	-0.0100** (0.0048)
<i>Panel B: 5-year window</i>								
ATT	0.0042 (0.0062)	0.0044 (0.0053)	0.0084** (0.0033)	0.0119*** (0.0031)	-0.0021 (0.0069)	0.0007 (0.0064)	-0.0059 (0.0044)	0.0011 (0.0047)
<i>Panel C: 10-year window</i>								
ATT	0.0038 (0.0056)	-0.0017 (0.0069)	0.0077** (0.0031)	0.0118** (0.0047)	-0.0035 (0.0063)	0.0015 (0.0082)	-0.0030 (0.0040)	0.0102* (0.0059)

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. In columns (13)-(16), we focus on the subsample of municipalities without cooperative bank (CB) branches. 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 3
Robustness check: Matched sample

Dependent variable Model	Full sample				Municipalities with bank branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
	DiD	CS	DiD	CS	DiD	CS	DiD	CS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A: 3-year window</i>								
ATT	-0.0032 (0.0057)	-0.0038 (0.0046)	-0.0073** (0.0036)	-0.0038 (0.0037)	0.0067 (0.0044)	0.0044 (0.0029)	0.0042 (0.0026)	0.0080*** (0.0029)
<i>Panel B: 5-year window</i>								
ATT	0.0040 (0.0050)	0.0033 (0.0049)	0.0004 (0.0031)	0.0057 (0.0036)	0.0100*** (0.0039)	0.0084** (0.0034)	0.0081*** (0.0023)	0.0140*** (0.0032)
<i>Panel C: 10-year window</i>								
ATT	0.0035 (0.0046)	0.0033 (0.0063)	0.0036 (0.0029)	0.0133*** (0.0045)	0.0093*** (0.0035)	0.0064 (0.0046)	0.0092*** (0.0021)	0.0188*** (0.0040)
Dependent variable Model	Municipalities with CB branches				Municipalities without CB branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
	DiD	CS	DiD	CS	DiD	CS	DiD	CS
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>Panel A: 3-year window</i>								
ATT	0.0051 (0.0063)	0.0029 (0.0044)	0.0059* (0.0036)	0.0087** (0.0038)	-0.0048 (0.0079)	-0.0053 (0.0064)	-0.0113** (0.0050)	-0.0081 (0.0050)
<i>Panel B: 5-year window</i>								
ATT	0.0089 (0.0055)	0.0055 (0.0054)	0.0097*** (0.0032)	0.0130*** (0.0039)	0.0044 (0.0069)	0.0042 (0.0067)	-0.0016 (0.0044)	0.0038 (0.0049)
<i>Panel C: 10-year window</i>								
ATT	0.0092* (0.0051)	0.0007 (0.0071)	0.0095** (0.0030)	0.01340*** (0.0048)	0.0042 (0.0064)	0.0074 (0.0086)	0.0030 (0.0040)	0.0151** (0.0062)

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 sample of matched (treated and not yet/never treated) 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. In columns (13)-(16), we focus on the subsample of municipalities without cooperative bank (CB) branches. 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 4
Earthquakes and banking activity

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

Table 5
Heterogeneous effects: Construction sector

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	0.0363*** (0.0085)	0.0161*** (0.0056)	0.0405*** (0.0067)	0.0262*** (0.0049)	0.0375*** (0.0095)	0.0241*** (0.0064)	0.0370*** (0.0116)	0.0129 (0.0082)
Panel B: 5-year window								
ATT	0.0483*** (0.0095)	0.0247*** (0.0064)	0.0495*** (0.0077)	0.0347*** (0.0056)	0.0422*** (0.0113)	0.0277*** (0.0073)	0.0513*** (0.0127)	0.0230*** (0.0086)
Panel C: 10-year window								
ATT	0.0531*** (0.0121)	0.0255*** (0.0080)	0.0553*** (0.0095)	0.0379*** (0.0070)	0.0441*** (0.0140)	0.0244*** (0.0088)	0.0580*** (0.0164)	0.0255** (0.0109)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. Standard errors are in parentheses. Three, two and one stars (***, **, *) denote significance at the 99%, 95% and 90% levels, respectively.

Table 6
Heterogeneous effects: Accommodation and food services sector

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	-0.0153*** (0.0082)	-0.0256*** (0.0064)	-0.0050 (0.0069)	-0.0114** (0.0052)	-0.0011 (0.0112)	-0.0118* (0.0065)	-0.0192* (0.0107)	-0.0304*** (0.0088)
Panel B: 5-year window								
ATT	-0.0068 (0.0086)	-0.0153** (0.0065)	-0.0025 (0.0076)	-0.0048 (0.0055)	-0.0026 (0.0125)	-0.0059 (0.0074)	-0.0062 (0.0111)	-0.0178** (0.0088)
Panel C: 10-year window								
ATT	0.0005 (0.0104)	-0.0039 (0.0073)	-0.0031 (0.0089)	0.0020 (0.0063)	-0.0165 (0.0149)	-0.0075 (0.0086)	0.0111 (0.0134)	-0.0004 (0.0098)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. Standard errors are in parentheses. Three, two and one stars (***, **, *) denote significance at the 99%, 95% and 90% levels, respectively.

Table 7
Heterogeneous effects: Services sector

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	0.0031 (0.0097)	0.0001 (0.0066)	0.0124 (0.0079)	0.0094* (0.0054)	-0.0077 (0.0106)	0.0033 (0.0075)	0.0081 (0.0134)	0.0000 (0.0089)
Panel B: 5-year window								
ATT	0.0018 (0.0103)	0.0047 (0.0068)	0.0171** (0.0083)	0.0153*** (0.0057)	-0.0052 (0.0121)	0.0065 (0.0081)	0.0054 (0.0139)	0.0044 (0.0092)
Panel C: 10-year window								
ATT	-0.0022 (0.0127)	0.0110 (0.0083)	0.0211** (0.0102)	0.0216*** (0.0069)	-0.0049 (0.0155)	0.0090 (0.0095)	-0.0005 (0.0171)	0.0119 (0.0112)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. Standard errors are in parentheses. Three, two and one stars (***, **, *) denote significance at the 99%, 95% and 90% levels, respectively.

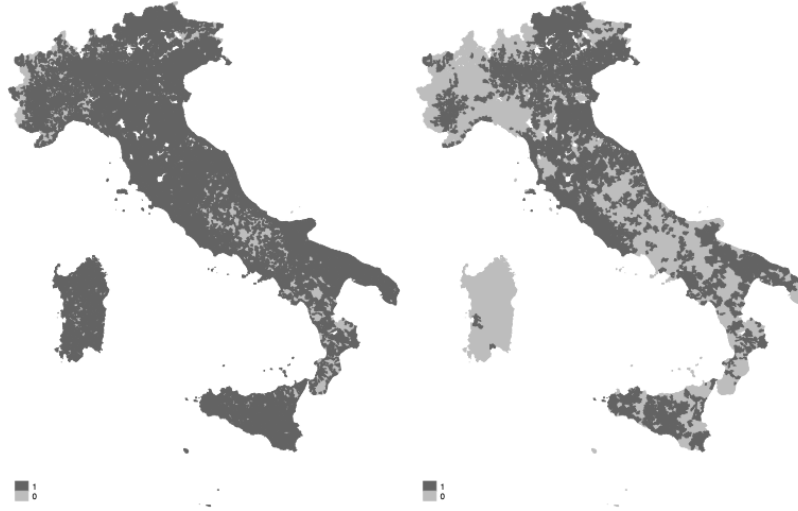
Table 8
Heterogeneous effects: Manufacturing sector

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	0.0014 (0.0090)	0.0058 (0.0059)	0.0090 (0.0060)	0.0075 (0.0047)	0.0034 (0.0085)	0.0027 (0.0060)	0.0018 (0.0125)	0.0079 (0.0082)
Panel B: 5-year window								
ATT	0.0100 (0.0101)	0.0126** (0.0063)	0.0138* (0.0073)	0.0124** (0.0050)	0.0107 (0.0109)	0.0070 (0.0068)	0.0125 (0.0137)	0.0164* (0.0086)
Panel C: 10-year window								
ATT	0.0064 (0.0129)	0.0147** (0.0074)	0.0053 (0.0096)	0.0098* (0.0060)	-0.0020 (0.0135)	-0.0003 (0.0081)	0.0135 (0.0177)	0.0235** (0.0102)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. Standard errors are in parentheses. Three, two and one stars (***, **, *) denote significance at the 99%, 95% and 90% levels, respectively.

Appendix

Figure A1
Bank branches across Italian municipalities (2015)



Notes: The maps show the presence of all bank branches (a) and cooperative bank branches (b) across Italian municipalities in 2015.

Table A1
Variable definitions

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

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)

Notes: 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
Robustness check: Alternative dependent variables

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers/pop.	Enterpr./pop.	Workers/pop.	Enterpr./pop.	Workers/pop.	Enterpr./pop.	Workers/pop.	Enterpr./pop.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	0.0002 (0.0008)	0.0002 (0.0002)	0.0006 (0.0007)	0.0007*** (0.0002)	0.0003 (0.0011)	0.0009*** (0.0002)	0.0001 (0.0010)	-0.0001 (0.0003)
Panel B: 5-year window								
ATT	0.0015* (0.0009)	0.0009*** (0.0002)	0.0017** (0.0008)	0.0012*** (0.0002)	0.0014 (0.0014)	0.0013*** (0.0003)	0.0014 (0.0011)	0.0007** (0.0003)
Panel C: 10-year window								
ATT	0.0018* (0.0011)	0.0016*** (0.0003)	0.0014 (0.0011)	0.0017*** (0.0003)	0.0011 (0.0019)	0.0015*** (0.0003)	0.0020 (0.0013)	0.0015*** (0.0004)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. Standard errors are in parentheses. Three, two and one stars (***, **, *) denote significance at the 99%, 95% and 90% levels, respectively.

Table A4
Robustness check: Including control variables

Dependent variable	Full sample		Munic. with bank branches		Munic. with CB branches		Munic. without CB branches	
	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)	Workers (ln)	Enterpr. (ln)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 3-year window								
ATT	0.0019 (0.0103)	0.0084 (0.0164)	0.0043 (0.0030)	0.0069** (0.0029)	0.0022 (0.0053)	0.0092** (0.0042)	-0.0026 (0.0101)	0.0007 (0.0145)
Panel B: 5-year window								
ATT	0.0075 (0.0101)	0.0164 (0.0164)	0.0082** (0.0037)	0.0137*** (0.0032)	0.0052 (0.0073)	0.0126*** (0.0044)	0.0042 (0.0100)	0.0092 (0.0133)
Panel C: 10-year window								
ATT	0.0018 (0.0072)	0.0216* (0.0127)	0.0072 (0.0049)	0.0204*** (0.0041)	0.0018 (0.0092)	0.0157*** (0.0054)	0.0029 (0.0093)	0.0176 (0.0116)

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. In columns (7)-(8), we focus on the subsample of municipalities without cooperative bank (CB) branches. 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.