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The Economic Geography of Institutional Quality: Local Administrations, Human Capital and Mobility

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Declaration

I certify that the thesis I have submitted for examination for the PhD degree at the Gran Sasso Science Institute is entirely my own work, except where otherwise indicated.

Statement of conjoint work

I confirm that Chapter 1 was jointly co-authored with Professor Augusto Cerqua, Doctor Costanza Giannantoni, and Doctor Matteo Mazziotta. I confirm that Chapter 2 was jointly co-authored with Professor Augusto Cerqua and Doctor Costanza Giannantoni. I also confirm that Chapter 3 was jointly co-authored with Professor Andrea Ascani and Professor Alessandra Faggian.

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Contents

Abstract

A substantial body of evidence demonstrates that institutions shape prosperity. Seminal contributions have established that the quality of institutions is a fundamental driver of economic growth, yet research on the role of local institutions in influencing economic activity remains limited. This dissertation shows that the quality of local formal institutions is measurable at scale and materially shapes economic and demographic outcomes, both in ordinary times and in the aftermath of disasters caused by natural hazards.

Chapter 1 develops a conceptual framework for municipal administrative quality and introduces the Municipal Administration Quality Index (MAQI), the first longitudinal, nationwide measure for Italy, covering almost all municipalities over more than two decades. MAQI aggregates eleven objective indicators on public employees, local politicians, and fiscal and economic performance using a non-compensatory, equal-weight method, enabling consistent comparisons across jurisdictions and over time.

Leveraging MAQI, Chapter 2 identifies the causal effect of jurisdiction size on institutional quality by exploiting the staggered mergers of 197 municipalities. Enlarging municipal scale significantly improves administrative quality, primarily through enhanced quality of local politicians and strengthened economic and fiscal performance, whereas bureaucratic efficiency improves only marginally. These positive outcomes appear to stem from economies of scale and the self-selection of higher-quality local politicians, who are attracted by the opportunity to earn higher wages.

While Chapter 2 examines whether a specific jurisdictional characteristic – its size – affects administrative quality, Chapters 3 and 4 investigate how administrative quality and

capacity influences post-disaster outcomes. Focusing on the aftermath of the 2016 Central Italy earthquake and employing the synthetic difference-in-differences estimator, Chapter 3 tests the mediating role of municipal public human capital – one specific dimension of local institutional quality – in shaping the resilience and recovery of economic activity. The findings indicate that generic public-sector human capital does not mitigate economic losses, whereas task-specific human capital substantially cushions post-quake declines in employment and active firms.

Chapter 4 explores whether regional institutional quality affects post-disaster population flows, exploiting the case of the Irpinia earthquake, which struck the border between the Italian regions of Campania and Basilicata – two areas with starkly different institutional quality – and drawing on a novel municipal-level dataset on population flows over an extended time span. While the results suggest no significant impact on the overall volume of migration, they reveal marked differences in its composition: higher regional quality and denser civic networks reduce the out-migration of incumbents. Complementary evidence from municipal industrial censuses and a synthetic-control analysis at the regional level shows a stronger rebound in value added per worker and GDP per capita where regional institutional quality is higher, suggesting that higher in-migration in places with lower institutional quality is a result of a demand surge mechanism, without benefits for the local economy. Taken together, Chapters 3 and 4 demonstrate that places experiencing similar levels of physical damage can nonetheless follow divergent recovery paths and display distinct migration patterns, depending on administrative quality and related institutional features. This evidence complements country-level research and underscores the importance of further exploring how to design more effective policies for post-disaster recovery.

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Introduction

There is considerable evidence proving that institutions affect prosperity. The 2024 Nobel Prize in Economic Sciences – awarded to Daron Acemoglu, Simon Henry Roberts Johnson and James Robinson for studies on how institutions are formed and influence prosperity – represents a clear acknowledgment that institutions matter. Seminal contributions have established that, alongside physical and human capital, the quality of institutions is a fundamental driver of economic growth (North, 1990; Putnam et al., 1993; Rodrik et al., 2004; Acemoglu et al., 2005; Acemoglu & Robinson, 2010). While most research examines cross-country or regional differences in institutional quality to account for disparities in economic performance, far less is known about the role of local (e.g., municipal) institutions in influencing economic activity. The absence of robust empirical evidence is even more pronounced when considering the role of local institutional quality to foster recovery in the aftermath of disasters caused by natural hazards, even though post-disaster recovery and service delivery are increasingly managed at the subnational level and there is high heterogeneity in local jurisdiction administrative quality and capacity.

This dissertation addresses these gaps, by focusing on several relevant aspects that are partially tackled by existing studies. It develops a conceptual framework for measuring local administrative quality, documents several empirical regularities, and provides causal evidence on how local institutional features shape economic and demographic outcomes in ordinary times and after disasters. The subnational level of analysis is central to this thesis. While cross-country work links institutional capacity to economic development (Besley and Persson, 2009), equally consequential variation unfolds within national borders, where local governments shape everyday outcomes via budgeting, procurement, and regulation

(Bandiera et al., 2009; Grembi et al., 2016)., and also coordinate extraordinary responses when shocks occur (Masiero and Santarossa, 2020). Within-country heterogeneity in institutional quality has tangible implications for innovation, employment, and the returns to public investment (Rodríguez-Pose and Di Cataldo, 2015; Crescenzi et al., 2016).

The main purpose of the remainder of this introductory section is to outline the conceptual framework and the research gaps this thesis aims at filling, then describing its structure and the main content and leitmotif of chapters 1 to 4.

i. Conceptual framework, research gaps and motivation

The meaning of the term 'institution' – understood as a system of socially embedded rules and norms – has reached broad scholarly consensus (see Hodgson, 2019). Since the 1990s, Nobel Laureate Douglass North popularized the distinction between 'formal' and 'informal' institutions (see, e.g., North, 1990; 1991; 1994; 2005), and his work has been critical in shaping subsequent usage in the literature. While much work has been conducted on the conceptualization of what institutions are, the terms 'formal' and 'informal' have often remained undefined or been used loosely. In an insightful contribution, Hodgson (2025) widely discusses this subject, and offers the following definition: "[…] Institutions may be subcategorized as formal or informal. Formal institutions are constituted or maintained through legally decreed procedures, and laws make up the dominant elements in their rule systems. Informal institutions include language, customs, rituals, or table manners. Most of their rules are not constituted by lawmaking institutions". Formal and informal institutions coexist, and informal rules may sometimes substitute for ineffective formal rules (Keefer and Shirley, 2000; Dixit, 2004), as well as amplify or dampen their effectiveness, particularly in places with large intra-national disparities in civic traditions (Putnam et al., 1993). The relative importance of different types of institutions in economic development is a matter of empirical study (Hodgson, 2025). This thesis primarily focuses on local formal political institutions, i.e., administrations understood as organizations that deploy leadership, people, and resources to produce public outputs (North, 1990; Acemoglu et al., 2005). At the municipal scale, formal institutions are concretely embodied in political leadership, the bureaucratic apparatus, and the fiscal and managerial rules that both constrain and enable action.

In recent decades, local governments have taken on a growing share of public service provision and administrative responsibilities (Ambrosanio et al., 2010; Dahis and Szerman, 2024; Narasimhan and Weaver, 2024). Indeed, being the level of government closest to citizens and firms, they are often entrusted with the direct provision of essential services for the local population. Local jurisdictions are also increasingly responsible in directly managing the emergency phase and long-run recovery of places hit by disasters caused by natural hazards, reflecting the decentralization of disaster management from central to local levels (Lee, 2019). Their capacity is thus central to the functioning of local economies – both in ordinary and extra-ordinary times. Despite the growing interest in examining the extent to which local governments contribute to economic development, convincing empirical evidence on this relationship remains scant. This is not surprising, as assessing the role of local governments necessitates a robust definition and measurement of their quality.

Several efforts have been made to measure institutional quality at broader scales. The most notable examples are the European Quality of Government Index, which measures citizen perceptions of corruption, quality, and impartiality in public services across 208 NUTS-2 regions in the EU-27, with editions released every three years starting from 2010 (Charron et al., 2014; 2021), and the Institutional Quality Index, which evaluates the institutional quality of NUTS-3 Italian regions with yearly frequency from 2004 to 2019, encompassing data on corruption, governance, regulation, law enforcement, and social participation (Nifo and Vecchione, 2014; 2015). Assessing the quality of local governments at a more granular administrative scale (i.e., at the municipal level) is challenging, primarily due to issues to identify a robust definition of quality and measure it. Existing indicators tend to capture narrow slices of performance (e.g., tax collection speed or transparency), cover limited areas or short periods, and do not offer a comprehensive, longitudinal gauge of local administrative quality. Conceptually, defining quality in political or economic institutions (Acemoglu et al., 2005) and distinguishing formal from informal institutions (North, 1990) further complicate measurement at fine spatial scales.

The lack of a granular and longitudinal municipal-level measure constrains both academic inquiry and policy design. For example, while many advanced economies are characterized by a high degree of administrative fragmentation, there is no evidence on whether and how the size of jurisdictions can affect local institutional quality. Scholars have long debated the notion of an optimal jurisdiction size (Oates, 1972; Epple & Romer, 1989; Ostrom, 2010) and the economic and political trade-offs involved in expanding territorial boundaries. In Oates's classic statement of the decentralization theorem, when preferences are heterogeneous and cross-jurisdictional spillovers are limited, decentralized provision dominates a uniform, centralized solution. Therefore, any optimal jurisdiction is conditional on scale economies and externalities rather than a single best size (Oates, 1972). Epple and Romer (1989) point out that, in the United States, the 1970s wave of municipal boundary adjustments was almost only annexation (over 98% of all changes), while owner-initiated detachments were rare, and state rules typically make detachment hard through referenda, special acts, or strict eligibility criteria, then limiting Tiebout-style competitive adjustment via 'flexible' borders. Ostrom (2010) reframes 'optimal size' as a design problem: polycentric systems with overlapping jurisdictions can contract across scales, exploit economies of scale for some tasks while avoiding diseconomies for others, and often achieve higher technical efficiency than large consolidated providers. Supporters contend that larger jurisdictions can harness economies of scale to enhance the efficiency of public service delivery, expand the range of available services, and streamline public spending. Excessive fragmentation can lead to inefficiencies and a heightened risk of corruption (Brueckner, 1981; Zodrow and Mieszkowski, 1986; Bardhan and Mookherjee, 2000). Conversely, they may also diminish citizen engagement in political processes and hinder the ability to tailor services to the needs of the local population (see, among others, Tiebout, 1956; Alesina & Spolaore, 1997; Blom-Hansen et al., 2014). Given the significance of administrative quality in influencing local economic outcomes, credible empirical evidence on its relationship with jurisdiction size is essential.

The quality and capacity of administrations is no less crucial in extra-ordinary periods, such as after disasters like earthquakes, floods, or hurricanes. These events can cause significant damage, up to total destruction, and their economic and societal repercussions are expected to intensify as climate change amplifies both the frequency and severity of extreme events. A substantial body of comparative literature highlights that the effects of catastrophic events are significantly shaped by the quality of the surrounding economic and political context. Cross-country studies demonstrate that wealthier and better-governed countries experience significantly fewer fatalities and economic losses following comparable shocks (Kahn, 2005;

Toya & Skidmore, 2007), and that such events tend to hinder long-term economic growth in contexts where weak governance obstructs effective reconstruction (Cavallo et al., 2013). Evidence on the relevance of regional and municipal administrative quality and capacity for post-disaster economic and demographic outcome remains limited. Furthermore, the literature is not informative on which specific component of local administrative quality can facilitate socio-economic recovery, or how local populations react to and interact with the local institutional environment after disruptive events.

This dissertation speaks to these gaps by examining how the quality and capacity of local formal institutions influence economic activity and demographic dynamics in ordinary and extra-ordinary times. All chapters composing this thesis focus on Italy. The Italian institutional framework is an ideal setting to test the relevance of the quality of jurisdictions on a wide range of socio-economic outcomes given the extensive responsibilities assigned to municipalities – spanning from public service provision to fund management and administrative tasks –, each consequential for local economic development. The administrative quality of Italian local jurisdictions has measurable consequences for procurement efficiency, fiscal choices, and the composition of spending (Gagliarducci and Nannicini, 2013)

The next section previews the structure, contributions, and unifying theme of the thesis.

ii. Structure of the dissertation

The thesis is organised as a collection of papers. Each chapter is a stand-alone academic article, followed by its own bibliography and by an appendix with additional materials.

As highlighted in section i, a key missing contribution in the literature is a comprehensive measure of institutional quality at the local level. The first chapter, 'The Municipal Administration Quality Index: The Italian Case', provides both a conceptual and empirical contribution on this subject. It introduces the Municipal Administration Quality Index (MAQI), the first composite index designed to assess the quality of municipal administrations in Italy over more than two decades, from 2001 to 2022. MAQI covers all municipalities without significant boundary changes over this period (7,723 municipalities, roughly 98% of the total). It captures one specific aspect of local institutional quality – *administrative* quality – through eleven objective indicators reflecting the quality and capacity of local public employees, the quality of local politicians, and fiscal and economic performance. Each indicator is normalised and aggregated using the Adjusted Mazziotta-Pareto Index (Mazziotta and Pareto, 2016), an equal-weight, non-compensatory method allowing three types of comparisons: (i) among municipalities within a specific year; (ii) over time for a particular municipality; (iii) among municipalities across the entire time span. A companion website makes the data publicly available, providing a tool for researchers and local authorities.

The availability of MAQI allows to conduct research on various important subjects, such as the influence of local administrative quality and capacity on socio-economic outcomes and place-based policy effectiveness, or by disentangling specific factors affecting jurisdiction quality. Chapter 2, 'The Causal Relationship between Jurisdiction Size and Institutional Quality', leverages the MAQI to ask whether, and how, jurisdiction size affects administrative quality. This represents a highly relevant matter, as it directly informs how government boundaries and administrative scale affect governance effectiveness, public service delivery, and economic development. By complementing the MAQI dataset with data on 197 municipal mergers occurred in the period 2013-2018, and employing a non-parametric generalisation of the difference-in-differences, chapter 2 finds causal evidence that expanding municipal scale substantially improve administrative quality. This improvement is mainly driven by increased local political quality and economic and fiscal performance, through two mechanisms: first, increased efficiency from economies of scale, and second, the positive self-selection of higher-quality local politicians, attracted by the possibility of earning higher wages. Furthermore, merged municipalities do not engage in inefficient hiring of local public employees in response to the increased size, and results are not driven by public incentives for mergers.

While chapter 2 assesses if a specific characteristic of jurisdictions, i.e. their size, has an impact on administrative quality, chapters 3 and 4 examine the impact of quality and capacity in a post-disaster setting on two distinct outcomes. Specifically, chapter 3, entitled '"Please, don't go": the role of local public human capital in post-disaster recovery', test the mediating role of municipal public human capital on the resilience and recovery of economic activity after the occurrence of a disruptive earthquake. Chapter 4 instead, titled 'Post-disaster regional institutional quality and geographical mobility', focuses on assessing the role of regional institutional quality on post-earthquake municipal population flows. A description of the main contribution and findings of chapters 3 and 4 follows.

Chapter 3 employs the synthetic difference-in-differences estimator to test the role of generic and specific local human capital in fostering economic recovery, focusing on the last major earthquake occurred in Italy – the Central Italy earthquake. While generic human capital of municipal public employees, proxied by their level of education and the number of personnel, shows no mitigating effect on economic loss, high levels of task-specific human capital, proxied by low levels of staffing turnover (i.e., higher levels of local administrative stability), have a significant role in sustaining local economic activity. Municipalities with low turnover suffer markedly smaller post-quake loss in jobs and in the total number of active enterprises. In a post-disaster setting, local officials must rapidly acquire on-the-job, ad-hoc procedural knowledge to manage extraordinary tasks amid incomplete guidelines and legislations, making institutional memory and short-term routinization crucial. Whether individual capability becomes organizational capacity depends on mechanisms of coordination and aggregation (Besley et al., 2022). Yet personnel discontinuity – i.e., turnover - undermines institutional memory (Lewis, 2011) and can result in lower quality in public service delivery (Akhtari et al., 2022). Therefore, higher turnover among municipal staff after an earthquake is a proxy for lower accumulation of post-disaster, task-specific experience, weakening administrative capacity precisely when it is most needed.

Chapter 4 shifts the focus on regional institutional quality, by leveraging a unique natural experiment: the occurrence of the 1980 Irpinia earthquake at the border of two NUTS-2 regions – Campania and Basilicata –, characterised by high differences in regional governance. Using newly digitised annual data on municipal population flows from 1958 to 2000 within a counterfactual framework, this empirical setting allows to isolate and test the effect of regional institutional quality on post-disaster geographical mobility. Although net migration flows are unaffected, the composition of these flows changes markedly. Higher regional quality reduces out-migration of incumbents. Complementary regional productivity evidence indicates faster rebounds of value added per worker and GDP per capita in Basilicata, suggesting that higher in-migration in places with lower institutional quality is a result of a demand surge mechanism, without benefits for the local economy. These findings indicate that sub-national institutional quality associated with denser civic networks and better long-run economic recovery reshape the composition, not the volume, of disaster-induced mobility.

Together, chapters 3 and 4 show that places experiencing comparable physical damage can nonetheless follow heterogeneous recovery trajectories and exhibit different migration patterns depending on administrative quality and related institutional features. This evidence complements research conducted at the country level. Further research is crucial to understand how to design better policies to manage post-disaster recovery.

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Chapter 1. The Municipal Administration Quality Index: The Italian case

Abstract

Municipal governments have become increasingly involved in public service provision, fund management, and administrative tasks. Despite their importance, studies of their relevance for local economic development have lacked a measure of their quality and capacity with extensive temporal and territorial coverage. We introduce the Municipal Administration Quality Index (MAQI), a novel composite index designed to assess the quality of local governments in Italy. Drawing on a newly compiled dataset covering 2001–2022, MAQI evaluates three key pillars: bureaucratic efficiency and capacity, the quality of local politicians, and the economic and fiscal performance of municipal administrations. Our findings reveal significant variations in administrative quality, with larger municipalities exhibiting higher scores due to fewer financial constraints and better-educated civil servants. We also identify distinct geographical patterns in institutional quality, challenging the conventional North–South divide.

Keywords: administrative quality; municipalities; composite index; multidimensional phenomena; Italy.

JEL codes: D73; H11; H70.

1.1. Introduction

There is substantial theoretical and empirical evidence supporting the role of institutions in shaping the economic performance of jurisdictions. Indeed, together with factors such as physical and human capital, institutions have been recognized as essential drivers of economic growth (North, 1990; Putnam, 1993; Rodrik et al., 2004; Acemoglu et al., 2005; Acemoglu and Robinson, 2010). Moreover, significant differences in subnational (regional) institutional quality explain a large share of within-country disparities in economic performance (Acemoglu and Dell, 2010; Charron et al., 2014). By contrast, there is much less evidence on the role of local (e.g., municipal) institutional quality in fostering economic growth.

In recent decades, local governments are increasingly involved in the provision of public services and administrative tasks (Ambrosanio et al., 2010; Dahis and Szerman, 2024; Narasimhan and Weaver, 2024). Indeed, being the level of government closest to citizens and firms, they are often entrusted with the direct provision of essential services for the local population. Despite the growing interest in examining the extent to which local governments contribute to economic development, convincing empirical evidence on this relationship remains scant. This is not surprising, as assessing the role of local governments necessitates a robust definition and measurement of their quality, which remains lacking. Hence, this field of research is hindered by the absence of a measure that is sufficiently disaggregated, covers an extensive time period, and provides comprehensive territorial coverage for evaluating the quality and capacity of local administrations.

To address this gap in the literature, we have developed the Municipal Administration Quality Index (MAQI), a composite index that provides a comparative assessment of the formal institutions of Italian municipalities. Specifically, MAQI focuses on the most crucial formal institutions at the local level – municipal governments – and particularly on their administrative quality and capacity, which are essential for delivering public services and managing funds (Polverari, 2020).[1] We leverage a newly assembled dataset containing rich objective information about the bureaucratic, political, and economic profiles of almost all Italian municipalities[2] for all the years from 2001 to 2022, to compute a composite index that mathematically combines a set of individual indicators to represent various aspects of the multidimensional phenomenon of administrative quality (Mazziotta and Pareto, 2018). To ensure comprehensive coverage in our index, we constructed it around three pillars: i) the bureaucratic efficiency and capacity, along with personal characteristics measuring the quality of local bureaucrats (Besley et al., 2022); ii) the valence attributes of local politicians (Gagliarducci and Nannicini, 2013); and iii) the economic and fiscal performance of municipal governments (Padovani et al., 2024). We define and measure municipal administrative quality through these pillars, as they comprehensively assess municipalities' 'enabling factors' (e.g., personnel and resources management) that are essential to achieve good outcomes through high-level service provisioning.

We have conducted several descriptive analyses, focusing on the geographical distribution of MAQI scores and their evolution over time. Our findings indicate that the size of the municipality is positively associated with the administrative quality of local governments,

[1] Building on these premises, the ability of local governments to handle both regular and additional responsibilities is receiving renewed focus under the Next Generation EU framework. This initiative calls for greater involvement of local actors—especially municipalities—that are already involved in managing the EU Cohesion Policy funds.

[2] MAQI includes 7,723 of the 7,901 municipalities. We excluded those that changed their boundaries during the period under analysis, as well as those with many missing values in at least one indicator. See Section 1.3 for more details.

primarily due to the economic and financial constraints faced by smaller municipalities, as well as the higher educational levels of local politicians and public employees in larger municipalities. Furthermore, we identify peculiar geographical patterns in local administrative quality that go beyond the classic North-South divide. Specifically, this divide is not pronounced, except when considering the economic and fiscal performance of municipal governments.

We contribute to several strands of literature. We are the first to operationalize conceptual frameworks that define administrative quality at the municipal level by creating a composite index. Specifically, we integrate key factors that determine administrative capacity and quality, with particular emphasis on comprehensive measurement across both spatial and temporal dimensions. Second, we contribute to the extensive literature on bureaucracy and public administration effectiveness. Bureaucracy, and its relationship with politics, is positively associated with growth (Cornell et al., 2020; Besley et al., 2022); however, its role – particularly at the local level – has been largely overlooked. By considering the personal characteristics of local civil servants, as well as measures of administrative efficiency and capacity, we bring prominence to the bureaucratic dimension in the conceptualization of municipal institutional quality. Third, given the lack of existing indices that offer both territorial and temporal granularity, we introduce a new index that provides a comprehensive overview of local government quality over two decades. This will allow to further develop the growing literature on the relationship between quality of local politicians and municipal economic outcomes (Gagliarducci and Nannicini, 2013; Bordignon et al., 2017; Bellodi et al., 2024). Fourth, we contribute to the literature of quality of institutions' indicators, whose most notable examples are the Worldwide Governance

Indicators (WGI, national level), the European Quality of Government Index (EQI, regional level), and the Institutional Quality Index (IQI, provincial level).

The structure of the paper is as follows: Section 1.2 discusses existing measures of institutional quality at various governmental levels and defines local administration quality for this study. Section 1.3 explores the MAQI's pillars, describes the data sources, and outlines the empirical methodology for the index's calculation. Section 1.4 presents the findings, including descriptive analyses of the MAQI's temporal and spatial variations. Section 1.5 offers some conclusive observations.

1.2. Measures and Concepts of Institutional Quality

1.2.1. Institutional Quality Indicators

Over the last decades, many scholars have devised measures of institutional quality at various levels of government, using data ranging from citizen perceptions to objective indicators. We outline the most prominent examples below, categorized by government level.[3]

At the country level, the World Bank's WGI stand out as the most recognized composite indices of institutional quality, capturing perceptions from households, businesses, and citizens regarding governance quality across over 200 countries and through time (Kaufmann and Kraay, 2023). WGI serve as crucial instruments for cross-country

[3] Considering the variation in labels for subnational administrative divisions across countries, we offer some preliminary explanations. By "regional level" it is intended the first administrative level (territorial administrations called "regions" or "states" or "provinces"; in Europe, this corresponds to NUTS-2), by "subregional level" it is intended the second administrative level (territorial administrations called "provinces" or "districts"; in Europe, this corresponds to NUTS-3) or the third or finest administrative level (territorial administrations which are usually called "municipalities"; in Europe, this corresponds to "Local Administrative Units (LAUs)") (Cerqua et al., 2023).

comparisons, with their broad timeframe from 1996 to 2023 making them especially useful for examining temporal trends. They are based on over 30 underlying data sources, combining primary and secondary data produced by several independent institutions.

As systematic assessment of subnational institutional features is essential for evaluating the root causes of local economic disparities (Acemoglu and Dell, 2010), several indices have been developed at the subnational level. Among them, one of the most relevant is arguably the EQI, which relies exclusively on primary survey data. The EQI measures citizen perceptions of corruption, quality, and impartiality in public services across 208 NUTS-2 regions in the EU-27, with editions released every three years starting from 2010 (Charron et al., 2014; 2021).

At a more disaggregated level, three notable indices are the Local Institutional Quality Index for African districts (Wig and Tollefsen, 2016), the Public Administration Performance Index (PAPI) for Vietnamese provinces (CECODES et al., 2020) and the IQI for Italian provinces (Nifo and Vecchione, 2014; 2015).[4] The Local Institutional Quality Index is derived at the district level for 19 African countries from Afrobarometer data regarding perception of corruption, local politicians' effectiveness, and judicial trust. PAPI assesses citizen views on the performance and quality of policy execution and service delivery in all 63 Vietnamese provincial governments since 2009. IQI evaluates the Italian subregional institutional quality with yearly frequency from 2004 to 2019, encompassing data on corruption, governance, regulation, law enforcement, and social participation. At the municipal level, which is the lowest tier of local governments, the most prominent indices are the Municipal Performance Index (MPI) and the Municipal Institutional Quality Index (MIQI). The MPI,

[4] The IQI for Italian provinces is based on secondary data collected from several institutional sources.

established by the Indian Ministry of Housing and Urban Affairs since 2019 (MOHUA, 2019), evaluates Indian municipalities on service delivery, financial management, planning, technology use, and governance. MIQI, covering Brazilian municipalities from 1997 to 2000, measures public political engagement, financial capabilities, and administrative capacity (MPOG, 2000).

Among the above-mentioned indices, three are those of major relevance to our research in terms of structure and content: the WGI, the EQI, and the IQI. WGI mix objective and subjective information, while EQI is only based on subjective perceptions of citizens and IQI on objective administrative data. The fact that these indices make a different use of objective and subjective information, allows for two major considerations: on the one hand, mixing objective and subjective information enables a comprehensive understanding of the phenomena. On the other hand, focusing on a smaller government size – such as provinces (IQI) or municipalities (MAQI) – makes objective information more reliable and affordable. Indeed, while subjective assessments can capture intangible aspects of local government such as public service motivation and managerial skills (Carreri and Payson, 2021), their comparability across different levels of subnational government quality is likely influenced by confounding factors. These factors include individual socio-economic and demographic characteristics (Löffler, 2002; Yang, 2010), challenges in effectively processing information to monitor administrators' behavior (Krause, 1997), and external influences like ineffective or distorted political communication (Besley and Prat, 2006; Chingos et al., 2012; Sanders and Canel, 2015).[5]

[5] Furthermore, these survey data may introduce biases that favor places with better conditions, where residents are likely to have more positive views of their administrations (Fratesi, 2023). It is also worth noting that creating a municipal quality index based on subjective measures is impractical, as it would require

In Italy, subnational institutional quality has been a highly debated topic, primarily concerning the North-South divide (Panetta, 2018) and the poor performance of the Italian economic system (IMF, 2015). Despite the recent fiscal and administrative decentralization processes, which have granted increased importance to local authorities (Ambrosanio et al., 2010; Lippi, 2011; Sacchi et al., 2019), and calls for using composite indices over single proxies for multidimensional constructs like institutional quality (Barone et al., 2017; Albanese and Gentili, 2021), a consensus on specific indicators and comprehensive composite measures at the municipal level is still lacking.[6] In the following, we will outline the available indicators for local institutional quality in Italy and discuss the notion of local public administration quality.

conducting extensive interviews within each municipality over multiple years—a requirement seldom met, even in advanced economies.

[6] For a comprehensive explanation of the definition and construction of a composite index, refer to Section 1.3.

Table 1.1. Indicators of institutional quality – Italian municipalities

Indicator	Domain of institutional quality	Coverage	
		N° of municipalities	Year(s)
Barone and Mocetti (2011)	Municipal inefficiency	~1,500	2001-2004
Giacomelli and Tonello (2015)	Public action quality	~1,000	2013
D'Amuri and Giorgiantonio (2016)	Municipal inefficiency	~7,000	2011-2012
De Angelis et al (2020)	Municipal inefficiency	~6,000	2012
Albanese et al (2021)	Municipal transparency	~500	2013
Gagliarducci and Nannicini (2013)	Municipal efficiency	~1,500	1993-2001
OpenCivitas	Municipal performance	6,562 (municipalities belonging to regions with special status not included)	2010; 2013; 2016; 2018; 2019; 2021
MAQI	Municipal administration quality	7,723	2001-2022

Notes: As of 2023, there are 7,901 municipalities in Italy. The list of available indicators builds upon and extends previous work by Albanese and Gentili (2021). Gagliarducci and Nannicini (2013) consider all municipalities with a population between 3,250 and 6,750 inhabitants. The OpenCivitas' indices can be downloaded here: https://www.opencivitas.it/it/open-data.

Barone and Mocetti (2011) developed a measure of municipal inefficiency correlating expenditures with outputs. D'Amuri and Giorgiantonio (2016) created an indicator for inefficiencies in civil status and registry service provision. De Angelis et al. (2020) introduced an institutional quality indicator based on the timeframe from the approval of the tax for indivisible services (*TASI*) application criteria to the municipal budget deadline. Additionally, two other indicators focus on the quality of public action and municipal transparency. Giacomelli and Tonello (2015) developed two cross-sectional measures of public action quality based on municipalities' management of the single desk for productive activities. Albanese et al. (2021) introduced a cross-sectional index measuring public administration transparency. Gagliarducci and Nannicini (2013) gauged municipal management efficiency via revenue collection speed and payment timeliness, with indicators for revenue collection efficiency and budgetary commitment fulfillment. Lastly, the OpenCivitas project provides indices assessing local government service performance and associated cost-effectiveness (Lockwood et al., 2022). Table 1.1 lists the available indicators with their territorial and temporal coverage, highlighting their limited time coverage and availability only for specific subsets of Italian municipalities.

1.2.2. Defining local public administration quality

From a theoretical perspective, defining quality in political or economic institutions (Acemoglu et al., 2005) and formal or informal institutions (North, 1990) involves significant differences in both conceptualization and measurement. By focusing on municipal administrations, we define and measure quality with reference to local formal political institutions.

While indicators often focus on overall institutional quality (Charron et al., 2014; Nifo and Vecchione, 2015) and efficiency in public service provision (Barone and Mocetti, 2011; D'Amuri and Giorgiantonio, 2016), quality has also been assessed through individual indicators such as the timing of public actions (Giacomelli and Tonello, 2015; De Angelis et al., 2020), the regulatory burden (Di Vita, 2018), the level of corruption (Mocetti and Orlando, 2017), and the level of transparency (Albanese et al., 2021). As a result, indicators at the municipal level typically consist of single proxies that focus on the outputs and outcomes produced by local public administrations. In contrast, the MAQI targets a specific dimension of municipal institutional quality—*administrative* quality—that does not focus only on outcomes and has not been previously measured for local administrations.

The theoretical foundation of our composite index is directly derived from the framework used by the European Institute of Public Administration (EIPA) and the European Public Administration Network (EPAN) to assess quality in public sector organizations. Drawing on the concept of quality in the private sector, the public sector shifted from defining quality as adherence to norms and procedures to emphasizing customer satisfaction, portraying local governments as service providers and citizens as customers (Beltrami, 1992). In line with this approach, most EU Member States have advocated for the Common Assessment Framework (CAF), developed by EIPA and EPAN, to motivate local governments toward self-assessment through a standardized procedure (Löffler, 2002). The CAF is a quality management model developed for the public sector to carry out self-assessment of organizational performance and it serves as the gold standard for assessing quality and excellence in European local administrations. Figure 1.A.1 in Appendix 1 illustrates the CAF model, explaining the cause-and-effect relationship between organizational factors and performance results. Specifically, Figure A.1 shows that CAF includes nine criteria that serve as analytical dimensions for evaluating public administration activities and outcomes. The first five criteria, termed "enabling factors," focus on the organization's actions to produce positive results, covering leadership, strategies and policies, personnel management, resources and partnership management, and process management. Criteria 6 through 9 evaluate public administration outcomes and are directly influenced by enabling factors, indicating that criteria 1 through 5 are necessary conditions for achieving positive results in public administrations.

The importance of the enabling factors is also highlighted in the empirical literature. The advantages of decentralization in advanced economies, such as better public goods provision (Weingast, 2009), increased public sector efficiency (De Mello and Barenstein, 2002), more accountable fiscal policies (Oto-Peralías et al., 2013), reduced corruption (Fisman and Gatti, 2002), and greater trust in government activities (Ligthart and van Oudheusden, 2015) can be significantly undermined by poor political leadership quality (Sacchi et al., 2019), particularly when local politicians are inexperienced (Prud'homme, 1995) or motivated by private interests (Hindriks and Lockwood, 2009). Given the importance of enabling factors in shaping administrative quality, our analysis specifically focuses on them. We avoid direct evaluation of outcomes, which relate to the service delivery effectiveness to the population, where citizen perception plays a crucial role, as various indicators in criteria 6 to 9 require measurement of perceived quality by citizens. Indeed, citizen perceptions of local public service quality can be affected not only by factors such as individual traits and external elements, but also – and profoundly – by informal institutions. Their presence, in the form of established norms of conduct and behavior, means that public service provision can be undermined by a weak civic sense (North, 1990), especially in regions with significant intra-national disparities (Putnam, 1993). Therefore, quality indicators should extend beyond merely gauging local government performance from a citizen's standpoint (Löffler, 2002).

By adapting the measurement of enabling factors to the framework of Italian municipalities, the MAQI specifically focuses on three criteria: leadership, people (personnel), and resources. Recognizing local administrators' competency importance (Prud'homme, 1995), we measure leadership by gathering data on the quality of local politicians, and personnel through the quality and capacity of local public employees. These measures are augmented with fiscal and economic indicators of municipal governments (resources), highlighting political accountability (Schaltegger and Torgler, 2007) and aiding national authorities in evaluating local government management's effectiveness and efficiency.[7] Thus, the theoretical foundation of our index and its composition complements, rather than duplicating, existing institutional quality indices such as the EQI or IQI. While overall institutional quality encompasses the broader governance environment, including rule of law, corruption control, and civic norms (Putnam, 1993; Charron et al., 2014; Nifo and Vecchione, 2014; 2015), administrative quality captures a narrower, operational dimension of institutional functioning - specifically, the competence, capacity, and resource management of public bureaucracies and elected officials as a formal institution.

1.3. The Municipal Administration Quality Index (MAQI)

1.3.1. The structure of the Index

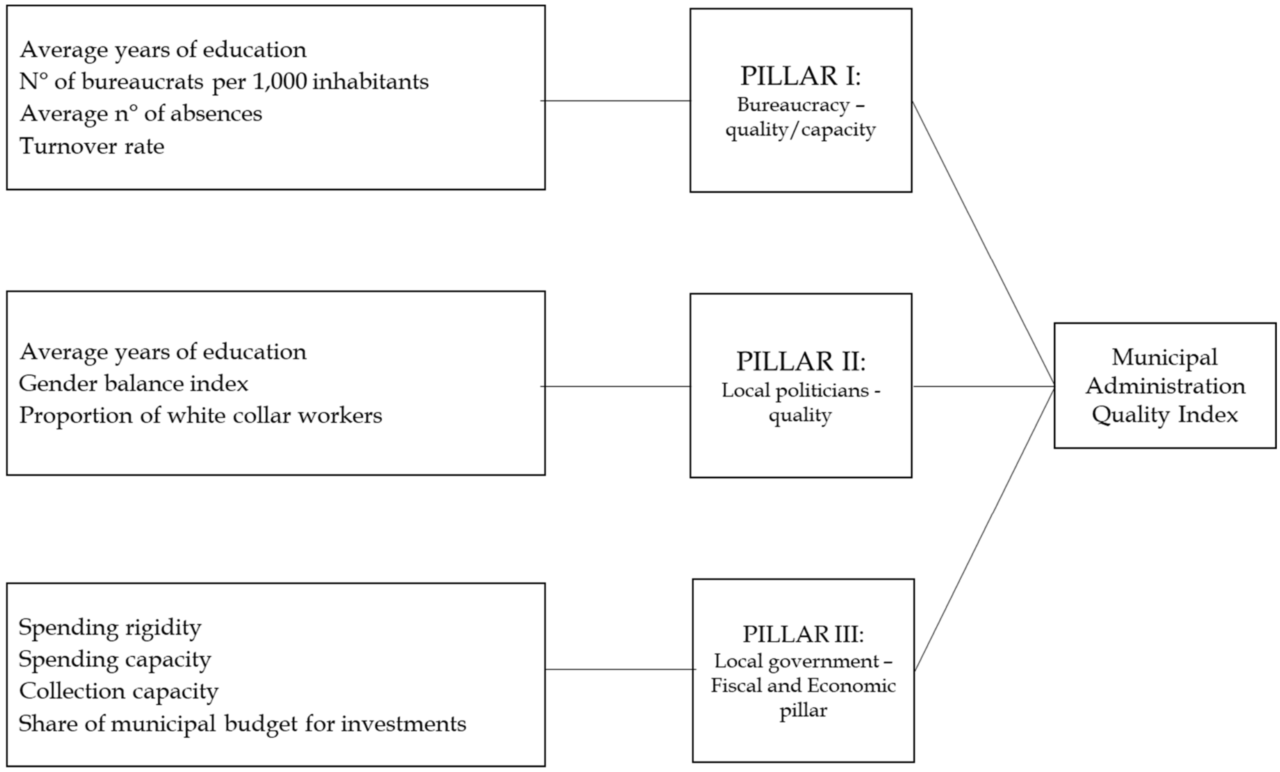
MAQI is computed as a composite index, which mathematically combines a set of individual indicators to represent various aspects of a multidimensional phenomenon (Mazziotta and Pareto, 2018). The choice of this structure is based on our main references for institutional quality indices (Charron et al., 2014; Nifo and Vecchione, 2015). Hence, to compute the MAQI, we decided to rely on and combine three key components, or *pillars*, each capturing a recognized driving factor of municipal administration quality: the quality and capacity of the local bureaucratic apparatus ("*Pillar I: bureaucracy - quality/capacity*"), the quality of local politicians ("*Pillar II: local politicians – quality*"), and the fiscal efficiency and

[7] See https://finanzalocale.interno.gov.it/docum/studi/paragest/paragest.html (in Italian).

economic performance of local governments ("*Pillar III: local government – fiscal and economic performance*"). The choice of the pillars reflects the CAF, which constitutes the theoretical foundation of MAQI. The three pillars are multidimensional and consist of multiple individual indicators, whose selection follows a vast previous literature on the role of bureaucracy, local politicians and fiscal efficiency for economic growth (Burden et al., 2012; Besley et al., 2022; Pavese and Rubolino, 2023). Figure 1.1 shows the index structure, with Pillars I, II, and III comprising four, three, and four indicators, respectively (for a detailed description of all the indicators and the literature supporting their inclusion, refer to Section 1.3.2).

We compiled our database using municipal data from diverse administrative sources. For Pillar I indicators, we utilized data from the Annual Account of the State General Accounting Department (https://contoannuale.rgs.mef.gov.it/), providing comprehensive insights into municipal bureaucratic structures from 2001 to 2022. For Pillar II, assessing local politicians' quality, data were sourced from the electoral database of the Italian Ministry of the Interior and the Register of Local and Regional Administrators, offering details on elected officials (mayors, councilors, and executives) since 1986 (https://elezioni.interno.gov.it/opendata ; https://dait.interno.gov.it/elezioni/anagrafe-amministratori). For Pillar III, data on municipal fiscal efficiency and economic performance were obtained from the Ministry of the Interior's municipal final balance certificates, available upon formal request.

Figure 1.1. The Municipal Administration Quality Index



To develop a dataset encompassing all indicators for each year, we created a balanced panel covering 2001-2022. Our analysis is confined to municipalities that maintained consistent boundaries during this period.[8] For municipalities lacking data for one or more indicators, we managed missing information as follows: if a municipality had a missing value for an indicator in the middle of the series (e.g., year t), we imputed the missing value by averaging the indicator's values at years t-1 and t+1;[9] ii) for municipalities with up to three consecutive

[8] Between 2001 and 2023, 157 municipalities adjusted their boundaries, either acquiring or ceding territory, often involving small areas such as forests, fields, and roads. These adjustments resulted in minimal population changes, with none exceeding a ±5% shift. These municipalities were also included in our analysis. Additionally, the sample incorporates the municipality of Pesaro which, on July 1, 2020, absorbed the municipality of Monteciccardo following a majority approval in a consultative referendum. The merger is unlikely to have significantly affected Pesaro's bureaucrats and politicians, given that Monteciccardo's population was less than 2% of Pesaro's.

[9] After this step, over 90% of the municipalities in the dataset have no missing values.

missing values, we imputed these gaps with the closest non-missing value for that indicator; iii) municipalities presenting four or more consecutive missing values in any indicator were omitted from the study. These procedures resulted in the exclusion of 38 municipalities, yielding a dataset that encompasses 7,723 municipalities. This represents 97.75% of all Italian municipalities, or 99.51% of those that did not undergo mergers during the period from 2001 to 2022.

1.3.2. Indicators' selection

We choose each indicator based on its relevance in assessing municipal administration quality, ensuring that all of them were consistently available throughout the analysis period.[10] Below, we detail every single indicator and the theoretical framework justifying its inclusion, beginning with Pillar I. The complete list of our indicators and their descriptive statistics is presented in Table 1.2 (see below).

Pillar I: The quality and capacity of the bureaucracy. To evaluate local bureaucratic quality and capacity, we use four indicators: average years of education of public employees, turnover rate, number of personnel per 1,000 inhabitants, and average annual absences. For the first indicator, education serves as a proxy for the quality of politicians and public employees, aligning with a well-established tradition in political economy (e.g., Galasso and Nannicini, 2011; Bellodi et al., 2024). We measure this indicator as follows:

$$Average\ years\ of\ education_{it} = \frac{\sum_{n=1}^{N} years\ of\ education_t}{N_{it}} \qquad (1.1)$$

[10] Some indicators potentially useful for index construction, such as the percentage of inquiries processed by the municipal technical office or the number of staff training days, were excluded due to their limited temporal availability, as they only covered a subset of the years 2001-2022.

where N is the number of public employees in municipality i and year t, with t ranging from 2001 to 2022.[11]

The second indicator is the turnover rate of public employees, as high turnover rates can negatively impact performance outcomes (Carley, 1992; O'Toole and Meier, 2003; Heavey et al., 2013). In addition, analyzing turnover alongside education offers a holistic understanding of turnover's impact on bureaucratic quality. Turnover can lead to leadership gaps and disrupt institutional continuity (Lewis, 2011), and these adverse effects are amplified when experienced personnel are replaced by less skilled individuals. Following Bellodi et al. (2024), we measure bureaucratic turnover in municipality i and year t as follows:

$$Turnover_{it} = \frac{N^{\circ}\ Hires_{it} + N^{\circ}\ Layoffs_{it}}{N^{\circ}\ Employees_{it}} \tag{1.2}$$

Adequate staffing levels and minimal absenteeism among employees are crucial for delivering efficient and effective public services. Italian municipalities have experienced notable downsizing in recent decades, with the average number of employees per 1,000 inhabitants decreasing from 7.3 in 2001 to 5.3 in 2022, alongside increasing public management decentralization (Ambrosanio et al., 2010; Lippi, 2011; Sacchi et al., 2019). Beyond efficiency losses, substantial and ongoing staff reductions may cause employees to feel overburdened, leading to uncooperative behaviors (Burden et al., 2012). Particularly in recent years, Italian municipalities with undersized staff level suffered to meet additional

[11] In alignment with the Italian educational system, we allocated education years to each public employee based on their level of schooling: 5 years for completing primary school, 8 years for middle school, 13 years for a high school diploma, 18 years for a bachelor's degree, 19 years for a postgraduate specialization, and 21 years for a PhD.

administrative and bureaucratic efforts required for the implementation of policies directly involving them such as the EU Cohesion Policy and the Italian National Recovery and Resilience Plan (OpenCoesione, 2022). To identify municipalities with insufficient staffing, we included an indicator of the number of personnel per 1,000 inhabitants.[12] Finally, given that absenteeism is considered a counterproductive behavior (Edwards and Greasley, 2010), we use the average number of absences among municipal employees as the fourth indicator.[13]

Pillar II: The quality of local politicians. To assess the quality of the local political class, we combine three indicators: average years of education, gender balance index, and the proportion of white-collar workers, focusing solely on key local political figures – the mayor (*sindaco*), the deputy mayor (*vicesindaco*), the members of the executive committee (*assessori*), and the president of the local council (*presidente del consiglio comunale*). As for Pillar I, education serves as a proxy for the quality of local politicians, computing the average years of education of the local political actors listed above.

Considering that gender imbalance leads to democratic deficits (McNeil et al., 2017; DeHart-Davis et al., 2020), entailing significant societal costs and undermining local politicians' quality (see, e.g., Baltrunaite et al., 2014; Weeks and Baldez 2015; Besley et al., 2017), we include an indicator to measure gender balance in local governments. Following the

[12] In calculating the total employee count, we assign a value of 1 to full-time employees and 0.5 to part-time employees. Considering the proportion of part-time contracts is crucial, as their use in local governments has risen significantly over time, from 6% in 2001 to 20.1% in 2022.

[13] In constructing the indicator for absences, we have included absences due to vacation, strikes, and those categorized as "other unpaid absences." However, other types of absences, such as those for sickness or training days, have been excluded due to missing data from 2001 to 2008.

European Institute for Gender Equality (EIGE, 2023), we measure gender gap among local political actors for each municipality i as follows:

$$Gender\ balance\ index_{it} = |share\ of\ women_{it} - share\ of\ men_{it}| \tag{1.3}$$

The higher the value of the index, the lower the balance.

Lastly, given that politicians with white-collar backgrounds are typically more skilled (Gagliarducci and Nannicini, 2013), we include the proportion of white-collar workers among local political figures as the third indicator for Pillar II.

Pillar III: The fiscal and economic performance of local governments. Local governments' economic performance and fiscal efficiency are gauged using four indicators: spending rigidity, spending capacity, collection capacity, and the proportion of the municipal budget allocated to investments. Given the complexity and multifaceted nature of local government financial management, these indicators encompass various critical aspects of this domain.[14] The indicators for spending rigidity and capacity assess local government expenditures.[15] Spending rigidity measures the municipality's potential to cut operational costs, and spending capacity evaluates its ability to fulfill current and past obligations within the fiscal year. We measure spending rigidity as follows:

[14] Due to substantial discontinuities stemming from the 2015 local government budget reform, enacted in 2016, which implemented new accounting standards for balance sheet preparation (Mulazzani, 2016), we omitted some useful indicators for evaluating municipal fund management. For instance, this reform made comparisons over time unreliable for metrics such as internal/external financing, reliance on higher government tiers, the transfers-to-current-expenditure ratio, the staff-costs-to-total-revenue proportion, and the disposable passive residuals index.

[15] Municipal spending efficiency can also be measured using Data Envelopment Analysis (DEA) (Charnes et al., 1978), a non-parametric method developed to analyze the relative technical efficiency of decision-making units (refer to Luca and Modrego (2021) for a DEA application involving Italian municipalities). However, we did not conduct such an analysis because its application requires data on outputs, such as municipal service provisioning, which are not available for the entire period from 2001 to 2022.

$$Spending\ Rigidity_{it} = \frac{(CPE_{it} + LRE_{it})}{(TR_{it} + TransfR_{it} + NTR_{it})} \tag{1.4}$$

where CPE_{it} are current personnel expenditures (commitments), LRE_{it} are loan repeyments expenditures (commitments), TR_{it} are tax revenues (assessments), $TransfR_{it}$ are revenues from current transfers (assessments), and NTR_{it} are non-tax revenues (assessments).

High municipal rigidity negatively impacts policy-making flexibility and the ability to withstand economic shocks (Openpolis, 2016; Grembi et al., 2016; Pavese and Rubolino, 2023; Gamalerio and Trombetta, 2025).

Moreover, we compute spending capacity as:

$$Spending\ Capacity_{it} = \frac{TR_{ab_{it}}}{TR_{a_{it}}} \tag{1.5}$$

where the total expenditures on an accrual basis ($TR_{ab_{it}}$) are expressed as a fraction of total assessed expenditures. A reduced spending capacity threatens a smooth implementation of municipal policy agenda (Bellodi and Morelli, 2024).

The indicators of collection capacity and municipal investments reflect financial autonomy and the competence and integrity of local administrations. Collection capacity gauges the efficiency of local governments in gathering confirmed revenues (Gagliarducci and Nannicini, 2013), and it is computed for each municipality as:

$$Collection\ Capacity_{it} = \frac{TE_{ab_{it}}}{TE_{a_{it}}} \tag{1.6}$$

where $TE_{ab_{it}}$ are total revenues on an accrual basis, and $TE_{a_{it}}$ are the assessed total revenues.

Finally, the municipal investments indicator calculates the budget portion designated for investments. A higher proportion of long-term investments correlates with competent local politicians in areas with weak informal institutions (Carreri, 2021) and is linked to reduced corruption levels (Mauro, 1995). This indicator is computed as follows:

$$Investments_{it} = \frac{(CE_{ab_{it}} + CE_{c_{it}})}{\left(TE_{ab_{it}} + TE_{c_{it}}\right) - (ESTP_{ab_{it}} + ESTP_{c_{it}})} \quad (1.7)$$

where capital expenditures are expressed as a fraction of total expenditures net of expenditures for services on behalf of third parties. In particular, subscript ab indicates the accrual basis, and subscript c indicates carryovers. Hence, $CE_{ab_{it}}$ are capital expenditures on accrual basis, $CE_{c_{it}}$ are carryovers capital expenditures. TE indicates total expenditures, and $ESTP$ refers to expenditures for services on behalf of third parties.

Table 1.2. Descriptive statistics

Pillar	**Indicator**	**Mean**	**St. deviation**	**Polarity**
Pillar I: Bureaucracy – quality/capacity	Average years of education	11.60	1.85	+
	N° of bureaucrats per 1,000 inhabitants	6.20	3.67	+
	Average n° of absences	30.49	7.76	-
	Turnover rate	0.13	0.18	-
Pillar II: Local politicians - quality	Average years of education	13.63	2.08	+
	Gender balance index	0.59	0.32	-
	Proportion of white-collar workers	0.19	0.22	+
Pillar III: Local government – Fiscal and Economic pillar	Spending rigidity	0.36	0.18	-
	Spending capacity	0.67	0.15	+
	Collection capacity	0.69	0.15	+
	Share of municipal budget for investments	0.24	0.15	+

Table 1.2 presents the descriptive statistics for all indicators, including their polarity – the sign indicating the relationship between each indicator and the phenomenon measured by our composite index (Mazziotta and Pareto, 2017) – in relation to municipal administration quality. Assigning polarity is crucial for computing composite indices, necessitating the normalization of all indicators (refer to Section 1.3.3). In this normalization, positive or negative polarity assigned to indicators mirrors their correlation with the measured phenomenon, so that an increase in normalized indicators corresponds to an increase in the composite index.

1.3.3. Composite Index (method)

Constructing a composite index is a complex task, entailing various options that influence the results' quality and reliability (Saltelli, 2007). Selecting indicators requires a balance between the redundancy risks due to overlapping information and the potential for information loss (Mazziotta and Pareto, 2016). Once a set of indicators for a multidimensional phenomenon is chosen, these indicators must be made comparable through normalization and then aggregated. Normalization is crucial for transforming indicators into dimensionless, comparable figures, and aggregation merges these normalized elements into a single composite index.

Creating a composite index involves critical decisions regarding the normalization and aggregation of indicators and the associated weighting system. Choosing not to apply weighting essentially means assigning equal weight to all indicators (Greco et al., 2019; Mazziotta and Pareto, 2022). Our selection of particular normalization and aggregation methods was driven by the aim to facilitate absolute temporal comparisons using a solid methodology. MAQI utilizes an equal-weighting method, assigning the same importance to each indicator.[16] Additionally, MAQI incorporates a penalization mechanism designed to give more weight to units that exhibit a greater balance among indicator values (Mazziotta and Pareto, 2017). In other words, the indicators contribute equally to defining the ranking of each municipality, which receives a lower score if it reports an imbalance in the values of the indicators themselves.

The MAQI is calculated using the Adjusted Mazziotta Pareto Index (AMPI) method (Mazziotta and Pareto, 2016), which synthesizes a set of indicators deemed non-substitutable, requiring balance across all components.[17] This approach involves re-scaling each indicator to fit within two "goalposts" — a minimum and a maximum value that delineate the potential range for each indicator across all the observations and over all considered time periods. Consistent with Mazziotta and Pareto (2016), we select "goalposts" with 100 as the reference value. Given x_{ij}^t – the value of the indicator *j* for the i^{th} municipality at time *t* – the corresponding normalized value r_{ij}^t is equal to:

$$r_{ij}^t = \frac{(x_{ij}^t - min_{x_j})}{(max_{x_j} - min_{x_j})} * 60 + 70 \tag{1.8}$$

where min_{x_j} and max_{x_j} are the "goalposts" for the indicator *j*. Equation (1.8) consists of two parts. The term $\frac{(x_{ij}^t - min_{x_j})}{(max_{x_j} - min_{x_j})}$ represents the normalized value of the indicator *j* for unit *i*, obtained through rescaling. The second part of the equation ensures that all normalized

[16] The literature lacks specific recommendations for applying a differential weighting scheme to the phenomenon we are analyzing.

[17] To address the assumption of full substitutability among indicators, some researchers recommend using multiplicative aggregation methods like the geometric mean (OECD 2008). However, the geometric mean tends to yield a "biased" low value (Mazziotta and Pareto, 2018).

values fall within the range of 70 to 130, having 100 as reference value.[18] The generalized form of the AMPI is given by:

$$AMPI^{+/-} = M_{ri} \pm S_{ri} * cv_{ri} \tag{1.9}$$

where M_{ri}, S_{ri}, and cv_{ri} are the mean, standard deviation, and coefficient of variation of the normalized values for each municipality i, respectively.[19] The AMPI provides a robust measure that performs well compared to other indices and exhibits less sensitivity to the inclusion or exclusion of individual indicators (Mazziotta et al., 2010, Mazziotta and Pareto, 2018).

In our analysis, we calculate the AMPI for each pillar and then average these scores to derive the MAQI. The reference value is established as the average of each indicator across all municipalities in the initial year of our panel, namely 2001. Therefore, a unit with the mean value for each indicator in 2001 would yield a MAQI score of 100.[20] By maintaining the same reference value throughout our analysis period, we enable three types of comparisons: (i) among municipalities within a specific year; (ii) over time for a particular municipality; (iii) among municipalities across the entire time span.

We evaluated potential issues in aggregating our selected indicators with the AMPI methodology. As it is known, a model of measurement can be conceived through two different conceptual approaches: reflective or formative. The approach adopted for the

[18] If indicator j has positive polarity, its normalized values are equal to equation (1.8). For an indicator with negative polarity, the complement to 200 of equation (1.8) is calculated.

[19] If the composite index is "increasing" or "positive", meaning higher index values indicate positive changes in the phenomenon (e.g., municipal administration quality), then $AMPI^{-}$ is applied in equation (1.9).

[20] This means that if a municipality's score in any given year is below (above) 100, its administrative quality is considered worse (better) than the one of a unit having the mean value for each indicator in 2001.

MAQI is a formative model, according to which individual indicators are causes of an underlying latent variable, rather than its effects. Therefore, causality is from the indicators to the concept and a change in the phenomenon does not necessarily imply variations in all its measures. In this model, the concept is defined by, or is a function of, the observed variables (Mazziotta and Pareto, 2019). Given the sensitivity of the AMPI computation to highly skewed and dispersed data (Scaccabarozzi et al., 2022), we address this issue by assessing the coefficients of variation for each indicator and replacing outliers in highly skewed indicators with capped values.[21] Table 1.A.1 in Appendix 1 presents the coefficients of variation for all normalized indicators, which are reassuringly low. Another potential issue arises from highly correlated indicators (Salzman, 2003). Although the use of non-substitutable indicators helps mitigate this concern, we report the correlation between our indicators in Table 1.A.2 in Appendix 1. Overall, there is no clear evidence of redundancy among them.

1.4. Results

This section starts with an overview of the geographical distribution of MAQI, followed by a detailed heterogeneity analysis based on different population thresholds and by geographical area. In addition, in Section 1.A.1 of Appendix 1, we report several sensitivity checks.

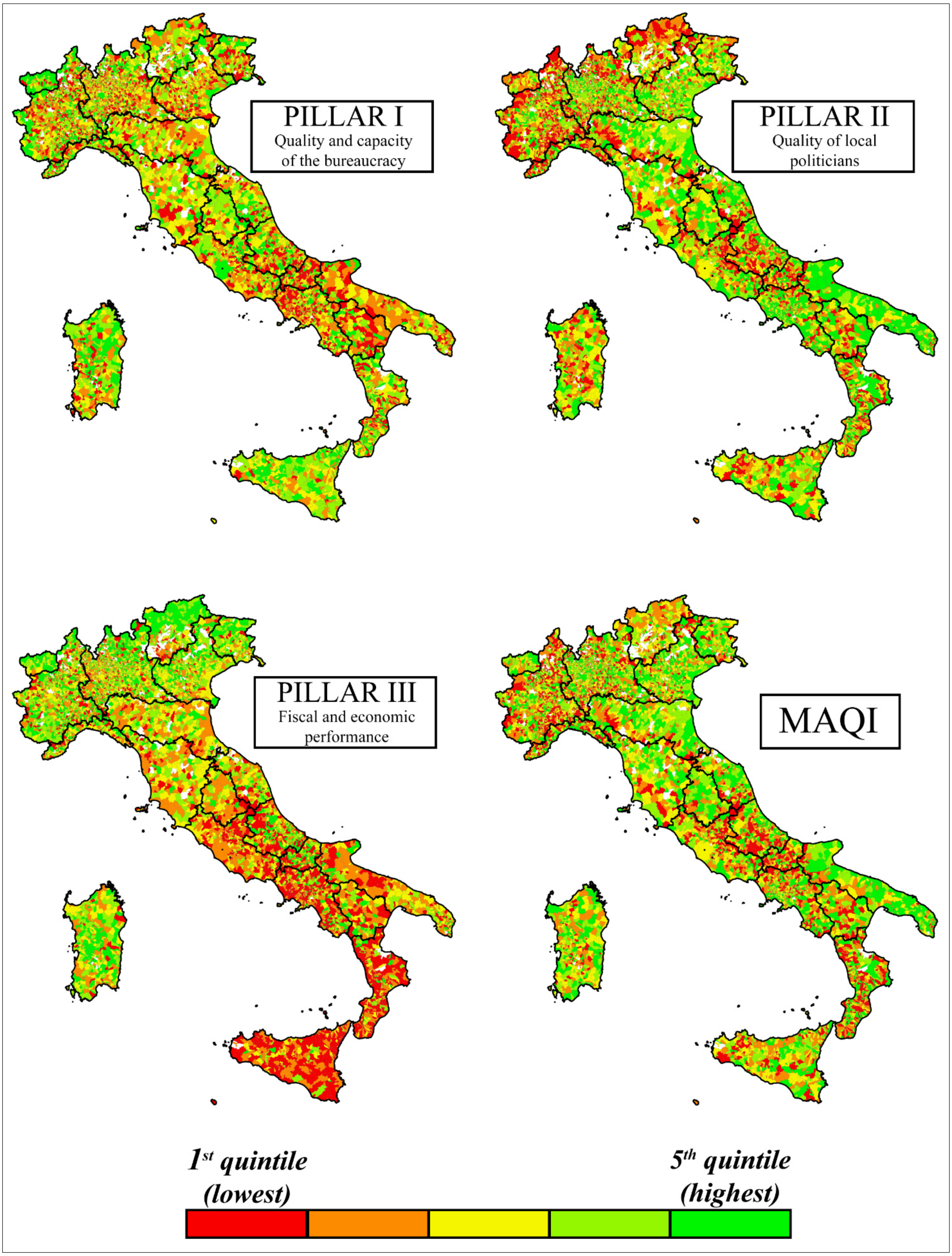
Figure 1.2 illustrates the geographical distribution of MAQI scores for 2022, along with the scores for each individual pillar.[22] The rankings are segmented into five classes (quintiles)

[21] For instance, to minimize the influence of extreme values, we set a cap of 30 for the "number of employees per 1,000 inhabitants" variable. Similarly, the "spending rigidity index" was capped at 1.5.

[22] Maps for the years 2011 and 2001 are presented in Figures 1.A.2 and 1.A.3 in Appendix 1.

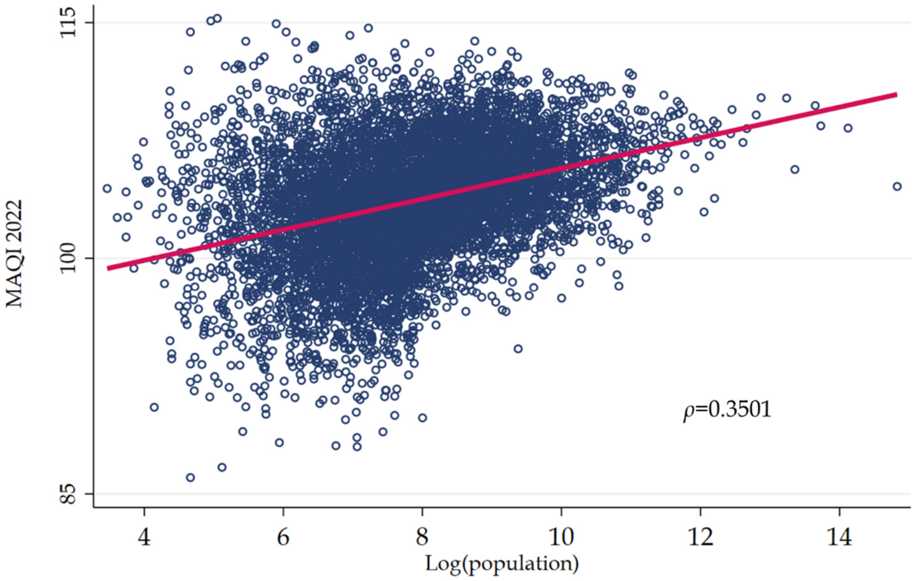
for enhanced clarity. A visual examination shows significant heterogeneity in MAQI scores across NUTS-2 regions. Notably, Emilia-Romagna and Veneto have the highest proportions of municipalities with superior administrative quality, whereas Calabria has many municipalities in the lowest quintile. The economic and fiscal rankings (Pillar III) distinctly reflect the recognized North-South economic disparity (Panetta, 2018). In contrast, the quality of the bureaucratic apparatus (Pillar I) does not display a consistent geographical trend, though numerous municipalities in Campania, Basilicata, and Calabria fall into the lowest quintile. The quality of local politicians (Pillar II), assessed through their valence attributes, tends to be lower in more peripheral municipalities.

Figure 1.2. The geographical distribution of MAQI and its pillars in 2022



Notes: Data are available for 7,723 of 7,901 municipalities. Missing data is indicated by empty areas.

Figure 1.3. Distribution of 2022 MAQI scores according to municipalities' population size



Notes: Population size is expressed in logarithmic form, and we employed a linear regression model to fit the line.

Table 1.3. Percentage of municipalities in the lowest and highest quintiles of 2022 MAQI scores by population size

	Lowest quintile	Highest quintile
Small (less than 5,000 inhabitants)	26.9%	14.5%
Medium (5,000 ≤ inhabitants <15,000)	2.5%	38.0%
Large (15,000 inhabitants or more)	4.6%	30.5%

Notes: The denominator corresponds to the number of municipalities within the same population size category. In our dataset, there are 5,415 small, 1,587 medium-sized, and 721 large municipalities.

Overall, Figure 1.2 indicates that larger municipalities generally achieve higher MAQI scores.[23] Table 1.3 and Figure 1.3 reinforce this observation, showing the percentage of municipalities in the lowest and highest quintiles of 2022 MAQI scores, categorized by population size, and the distribution of 2022 MAQI rankings across the logarithm of population size, respectively. MAQI scores positively correlate with population size, indicating that larger municipalities tend to achieve higher scores. The observed trend is likely attributed to the economic and financial constraints of smaller municipalities, resulting in reduced efficiency levels (Iommi, 2013). Specifically, Iommi (2013) distinguishes between the explicit costs of fragmentation (politics, general administration and personnel) and the implicit/opportunity costs (slow decisions, duplication, inability to deliver innovative supra-local services), showing that small municipalities face both scale-related inefficiencies and thin financial and professional capacity, and that simulated reorganizations yield sizable reductions in running costs. The observed trend is also attributable to the higher educational levels of local politicians and public employees in larger municipalities. This latter observation aligns with the findings of De Benedetto and De Paola (2015), who demonstrate that higher wages in larger municipalities increase the median educational level of mayoral candidates.[24]

[23] For example, the average 2022 MAQI score for municipalities in Apulia, which has the largest average municipal population (15,228 inhabitants), is 105.4. In contrast, municipalities in Piedmont, with a significantly lower average population size (3,570 inhabitants per municipality), exhibit a lower level of municipal administration quality, with an average score of 102.5.

[24] Moreover, descriptive evidence in our dataset confirms both findings. For instance, the median years of educations of local politicians in 2022 is 15 in large municipalities and 13.8 in small municipalities, while the median spending capacity in 2022 is 0.79 in large municipalities and 0.74 in small municipalities.

We further perform a heterogeneity analysis by grouping municipalities into macro-regional areas (NUTS-1 level).[25] Specifically, Table 1.4 presents the percentage of municipalities within each macro-regional area that exhibited the lowest and highest levels of municipal administration quality in 2022.[26] In 2022, the North-East macro-region had the highest percentage of municipalities with top municipal administration quality. Conversely, the South and North-West regions saw 21% and 23% of their municipalities scoring at the lowest level. Notably, the North-West exhibits the greatest fragmentation among the NUTS-1 regions, with over 90% of its municipalities having fewer than 10,000 inhabitants, indicating that the prevalence of small municipalities contributes to this relatively "poor" performance.

Table 1.4. Percentage of municipalities in the lowest and highest quintiles of 2022 MAQI scores across NUTS-1 regions

	MAQI		PILLAR I		PILLAR II		PILLAR III	
NUTS-1 region	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile
North-East	10%	23%	18%	13%	13%	19%	7%	25%
North-West	23%	17%	20%	21%	28%	14%	10%	26%
Centre	21%	21%	17%	19%	18%	22%	24%	8%
South + Islands	21%	21%	22%	22%	19%	26%	36%	14%

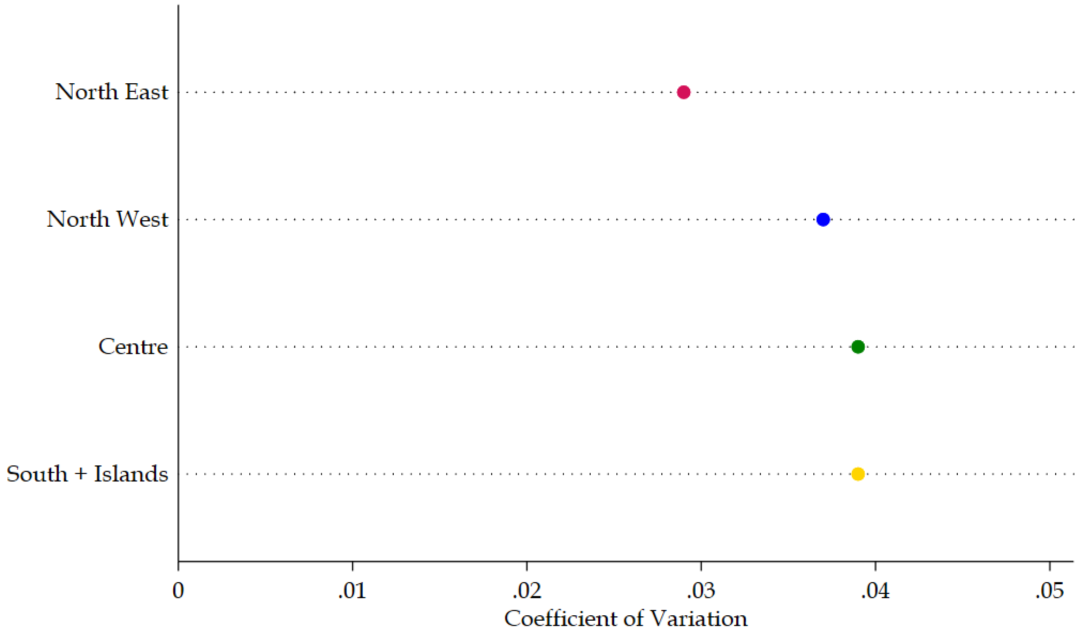
Notes: The denominator is represented by the total number of municipalities belonging to the same NUTS-1 region.

[25] The heterogeneity analysis can be extended to various subnational levels, for instance, by comparing municipalities within the same or different NUTS-2 or NUTS-3 regions, or considering specific municipal features such as the degree of peripherality relative to socio-economic centers. In line with common practice in Italian geographical analyses, we combine regions from the "South" and "Islands" categories when using the NUTS-1 territorial classification.

[26] We report the same data for the years 2011 and 2001 in Tables 1.A.3 and 1.A.4 in Appendix 1.

The Southern macro-region has the highest percentage of municipalities with low scores in bureaucratic quality (Pillar I) and economic and fiscal performance (Pillar III). Conversely, the North-West records the highest percentage of municipalities with poor-quality local administrations based on the politicians' pillar (Pillar II). Again, the prevalence of small municipalities in the North-Western municipalities is a significant factor influencing this outcome.

Figure 1.4. Coefficient of variations of 2022 MAQI scores within NUTS-1 regions



We further investigate the within-region heterogeneity of municipal administration quality by calculating the coefficient of variation for 2022 MAQI scores at the NUTS-1 level. This analysis helps pinpoint geographical areas with greater internal variability in municipal administration quality and those exhibiting more consistency. Figure 1.4 reveals that the North-East has the lowest coefficient of variation, indicating a uniformity in higher municipal administration quality across its municipalities. In contrast, the Central and

Southern municipalities display the highest heterogeneity, signifying less uniform local administration quality levels.

MAQI represents the first attempt to measure the quality and capacity of municipal administrations through a composite index. This uniqueness makes direct validation or comparison with other indices challenging, if not impossible. Nonetheless, we have attempted a direct comparison between MAQI and the closest available index, namely the Institutional Quality Index provided by Nifo and Vecchione (2014).[27] We find a strong and positive correlation between IQI and both MAQI's bureaucratic capacity and efficiency and economic balance sheet indicators. However, the correlation between the quality of politicians' pillar and IQI is negative, albeit small.[28] The latter finding is not surprising, as none of the IQI's pillars directly measure the valence attributes of politicians.

1.4.1. Analysis over time

Thus far, the discussion has centered on the spatial distribution of MAQI, its ranking, and the heterogeneity within macro-regions at a specific time. In contrast, this subsection examines the temporal dynamics of Italian municipal administration quality by analyzing the trend evolution of MAQI and its three pillars, with a focus on NUTS-1 regions.

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[27] Given that IQI provides data at the provincial level from 2004 to 2019, we aggregated MAQI data at the provincial level for 2019 and examined the correlation between MAQI and IQI.

[28] We found that the correlation between each of the MAQI pillars and IQI is +0.5876, -0.1530, and +0.7142, respectively. Further investigation into the link between politicians' valence features and IQI reveals a positive correlation (+0.1115) only with the Government Effectiveness pillar of the IQI, while the correlation is negative with the other pillars.

Figure 1.5. The temporal evolution of MAQI across NUTS-1 regions

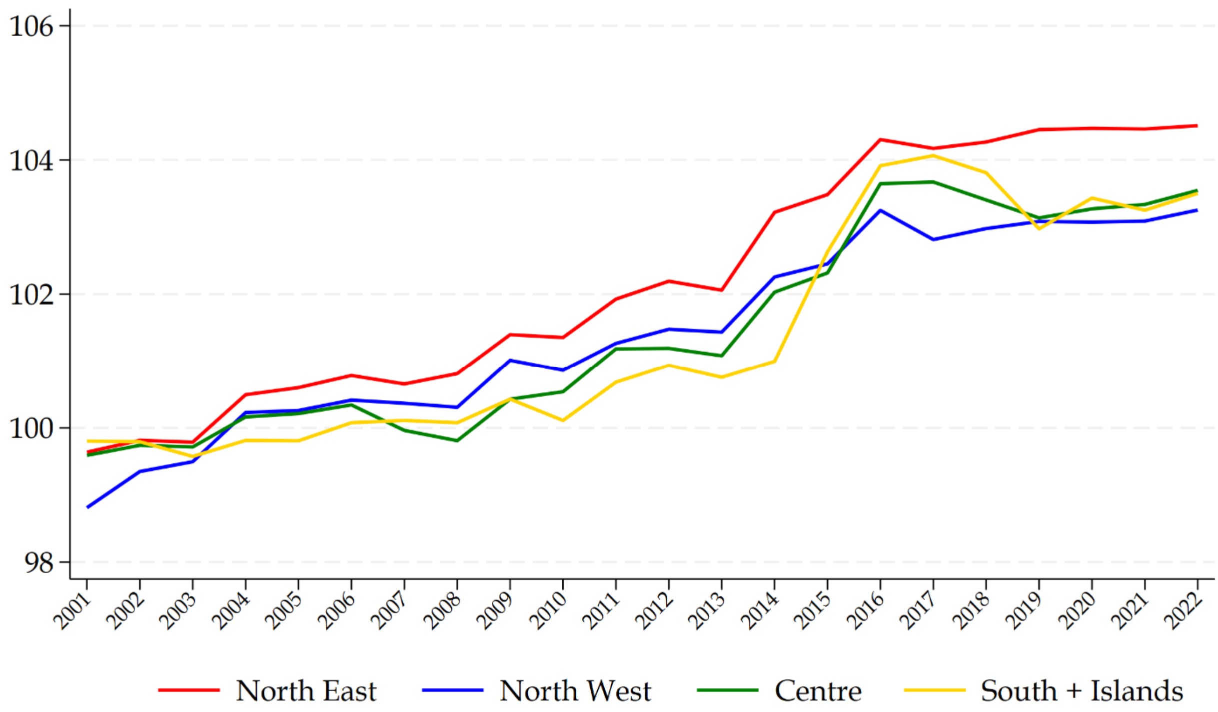


Figure 1.5 illustrates the temporal evolution of MAQI across macro-regions, revealing a general positive trend indicating that all NUTS-1 regions have enhanced their average municipal administration quality over time. The Northern regions exhibit an immediate upward trend, whereas the upward trend in the Central and Southern regions emerged more gradually. This broadly positive trend signifies a level of uniformity across macro-regions, becoming more stable post-2016, after which the trend flattens.

The subplots in Figures 1.A.4, 1.A.5, and 1.A.6 in Appendix 1 display the trends for Pillars I, II, and III, respectively. The bureaucracy pillar contributes to the general improvement up to 2013, then exhibits a general decline, with the Southern regions experiencing a notable dip in 2019. This trend is primarily attributed to high turnover rates, resulting from a significant stabilization of temporary workers in municipal offices, particularly in Sicily.[29] Conversely, Pillar II shows a consistent upward trend since 2003, with Southern regions performing notably well, likely due to a higher proportion of politicians with university degrees, and typically larger municipalities. In contrast, Northern regions exhibit strong performance in the fiscal and economic pillar (Pillar III), whereas the Central and Southern regions do not demonstrate improvement until 2013 and 2014, respectively.[30] The stable trend observed across macro-regions from 2016 onwards may be attributed to the introduction of new balance sheet formation criteria, aimed at enhancing homogeneity and comparability (Mulazzani, 2016).

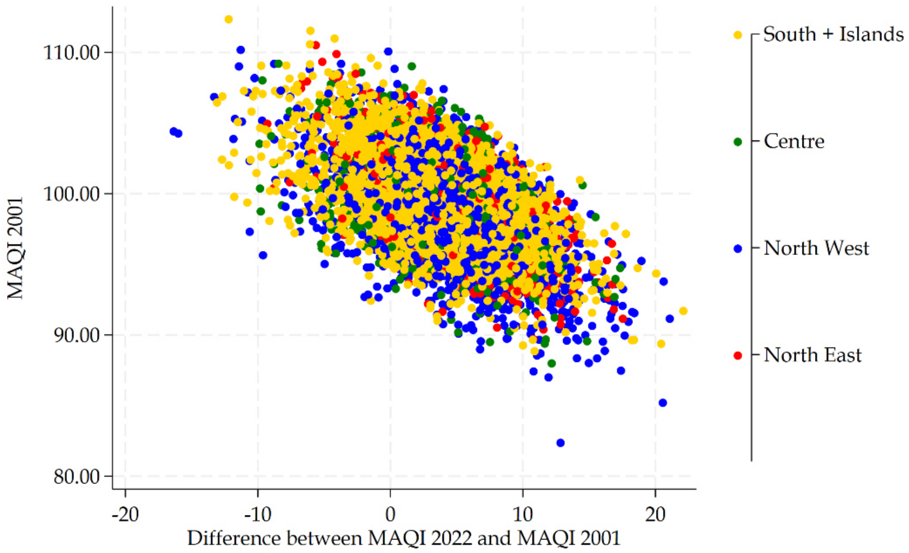
Finally, the analysis of municipalities showing the most significant improvement in municipal administration quality over time within each NUTS-1 region is captured in Figure 1.6, which displays the velocity-acceleration plot for MAQI scores. This graph illustrates the progression of the Index in the last year of analysis relative to the 2001 MAQI scores for each municipality, with each dot representing a municipality and its color denoting the corresponding macro-region. The x-axis shows the 2001 MAQI value, while the y-axis reflects the change between the final and initial values, indicating the extent of Index evolution from the start of the period. The observed negative relationship suggests a catch-up effect among the initially worse-performing municipalities: those with lower scores in

[29] See https://contoannuale.rgs.mef.gov.it/ext/Documents/ANALISI%20E%20COMMENTI%202012-2021.pdf (in Italian). With an amendment to the financial law, the government allowed the stabilization of all the temporary employees of Sicilian local governments. See https://palermo.repubblica.it/cronaca/2015/11/28/news/precari_enti_locali_sicilia_ok_del_governo_renzi_alla_stabilizzazione-128364055/ (in Italian).

[30] The sizable dip in 2014 for the Southern regions, followed by a sharp increase in 2015, is largely due to changes in two indicators within Pillar III: spending rigidity and spending capacity, both heavily influenced by the new accounting method for passive residuals. Despite these regional variations, it is important to note that this new recording procedure was implemented across all Italian municipalities.

2001 improved the most. The prevalence of blue dots in the graph's bottom-right section denotes significant improvement in North-Western municipalities.

Figure 1.6. Velocity-acceleration score plot of MAQI



1.5. Conclusions

We tackle the challenge of evaluating local administration quality by developing the MAQI, a composite index based on objective data. MAQI facilitates a comparative analysis of bureaucratic efficiency, political quality, and fiscal and economic performance among Italian municipalities. Providing an extensive review of municipal administrative quality over two decades and covering nearly all Italian municipalities, MAQI enhances the understanding of local administration quality. The empirical analysis reveals notable variations in MAQI scores among municipalities of varying sizes and distinct geographical patterns within each MAQI pillar.

MAQI serves as an instrument for assessing local public administration performance, providing vital information for government officials, civil society actors, citizens, and researchers. It helps pinpoint geographical areas in need of policy action and furnishes fresh perspectives on evaluating local governments, revealing significant spatial and temporal variations in their performance. By doing so, MAQI aids local governments in more effectively meeting their challenges and needs, and it promotes increased citizen involvement in local public affairs. The dedicated resource site https://sites.google.com/view/maqi/home provides access to the complete set of MAQI scores, along with its underlying pillars, for each municipality annually from 2001 to 2022.

MAQI could function as a valuable tool for addressing research questions on a more localized scale than previously possible. For instance, it can assess whether local governments of higher administrative quality are more successful at attracting external funding and more effective in implementing and managing the financed projects. This analysis can facilitate the identification of best practices and pinpoint areas that require improvement, thereby boosting the effectiveness of place-based policies (e.g., the EU Cohesion Policy or the Italian National Recovery and Resilience Plan) at the local level. In addition, MAQI and its pillars could be utilized to investigate whether higher-quality local administrations foster conditions that better support startups and local entrepreneurs, enhancing firm productivity and innovation performance.

While MAQI is implemented for Italy, its architecture is portable to comparative settings. Because the three pillars operationalise the CAF 'enabling factors' (leadership, people, resources), they can be mapped to harmonised cross-country sources (e.g., Eurostat statistics). A pragmatic path is to define comparable indicators in different countries which are already present in the MAQI (e.g., staff per 1,000 residents, gender balance in the executive, capital-expenditure share, revenue-collection ratio) and then incorporating country-specific measures where reliable micro-administrative data exist. Embedding

MAQI in this framework would enable benchmarking of local administrative capacity across systems and empirical tests linking administrative quality to broader institutional outcomes and policy performance.

Creating the MAQI involved several critical decisions and trade-offs. These discretionary choices represent the main limitations of this study and, more broadly, of any attempt to construct composite indices. For example, although the selection of indicators included in the MAQI is theoretically grounded in the Common Assessment Framework and supported by relevant literature, the unavailability of certain potentially useful indicators for the period 2001–2022 required their exclusion. Moreover, the AMPI methodology assigns equal weight to all indicators, whereas in some cases a differentiated weighting scheme might be more appropriate. We therefore encourage researchers and policymakers to carefully assess the suitability of this index for context-specific analyses.

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Appendix 1

Table 1.A.1. Coefficients of variation of the normalized indicators

Indicator	**Coefficient of variation**
Average years of education (bur)	0.067
N° of bureaucrats per 1,000 inhabitants	0.075
Average n° of absences (bur)	0.046
Turnover rate (bur)	0.107
Average years of education (pol)	0.076
Gender balance index (pol)	0.132
Proportion of white-collar workers (pol)	0.176
Spending rigidity	0.074
Spending capacity	0.086
Collection capacity	0.087
Share of municipal budget for investments	0.094

Table 1.A.2. Pairwise correlations between indicators

	Avg years of ed. (bur)	N° of bureaucrats per 1,000 inhabitants	Avg n° of absences (bur)	Turnover rate (bur)	Avg years of ed. (pol)	Gender balance index (pol)	Proportion of white-collar (pol)	Spending rigidity	Spending capacity	Collection capacity	Share of municipal budget for investments
Avg years of ed. (bur)	1										
N° of bureaucrats per 1,000 inhabitants	-0.18	1									
Avg n° of absences (bur)	-0.01	-0.05	1								
Turnover rate (bur)	0.20	-0.11	-0.04	1							
Avg years of ed. (pol)	0.08	-0.11	0.01	0.01	1						
Gender balance index (pol)	-0.11	0.12	-0.05	-0.01	-0.24	1					
Proportion of white-collar (pol)	0.02	-0.10	0.01	-0.01	0.41	-0.10	1				
Spending rigidity	-0.19	0.27	0.01	0.11	-0.03	0.08	-0.03	1			
Spending capacity	0.10	-0.11	0.11	-0.06	0.05	-0.19	0.01	0.01	1		
Collection capacity	0.13	-0.10	0.11	-0.03	0.01	-0.11	-0.02	-0.01	0.60	1	
Share of municipal budget for investments	-0.05	0.23	-0.07	0.02	-0.24	0.23	-0.15	0.06	-0.25	-0.18	1

Notes: the correlations refer to the last year of our analysis, i.e., 2022.

Table 1.A.3. Share of municipalities in the lowest and highest quintile of 2011 MAQI scores by NUTS-1 regions

	MAQI		PILLAR I		PILLAR II		PILLAR III	
NUTS-1 region	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile
North-East	13%	25%	19%	15%	15%	23%	10%	27%
North-West	18%	20%	24%	17%	24%	17%	9%	28%
Centre	20%	21%	15%	23%	19%	20%	22%	12%
South + Islands	25%	17%	18%	25%	19%	21%	37%	10%

Notes: The denominator is represented by the total number of municipalities belonging to the same NUTS-1 region.

Table 1.A.4. Share of municipalities in the lowest and highest quintile of 2001 MAQI scores by NUTS-1 regions

	MAQI		PILLAR I		PILLAR II		PILLAR III	
NUTS-1 region	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile	Lowest quintile	Highest quintile
North-East	17%	22%	24%	10%	19%	22%	13%	25%
North-West	26%	16%	29%	16%	27%	17%	18%	21%
Centre	17%	20%	13%	21%	19%	21%	21%	13%
South + Islands	16%	23%	11%	30%	16%	22%	25%	20%

Notes: The denominator is represented by the total number of municipalities belonging to the same NUTS-1 region.

Figure 1.A.1. The Common Assessment Framework Model

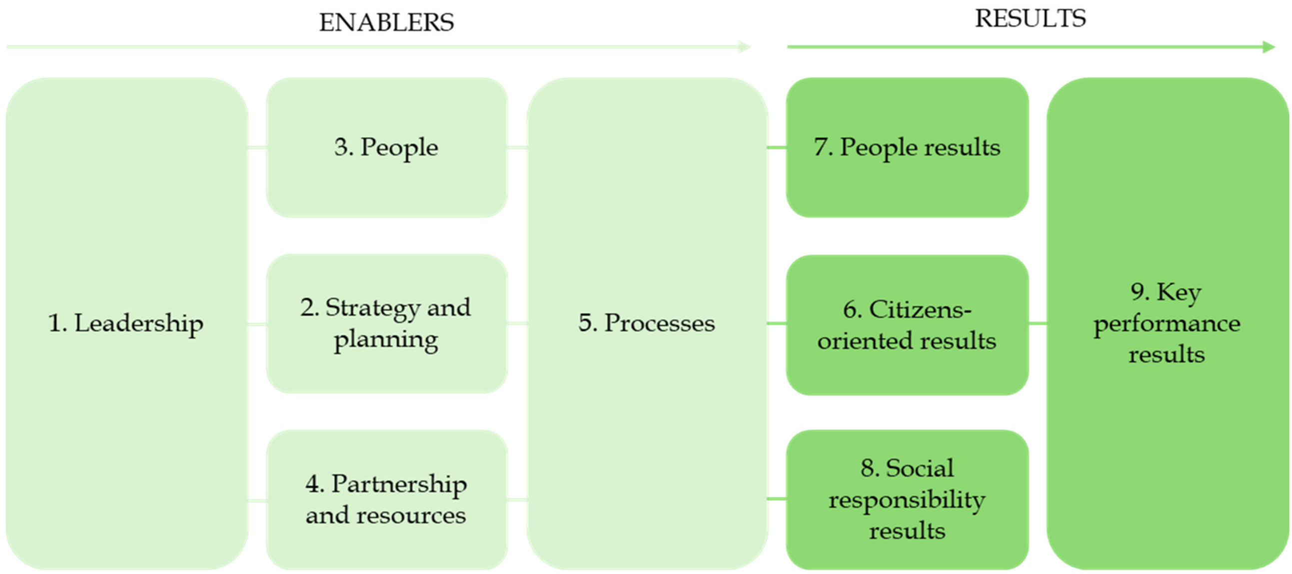
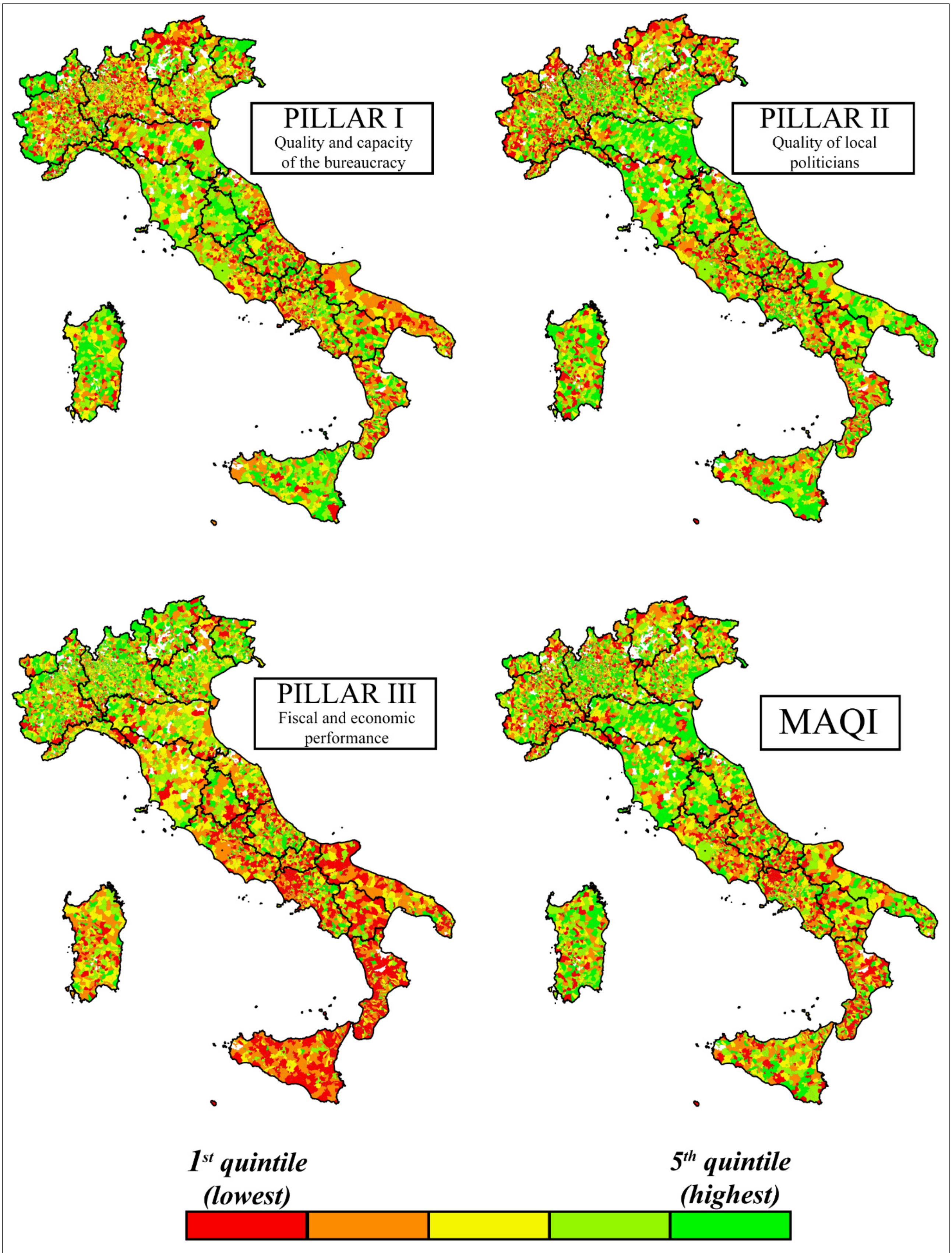
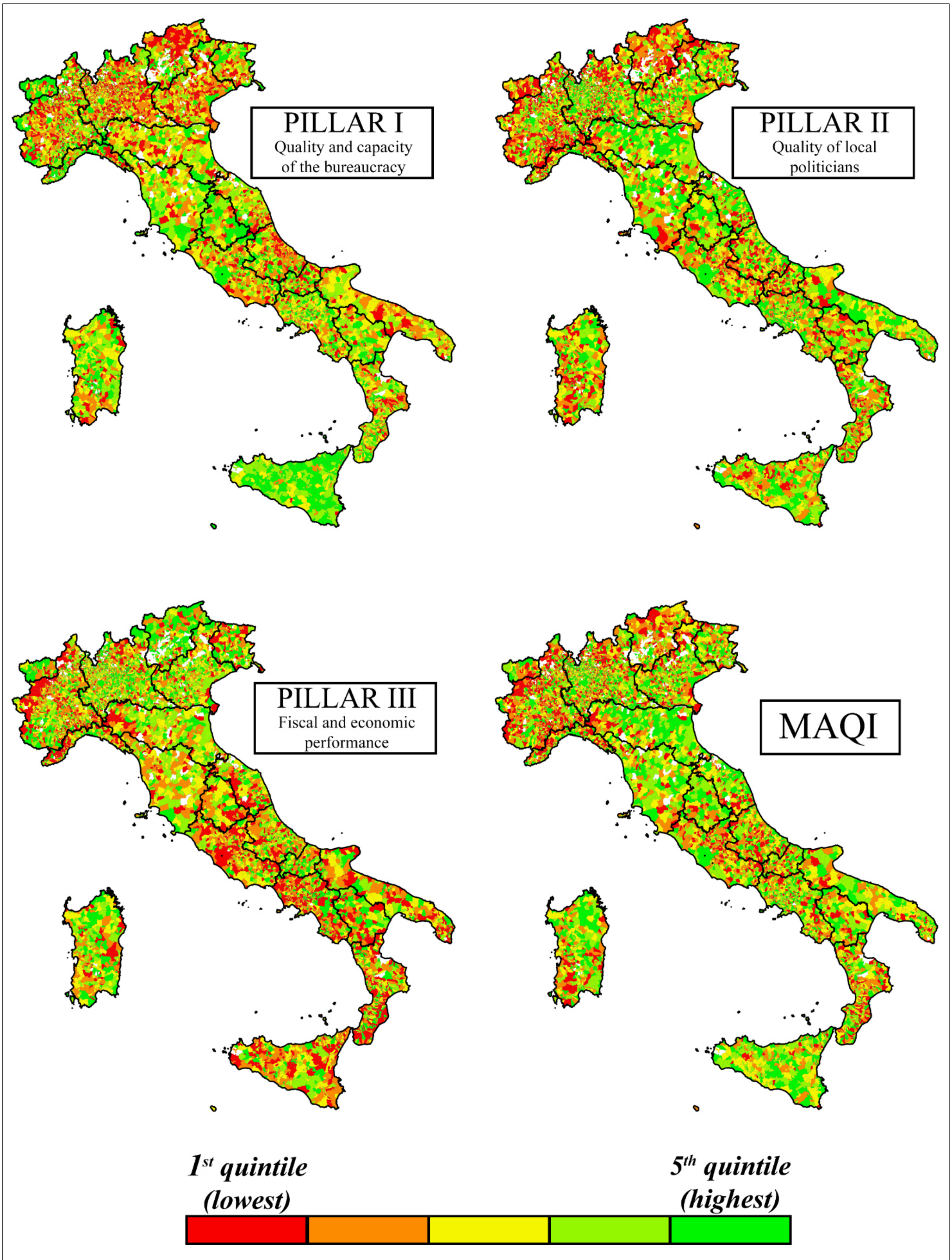


Figure 1.A.2. The geographical distribution of MAQI and its pillars in 2011



Notes: Data are available for 7,723 of 7,901 municipalities. Missing data is indicated by empty areas.

Figure 1.A.3. The geographical distribution of MAQI and its pillars in 2001



Notes: Data are available for 7,723 of 7,901 municipalities. Missing data is indicated by empty areas.

Figure 1.A.4. The temporal evolution of Pillar I – Quality of bureaucracy across NUTS-1 regions

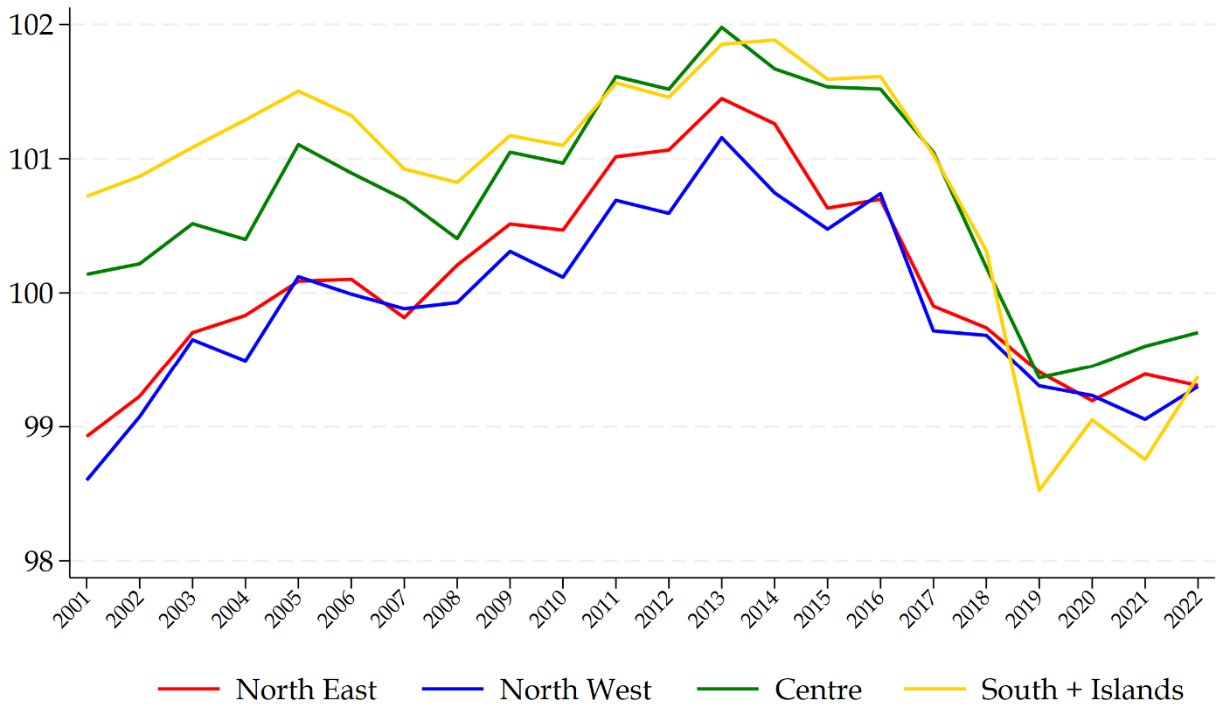


Figure 1.A.5. The temporal evolution of Pillar II – Quality of politicians across NUTS-1 regions

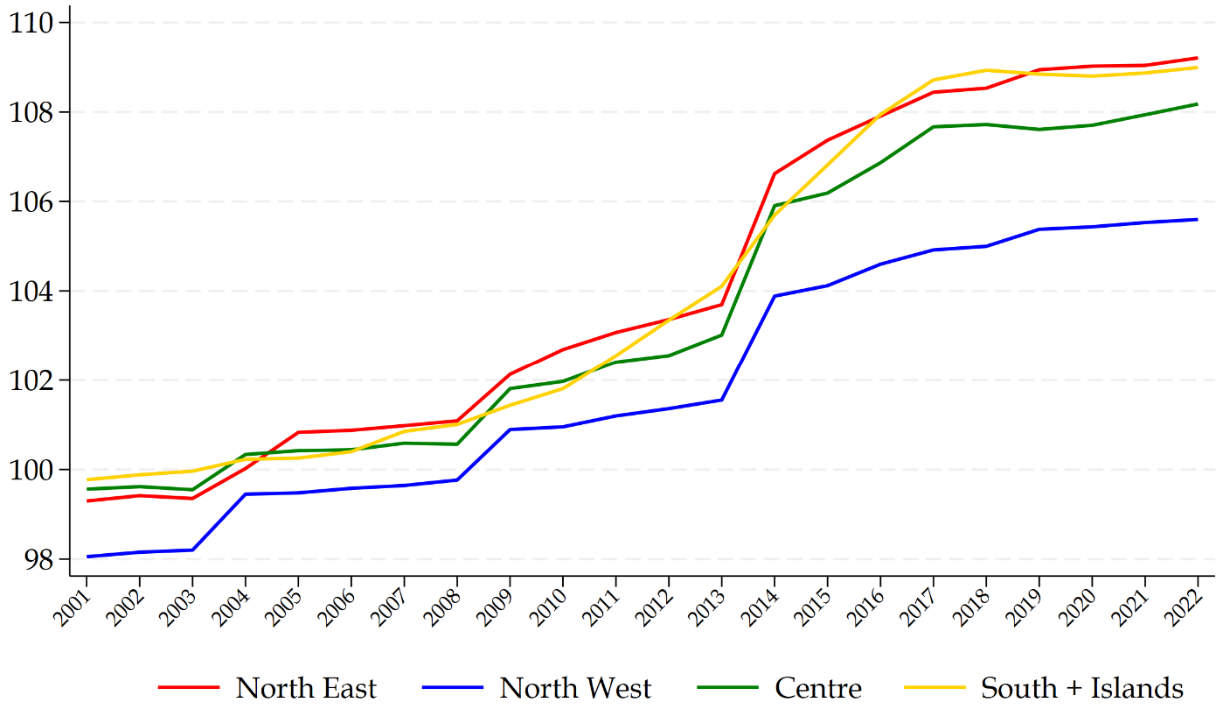
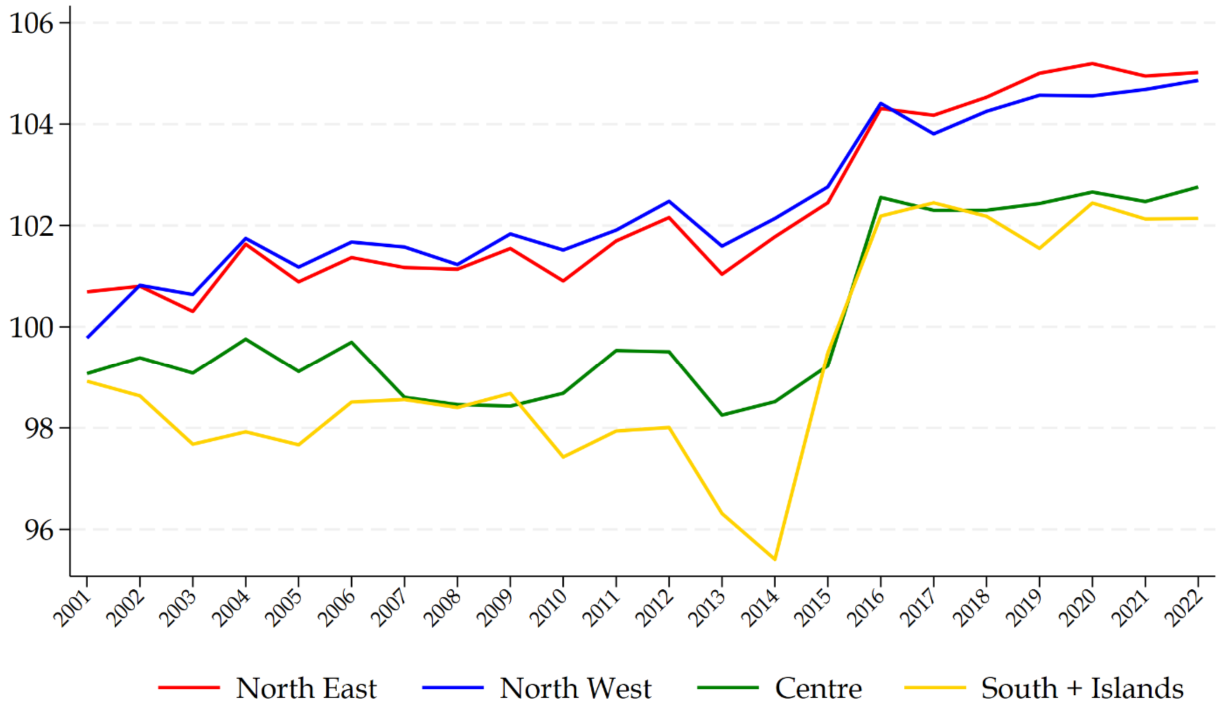


Figure 1.A.6. The temporal evolution of Pillar III – Economic and Fiscal performance across NUTS-1 regions



1.A.1. Influence analysis and sensitivity checks

To assess the impact of each pillar on the overall municipal administrative quality, we conducted three leave-one-out tests, removing one pillar at a time (Scaccabarozzi et al., 2022), and then calculated the reduced versions of MAQI, each including only two pillars. Initially, we determined the correlation coefficients between the complete MAQI and each reduced version. The results showed a 0.562 correlation for the version omitting the political pillar, 0.876 for the one without the bureaucracy pillar, and 0.393 for the exclusion of the economic pillar. These findings suggest that the political pillar, which assesses the quality of local politicians, has the most significant influence on the overall MAQI score.

Then, for each municipality, we calculated the difference between the ranking based on the complete MAQI and the reduced versions of MAQI. The distributions of these rank differences for 2022 are depicted in the boxplots in Figure 1.A.7, and for 2001 in Figure 1.A.8, with the y-axis representing the rank differences. The exclusion of each pillar affects the final ranking differently. Removing the economic pillar leads to greater variability in the ranking differences, evidenced by the denser tail in the green boxplot. On the other hand, the red boxplot's concentration around zero suggests that omitting the political pillar has minimal impact on the ranking.

Figure 1.A.7. Boxplots of the distributions of the absolute differences of ranks between the original MAQI and the three reduced versions

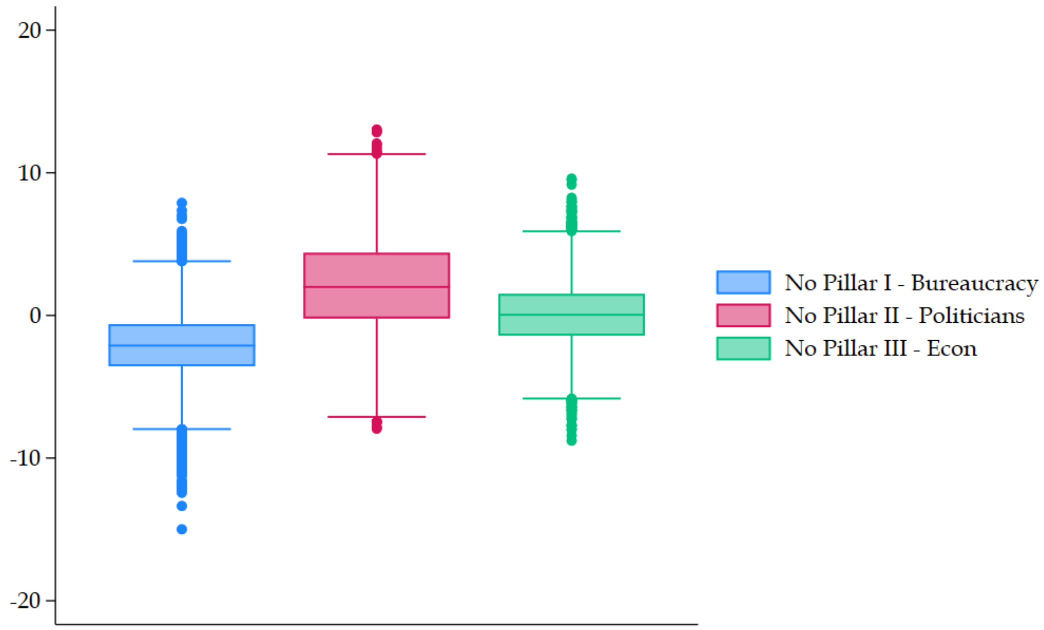
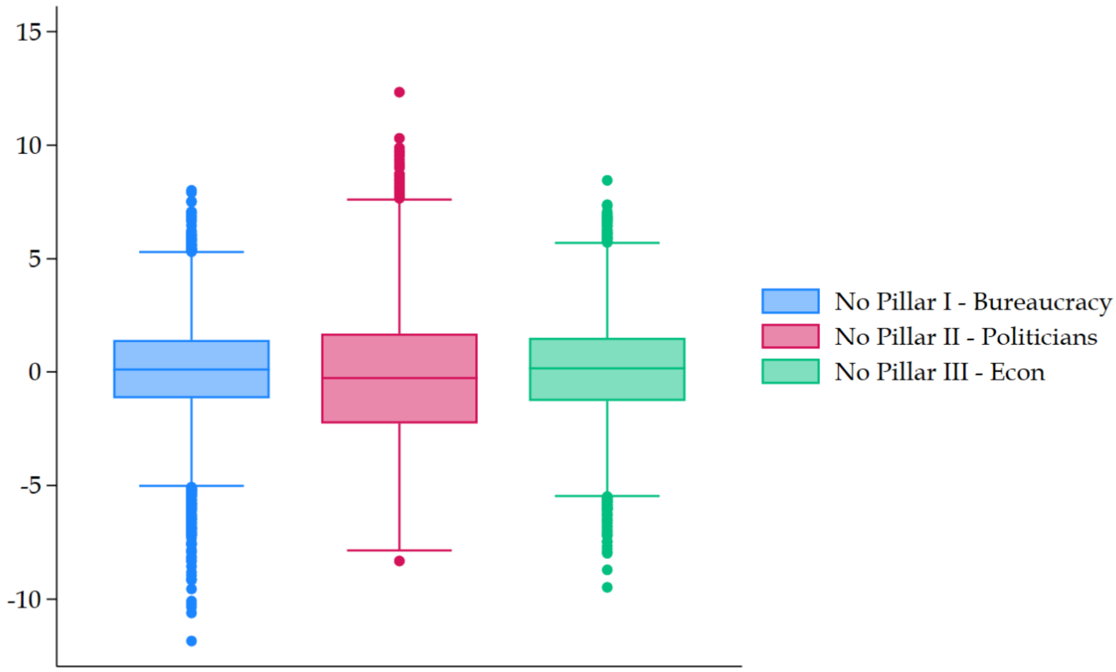


Figure 1.A.8 Boxplots of the distributions of the absolute differences of ranks between the original MAQI and the three reduced versions, 2001



Lastly, we evaluate MAQI's sensitivity to various aggregation techniques, specifically comparing the use of the geometric mean with the AMPI methodology for aggregating Pillars I, II, and III. The two methods yield nearly identical rankings, with a correlation of 0.9989 between the municipal administration quality scores derived from each method).

Chapter 2. The Causal Relationship between Jurisdiction Size and Institutional Quality

Abstract

While the relationship between jurisdiction size and economic and electoral outcomes has been extensively studied, its causal impact on institutional capacity and quality remains unexplored. Leveraging the mergers of 197 Italian municipalities, we investigate changes in administrative quality using the Municipal Administration Quality Index (MAQI), a novel composite measure of local administrative capacity and quality based on three pillars: bureaucratic, political, and economic. Using a non-parametric difference-in-differences approach, we find that mergers substantially improve administrative performance. This improvement is driven primarily by the enhanced quality of local politicians and strengthened economic-fiscal performance, whereas bureaucratic efficiency improves only marginally. We demonstrate that these positive outcomes are attributable to economies of scale and the self-selection of higher-quality local politicians, who are drawn by the opportunity to earn higher wages. Our findings contribute to the broader debate on the optimal municipal size and demonstrate that municipal mergers among small municipalities can enhance the quality of local government.

Keywords: administrative quality; municipalities; composite index; municipal mergers; non-parametric difference-in-differences.

JEL codes: D73; H11; H70.

2.1. Introduction

There has long been debate over the potential existence of an optimal jurisdiction size (Oates, 1972; Epple and Romer, 1989; Ostrom, 2010) and the economic and political advantages and disadvantages of enlarging jurisdictions. Proponents argue that larger jurisdictions can exploit benefits from economies of scale and improve efficiency in public service delivery, offer a wider range of services, and rationalize expenditures. However, they may also reduce citizen participation in politics and make it harder to tailor services to a diverse population (see, among others, Tiebout, 1956; Alesina and Spolaore, 1997; Blom-Hansen et al., 2014). Although extensive literature has examined the relationship between jurisdiction size and various economic and political outcomes,[31] a key question remains unanswered: does jurisdiction size affect institutional quality, and if so, how? Indeed, there is no study investigating the causal relationship between jurisdiction size and institutional quality — a highly relevant matter, as it directly informs how government boundaries and administrative scales affect governance effectiveness, public service delivery, and economic development.

By increasing the size of local governments, municipal mergers provide an ideal natural experiment to test the impact of jurisdiction size on institutional quality. In this paper, we explore this causal relationship by assessing the impact of municipal mergers on administrative quality and capacity. Municipal mergers are implemented primarily to reduce fixed costs, achieve greater allocation efficiency, and contribute to a more rational governmental structure. Of particular relevance to our analysis is the potential for mergers

[31] For instance, scholars have investigated the impact of municipal mergers on debt (Hinnerich, 2009), expenditures (Allers and Bieuwe Geertsema, 2016; Blesse and Baskaran, 2016; Blom-Hansen et al., 2016; Hirota and Yunoue, 2017; Roesel, 2017), voter turnout (Horiuchi et al., 2015; Bolgherini and Mollisi, 2024), and the spatial distribution of economic activity (Egger et al., 2022).

to improve municipal efficiency through enhanced staff performance (Fox and Gurley, 2006; Steiner and Kaiser, 2017). To test this hypothesis, we exploit the staggered merging of 197 Italian municipalities from 2013 to 2018, using a refined version of the non-parametric difference-in-differences (DiD) estimator (Imai et al., 2023) to identify the causal effect of boundary changes. This evaluation strategy allows us to investigate the extent to which municipal mergers affect local governments' capacity to meet the needs of citizens and businesses by leveraging the Municipal Administration Quality Index (MAQI) (Cerqua et al., 2025). The MAQI evaluates municipal administrative capacity by combining information on the quality and capacity of public employees, the quality of local politicians, and municipal fiscal and economic performance. It is the first comprehensive measure enabling an analysis of institutional quality dynamics at the municipal level over a long time span for almost all local institutions.[32] By leveraging the MAQI and its pillars (1. quality and capacity of public employees; 2. quality of local politicians; 3. the economic and fiscal performance of municipalities), we shift the focus from the direct evaluation of outputs (e.g., public service provision or expenditure patterns) to an examination of how mergers influence the "input" side — such as the expertise and accountability of local governments and bureaucrats.[33] Moreover, unlike most existing studies on municipal mergers, our sample is heterogeneous in terms of population size, allowing us to explore how different

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[32] MAQI includes 7,920 municipalities, representing 98% of Italian municipalities as of 2011 (8,092 municipalities). Only municipalities with several missing values in at least one indicator were excluded (for more details, see Section 2.4.1).

[33] Testing the effect of mergers on a composite measure that provides a comprehensive picture of outputs requires assessing service delivery effectiveness — a domain where citizens' perceptions play a crucial role. However, incorporating these perceptions raises significant measurement and comparability issues, as described in Section 2.3.

municipal characteristics shape these outcomes and improve the external validity of the findings.[34]

We find that enlarging jurisdiction size substantially improve administrative quality. On average, merged municipalities experience an 18-percentile increase in the MAQI distribution, moving from the 52nd to the 70th percentile. This improvement is driven primarily by enhanced local political quality and improved economic and fiscal performance. Although we also find significant positive effects on bureaucratic efficiency, these improvements manifest more gradually. Our results remain robust to a variety of sensitivity checks. By assessing the effect of mergers on each individual MAQI indicator separately, we disentangle the mechanisms driving improvements in administrative quality. Specifically, we show that two mechanisms drive improvements in administrative quality: first, increased efficiency from economies of scale, and second, the positive self-selection of higher-quality local politicians attracted by the possibility of earning higher wages. We further show that merged municipalities do not engage in inefficient hiring of bureaucrats in response to the increased size. Additionally, we provide evidence that our results are not driven merely by public incentives for mergers.[35]

We are the first to provide evidence of how changes in local jurisdictions' size affect local institutional quality, which is specifically viewed as a precondition for effective public service provision and efficient fund management. In this respect, our work relates to the

[34] Since most countries mandate mergers once a municipality exceeds certain population thresholds, existing studies necessarily focus predominantly on smaller municipalities (Blesse and Baskaran, 2016; Blom-Hansen, 2010; Hirota & Yunoue, 2017; Reingewertz, 2012). In contrast, our sample includes municipalities with greater population heterogeneity (see Table 2.2 in Section 2.4), enhancing the external validity of our results.

[35] The central government provides incentives for municipal mergers, as explained in Section 2.2. However, in Section 2.6, we provide robust evidence that these incentives do not contribute to improvements in administrative quality.

literature on the optimal size of local governments. This line of research examines the trade-offs involved in public goods provision and service delivery at the most decentralized level of government. While some studies argue that local governments are better positioned to tailor services to community needs (Tiebout, 1956; Oates, 1969; 1972; Hatfield and Kosec, 2013), others emphasize that excessive fragmentation leads to inefficiencies and a heightened risk of corruption (Brueckner, 1981; Zodrow and Mieszkowski, 1986; Bardhan and Mookherjee, 2000). Recent evidence from Sovera (2024) demonstrates that even less invasive forms of coordination, such as intermunicipal cooperation, can result in congestion effects, prolonged administrative procedures, and more complex decision-making processes. Our analysis of municipal mergers — which represents a more substantial increase in government size — provides new evidence on how the municipal scale affects political and administrative mechanisms.

Moreover, our work contributes to several strands of literature on the effects of different forms of municipal associations. First, it speaks to the extensive research on voluntary and mandatory boundary reforms, where evidence on merger impacts has been mixed. Some studies document positive effects, such as higher population growth in Swedish voluntary mergers (Hanes et al., 2012), enhanced economies of scale in Israel (Reingewertz, 2012), reduced administrative expenditures following compulsory mergers in Germany (Blesse and Baskaran, 2016), and increased voter turnout in Italian municipalities opposing mergers (Bolgherini and Mollisi, 2024). However, other research highlights negative consequences, including decreased citizen satisfaction in Denmark (Blom-Hansen, 2016; Hansen, 2015), diminished public service provision in marginalized Finnish municipalities (Harjunen et al., 2021), increased current expenditure in Italian municipalities (Caporali et al., 2025), and reduced voter turnout in Japan (Horiuchi et al., 2015).[36] Looking at municipal splits rather than mergers, Dahis and Szerman (2024) show that splitting leads to increased public service provision in Brazil, whereas Cerqua and Di Matteo (2025) find a sizable increase in voter turnout — albeit limited to local elections — in Italy.

Last, we contribute to the literature on citizens' preferences for municipal cooperation. Lapointe (2018) examines post-merger secession preferences in Québec and finds that differences in median income and language composition between merged municipalities increase support for secession. In a related study focusing on a less stringent form of municipal association, Tricaud (2025) analyzes France's mandatory intermunicipal cooperation reform. Her findings reveal resistance to forced cooperation, especially with respect to the loss of urban planning control, and highlight a different pattern among municipalities that had previously chosen voluntary cooperation. In particular, while forced and unforced municipalities experienced similar gains from cooperation, only forced municipalities bear the cost of integration associated with increased construction and the loss of local public services.

The remainder of the paper is organized as follows. Section 2.2 presents the Italian institutional framework and describes the merger process. Section 2.3 introduces the MAQI and establishes the conceptual framework for assessing municipal administrative quality. Sections 2.4 and 2.5 detail our data and empirical strategy, respectively. Section 2.6 presents

[36] A particularly significant challenge associated with boundary reforms is the "common pool" problem. Municipalities anticipating a merger may engage in opportunistic behavior by increasing expenditures and debt — costs that will ultimately be borne by the newly consolidated entity, essentially shifting the burden onto a different set of citizens. This free-riding behavior has been empirically documented in various contexts, including Swedish municipalities (Hinnerich, 2009), Danish municipalities (Blom-Hansen, 2010), and Japanese municipalities (Hirota and Yunoue, 2017).

our empirical findings and investigates the main potential mechanisms, while Section 2.7 offers concluding remarks.

2.2. Institutional Framework

As of 2023, Italy is composed of 7,901 municipalities, which are the lowest and closest to citizens' tiers of government. Municipalities are in charge of several duties, such as waste management, road maintenance, street lighting, nursery schooling, school building, urban planning, social services, and environmental policies. To finance their activities, municipalities raise local taxes and receive contributions from central and regional governments.[37]

The landscape of Italian local governments is fragmented and comprises numerous very small municipalities: indeed, 86% of Italian municipalities have fewer than 10,000 inhabitants. This challenge hinders the ability of many small local governments to provide public services effectively and efficiently. For this reason — and to reduce the costs of local administrations — over the years, the central government has encouraged or mandated that small municipalities adopt various forms of municipal cooperation. These range from "soft" collaborations, such as mountain communities (a cooperative of mountain municipalities) and municipal unions (a form of inter-municipal cooperation), to more comprehensive approaches, such as municipal mergers. The Italian system grants all municipalities the

[37] Italian municipalities finance themselves through own-source revenues - mainly the real-estate tax IMU, the municipal IRPEF surtax, the TARI waste fee, and where eligible a tourist tax - together with transfers from the central government. The cornerstone transfer is the *Fondo di Solidarietà Comunale* (FSC). Each year the government allocates the FSC using formulae based on standard spending needs and standard fiscal capacity estimated by a technical commission. Parts of the FSC are earmarked for essential services (e.g., social services, nurseries, transport for students with disabilities). Outside the FSC, municipalities receive investment-specific grants (e.g., NRRP funds). In special-statute regions, regional laws/funds complement or replace state equalisation; for Sicily and Sardinia, FSC balances are issued via dedicated lines.

opportunity to merge, making it a voluntary process that, unlike in other countries, requires referenda from all the local governments involved. If the majority of citizens vote in favor, the regional government proceeds with boundary reform.[38] There are two types of mergers. The most common scenario involves the creation of a brand-new municipality, with a new name and government bodies, formed by the merging of two or more municipalities. Alternatively, one or more smaller municipalities may be absorbed by a larger one, which retains its original name and government structures. In this paper, we only analyse the most common merging mechanism.

Since 1990 (Law 142/1990),[39] municipal mergers have been encouraged by the central government through generous financial contributions, provided for a period of 10 years following the merger, and exemptions from the new-hiring ban.[40] Regional governments also play a key role, as they announce the referendum, formally arrange mergers, and provide merging municipalities with technical support during the process. Despite being formally possible since 1990, Italian municipalities largely resisted mergers until 2013, when the massive increase in financial incentives following the Great Recession triggered a rise in their adoption. Indeed, we observed only a few mergers up to 2011, while after the incentives for the *spending review,* the number of mergers sharply increased, as shown in

[38] There are a few exceptional cases. Four mergers in the Piedmont region were approved despite not securing full majorities in each municipality (Cassano Spinola, Lu e Cuccaro Monferrato, Valchiusa, and Varallo), and one merger (Gattico-Veruno) was approved even though both municipalities opposed it in the referendum. Following these cases, the regional law in Piedmont was amended to remove the regional council's authority to impose a merger in the event of a negative referendum outcome (Celati, 2023).

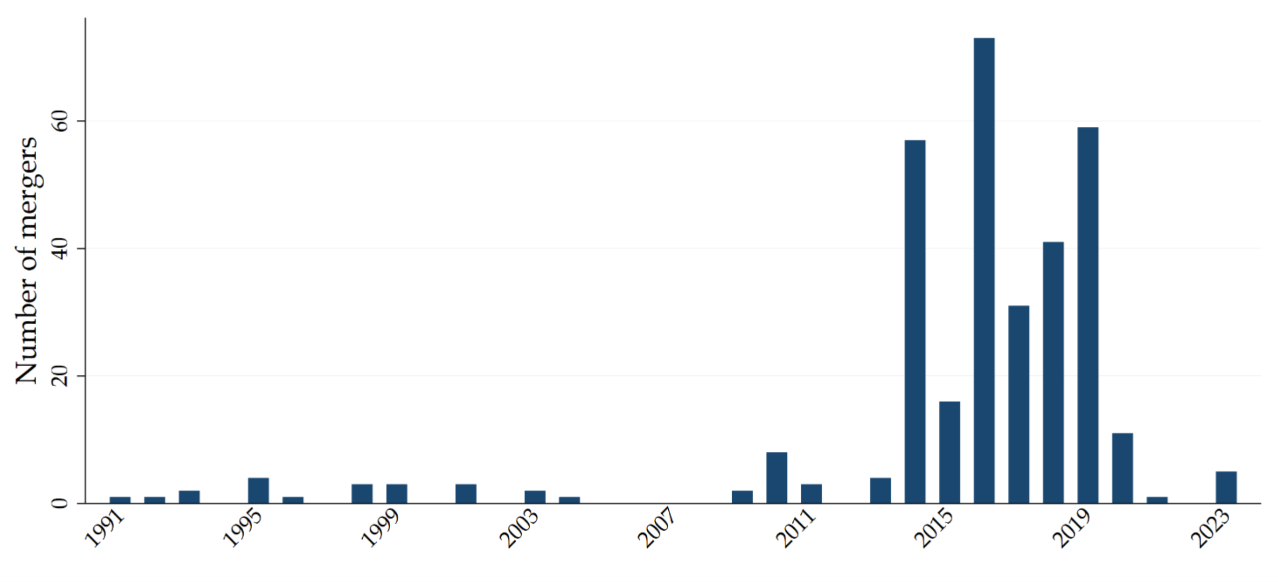
[39] In the period between 1950-1990 only a few municipalities merged, while hundreds of mergers/splits occurred during or immediately after the fascist era.

[40] Merged municipalities are the only ones exempted from constraints or limitations on hiring new personnel, including fixed-term contracts, for up to five years after the merger year (Law 190/2014). We test the role of these incentives in Section 2.6.3.1.

Figure 2.1. This has reduced the number of Italian municipalities from 8,092 in 2011 to 7,901 in 2023.

Incentives for mergers were primarily intended to reduce municipalities' fixed costs and rationalize overall expenditures. Furthermore, policymakers recommend mergers to achieve higher economies of scale and improve public goods provision. In this paper, we aim to analyze the mechanisms behind these expected outcomes by examining the effects of mergers on the functioning of municipal governments and, consequently, on their performance and administrative quality.

Figure 2.1. Number of municipal mergers by year



2.3. Measuring municipal administrative quality

Overall institutional quality (Charron et al., 2014; Nifo and Vecchione, 2015) and public service delivery efficiency (Barone and Mocetti, 2011; D'Amuri and Giorgiantonio, 2016) are frequently evaluated by existing indicators. Assessments of quality at the local level have typically focused on individual indicators, such as the timeliness of public actions (Giacomelli and Tonello, 2015; De Angelis et al., 2020), regulatory burdens (Di Vita, 2018), corruption levels (Mocetti and Orlando, 2017), and transparency (Albanese et al., 2021). As a result, indicators at the municipal level are typically single proxies that focus on the outputs and outcomes produced by local public administrations. In contrast, the MAQI aims to capture a distinct aspect of municipal institutional quality — *administrative* quality — which is not solely focused on outcomes and has not previously been measured for local administrations.

The theoretical foundation of the MAQI is drawn from the quality framework for public sector organizations, as established by the European Institute of Public Administration (EIPA) and the European Public Administration Network (EPAN). Drawing on the concept of quality in the private sector, the public sector has evolved from defining quality as compliance with norms and procedures to prioritizing citizen satisfaction and positioning local governments as service providers and citizens as clients (Beltrami, 1992). To reflect this shift, most EU Member States have adopted the Common Assessment Framework (CAF), developed by the EIPA and EPAN, to encourage local governments to undertake self-assessment through standardized procedures (Löffler, 2002). The CAF consists of nine criteria that serve as analytical dimensions for assessing public administration activities and outcomes, with the first five criteria, known as "enabling factors", which focus on organizational efforts to achieve positive outcomes. These include leadership, strategies and policies, personnel management, resource and partnership management, and process management.

The importance of these enabling factors is also underscored in the empirical literature. The benefits of decentralization in developed economies — such as improved public goods provision (Weingast, 2009), enhanced public sector efficiency (De Mello and Barenstein, 2002), more accountable fiscal policies (Oto-Peralías et al., 2013), reduced corruption (Fisman and Gatti, 2002), and increased trust in government (Ligthart and van Oudheusden, 2015) — can be significantly compromised by poor political leadership (Sacchi et al., 2019), especially when local politicians are inexperienced (Prud'homme, 1995) or driven by personal interests (Hindriks and Lockwood, 2009). Given the significance of enabling factors, the MAQI focuses specifically on them, avoiding direct evaluation of outcomes, which is related to the service delivery effectiveness to the population, where citizen perception plays a crucial role.[41] By adapting the measurement of enabling factors to the context of Italian municipalities, the MAQI emphasizes three main criteria: leadership, personnel, and resources. Recognizing the importance of administrative competence (Prud'homme, 1995), the MAQI evaluates leadership by assessing the quality of local politicians and measures personnel on the basis of the capacity and expertise of local public employees. These assessments are complemented by fiscal and economic indicators of municipalities (resources), underscoring political accountability (Schaltegger and Torgler, 2007) and facilitating national authorities' evaluation of the effectiveness and efficiency of local government management. Our empirical analysis evaluates the effects of municipal mergers on these specific factors.

2.3.1. The Municipal Administration Quality Index (MAQI)

The structure of the Municipal Administration Quality Index (MAQI) is grounded on its theoretical basis — the CAF — and key references for institutional quality indices (Charron

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[41] The influence of informal institutions, such as established norms of conduct and behavior, implies that public service provision can be weakened by a lack of civic-mindedness (North, 1990), particularly in regions marked by significant intra-national disparities (Putnam et al., 1993). Beyond individual characteristics and external factors, informal institutions can significantly shape citizens' perceptions of the quality of local public services. Consequently, quality indicators should go beyond assessing local government performance solely from the citizen perspective (Löffler, 2002).

et al., 2014; Nifo and Vecchione, 2015). Table 2.1 illustrates the structure of the index. The MAQI is built around three main components, or *pillars*, each reflecting a crucial factor influencing municipal administration quality: the quality and capacity of the local bureaucratic system ("Pillar I: Bureaucracy – Quality/Capacity"), the quality of local politicians ("Pillar II: Local Politicians – Quality"), and the fiscal efficiency and economic performance of local governments ("Pillar III: Local Government – Fiscal and Economic Performance"). These pillars are multidimensional, comprising several indicators selected on the basis of extensive literature on the impact of bureaucracy, politicians, and fiscal efficiency on economic growth (Burden et al., 2012; Besley et al., 2022; Pavese and Rubolino, 2023). Covering 98% of all Italian municipalities from 2001 to 2022 (see Section 2.4.1), the MAQI is the first composite index measuring the administrative quality of local governments with both territorial and temporal granularity, offering significant potential for replication in other advanced economies. In Appendix 2.A, we provide a detailed description of the literature supporting the inclusion of each indicator and the method used to compute the MAQI.

Table 2.1. The Municipal Administration Quality Index

Pillars	Indicators
Pillar I: Bureaucracy – quality/capacity	Average years of education # of bureaucrats per 1,000 inhabitants Average n° of absences Turnover rate
Pillar II: Local politicians - quality	Average years of education Gender balance index Proportion of white-collar workers
Pillar III: Local government – Fiscal and Economic pillar	Spending rigidity Spending capacity Collection capacity Share of municipal budget for investments

Notes: The Gender balance index is computed as $\text{Gender balance index}_{it} = |\text{share of women}_{it} - \text{share of men}_{it}|$, whereas the Turnover rate is computed as $\text{Turnover}_{it} = \frac{\text{N° Hires}_{it} + \text{N° Layoffs}_{it}}{\text{N° Bureaucrats}_{it}}$. For further details, see Cerqua et al. (2025).

2.4. Data

The eleven indicators comprising the MAQI are drawn from various data sources. Data collection for all the indicators refers to the time span 2001-2022. For Pillar I, data are collected from the Annual Account of the State General Accounting Department (https://contoannuale.rgs.mef.gov.it/), offering comprehensive information on municipal bureaucratic structures from 2001 to 2022. Specifically, we include data on the number of bureaucrats working in municipal offices, their level of education, the number of days off, and the turnover rate. To evaluate the quality of local politicians (Pillar II), data on the level of education, the gender balance index, and the proportion of white-collar workers were obtained from the electoral database of the Italian Ministry of the Interior and the Register of Local and Regional Administrators (https://elezioni.interno.gov.it/opendata;

https://dait.interno.gov.it/elezioni/anagrafe-amministratori). For Pillar III, data on municipal fiscal efficiency and economic performance were sourced from the Ministry of the Interior's municipal final balance certificates, which are accessible upon formal request. With this information, we compute the spending rigidity, spending capacity, collection capacity, and the share of investment expenditures. Finally, we collect data on the municipal population from 2001 to 2022 from the Italian National Institute of Statistics.

2.4.1. Sample – municipal mergers

We calculate the MAQI for 7,920 municipalities. Specifically, we enrich the MAQI database available for 7,723 municipalities, adding data for 197 municipalities that underwent mergers between 2013 and 2018.[42] Municipalities that merged before 2013 or after 2018 were excluded to ensure sufficient pre- and post-merger time points for our analysis. Moreover, only a few mergers occurred before 2013, as shown in Figure 2.1. For the 197 merged municipalities — which resulted in 79 new municipalities — we capture variations in administrative quality attributable to the merger by compiling data on all MAQI indicators for the pre-merger period using the original municipalities, and by using data from the newly constituted municipalities for the post-merger period. In other words, we adopt the perspective of the pre-merged municipalities, which we believe is the best choice for estimating what would have happened to those entities in the counterfactual scenario without the merger in terms of institutional capacity and quality.

[42] Between 2001 and 2023, 7,761 out of 7,901 municipalities did not experience substantial changes in their administrative boundaries. We excluded 38 of these municipalities from our analysis due to missing data in one or more MAQI indicators. Regarding merged municipalities, we excluded 25 out of the 222 that merged between 2013 and 2018 due to missing data, resulting in a sample of 197 municipalities for our study.

Table 2.2 presents descriptive statistics for the MAQI and its Pillars' rankings, as well as for the municipal population. We provide separate statistics for merged and unmerged municipalities. On average, merged municipalities are less populated than other municipalities, and they appear to perform better in terms of fiscal and economic outcomes.

Table 2.2. Descriptive statistics

	Merged municipalities (197)				Other municipalities (7,723)			
Variable	**Mean**	**St. dev.**	**Min**	**Max**	**Mean**	**St. dev.**	**Min**	**Max**
MAQI	101.60	3.19	90.79	113.39	101.34	3.29	85.18	114.01
Pillar I: Bureaucracy – quality/capacity	101.46	3.72	80.95	114.07	101.05	3.55	69.69	116.53
Pillar II: Local politicians - quality	102.21	7.32	85.09	132.21	102.36	8.16	80.61	136.40
Pillar III: Local government – Fiscal and Economic pillar	101.14	4.56	86.94	112.52	100.59	4.87	66.09	117.58
Population	2,440.62	4,286.98	115	39,093	5,110.24	7,171.51	34	49,911

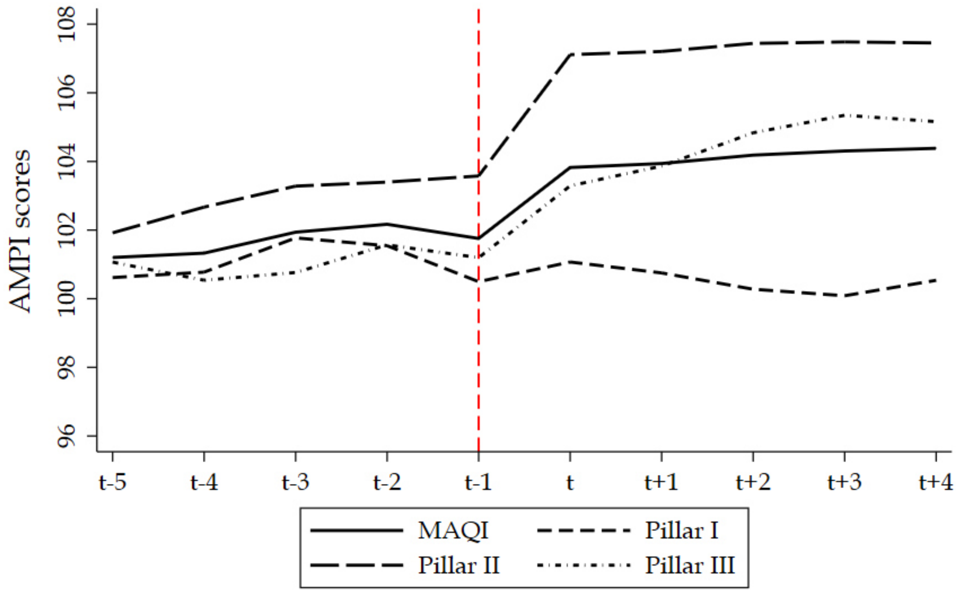
Notes: The merging of the 197 municipalities produced 79 new municipalities. Descriptive statistics refer to 2012, i.e., the year just before the first municipal merger in our sample.

Figure 2.2 illustrates the geographical distribution of municipalities in our sample that experienced mergers, whereas Figure 2.3 presents the trend of the MAQI and its three components (Pillars I, II, and III) from five years before the merger to four years after. Municipalities that merged are widely dispersed across the Italian peninsula, covering 11 of the 20 NUTS-2 regions. However, most mergers occurred in Centre-North, with the highest number of merged municipalities in Trentino-South Tyrol (53), Lombardy (38), Emilia-Romagna (27), and Tuscany (24). The descriptive evidence in Figure 2.3 indicates an overall improvement in administrative quality following the merging year, primarily driven by an upward shift in the quality of local politicians (Pillar II) and the economic and fiscal performance of municipalities (Pillar III). In contrast, the quality and capacity of public employees (Pillar I) exhibit a largely flat trend.

Figure 2.2. Geographical distribution of merged municipalities

Notes: There are 197 treated municipalities and 7,723 in the initial control group. No MAQI data are available for municipalities that are left blank.

Figure 2.3. Temporal evolution of the MAQI and its pillars for merged municipalities



2.5. Empirical strategy

We conduct our analysis using a non-parametric generalization of the staggered DiD estimator proposed by Imai et al. (2023). This method introduces a matching approach tailored for time-series cross-sectional data, providing a flexible framework to estimate both short- and long-term average treatment effects on the treated (ATT), even with a limited number of pre-treatment time periods.[43] For each unit (municipality) $i = 1, \dots, N$ and year $t = 2001, \dots, 2022$, we observe our outcome variables of interest — the MAQI and the AMPI scores for Pillars I, II, and III — Y_{it}, a vector of time-invariant characteristics V_i (population in 2012 and NUTS-2 region), and a treatment dummy variable X_{it} identifying the municipal merger, taking the value of 1 from the merger year onward, i.e., municipalities remain treated up to the last year of analysis. The treatment status is assigned at different points in

[43] Although there are other estimators appositely developed to take into account the staggered adoption of a treatment, such as the DiD with multiple time periods estimators proposed by de Chaisemartin and D'Haultfoeuille (2024) and Callaway and Sant'Anna (2021), we opted for an evaluation method that explicitly accounts for pre-treatment trend differences in all covariates and does not rely on parametric assumptions. However, in Section 2.6.2 we show that our results are robust to the use of Callaway and Sant'Anna (2021).

time depending on the merging year. The estimator proposed by Imai et al. (2023) allows multiple units to be treated at any point in time and builds the counterfactual for each treated unit only using never treated municipalities.

We set five pre-treatment periods (lags, L) and four post-treatment periods (leads, F). Following Imai et al. (2023), we estimate the ATT as follows:

$$\delta(F,L) = E\{Y_{i,t+F}\left(X_{it}=1, X_{i,t-1}=0, \{X_{i,t-l}\}_{l=2}^{L}\right) - Y_{i,t+F}(X_{it}=0, X_{i,t-1} = 0, \{X_{i,t-l}\}_{l=2}^{L} | X_{it}=1, X_{i,t-1}=0\} \tag{2.1}$$

where $Y_{i,t+F}\left(X_{it}=1, X_{i,t-1}=0, \{X_{i,t-l}\}_{l=2}^{L}\right)$ is the potential outcome in the case of treatment and $Y_{i,t+F}(X_{it}=0, X_{i,t-1}=0, \{X_{i,t-l}\}_{l=2}^{L})$ is the potential outcome in the absence of treatment. $\{X_{i,t-l}\}_{l=2}^{L}$ represents the realized history. For example, δ(3,5) represents the average causal effect of the municipal merger on the outcome, three years after the treatment, while assuming that the potential outcome depends on the treatment history up to five years earlier.

In our setting, applying this methodology involves three stages. First, for each treated unit, we employ a matching method to create a matched set M_{it} of control units. Each matched set is constructed by performing an exact matching on the basis of municipalities' time-invariant characteristics V_i, i.e., the municipal population and NUTS-2 region of belonging. Specifically, we created a categorical variable for the municipal population in 2012 (i.e., one year before the first treatment year), splitting municipalities into five population categories.[44] We then match each treated unit with control units in the same NUTS-2 region and population category. Restricting the comparison to these municipalities is particularly relevant, as it accounts for variations in regional administrative quality, which tends to be positively correlated with municipal population size (Cerqua et al., 2025) and would otherwise represent a confounder for the identification of the causal effect of interest. We then refine each matched set by calculating the Mahalanobis distance between the control units in the matched set and the treated unit, considering the pre-treatment values of the MAQI and the scores for the three Pillars. The algorithm matches each treated unit with the three most similar control units on the basis of the Mahalanobis distance, assigning equal weights to each unit in the refined matched set M_{it}. Second, after refining the matched set, we estimate the counterfactual post-treatment outcome for the treated units by calculating a weighted average of the outcomes of the control units within each refined matched set. Finally, we apply the DiD estimator to calculate the treatment effect for each treated unit by measuring the difference between the observed and counterfactual changes in outcomes. As reported in Equation (2.2), we then compute the ATT by averaging the treatment effects across all treated units:

$$\hat{\delta}(F,L) = \frac{1}{\sum_{i=1}^{N}\sum_{t=L+1}^{T-F} D_{i,t}} \sum_{i=1}^{N}\sum_{t=L+1}^{T-F} D_{i,t}\left\{\left(Y_{i,T+F} - Y_{i,T-1}\right) - \sum_{i'\in M_i} \omega_{it}^{i'}\left(Y_{i',T+F} - Y_{i',T-1}\right)\right\} \qquad (2.2)$$

where $\omega_{it}^{i'}$ denotes the non-negative normalized weight such that $\omega_{it}^{i'} \geq 0$ and $\sum_{i'\in M_i}\omega_{it}^{i'} = 1$.

[44] The five population categories are: municipalities with up to 1,000 inhabitants; 1,001 to 3,000 inhabitants; 3,001 to 5,000 inhabitants; 5,001 to 10,000 inhabitants; and more than 10,000 inhabitants. Of our treated municipalities, 77.3% fall into the first two categories (up to 3,000 inhabitants). We have excluded all municipalities with more than 50,000 inhabitants in 2012 (142 municipalities) from the control group, since the largest treated municipality had 39,093 inhabitants in that year.

This method relies on three identifying assumptions:

i) Absence of the carryover effect. This assumption states that the post-treatment potential outcome for each treated municipality does not depend on its previous treatment status. In our application, this assumption is automatically satisfied because none of the treated municipalities experienced any significant boundary change in previous decades.

ii) Absence of interference among the treated and control municipalities (Cox, 1958). In our context, this assumption is plausible since it is highly unlikely that the merger of two or more municipalities would affect the administrative capacity and quality of other municipalities.

iii) The parallel trends assumption after conditioning on outcome history. Considering five pre-treatment years enhances the credibility of this assumption by accounting for a relatively long history of prior outcomes. Moreover, as demonstrated in Section 2.6.1, there are no pre-treatment imbalances in outcome trends, further reinforcing the plausibility of the parallel trends assumption.

These identifying assumptions are milder than those of many common methods, such as the linear regression with fixed effects, the standard DiD estimator and the parametric DiD with multiple time periods estimators (Imai et al., 2023; Chiu et al., 2024; Xu, 2024).

While staggered municipal mergers are a plausible exogenous shock to jurisdiction size, some factors could introduce selection into treatment. Prior studies document that political incentives matter, as incuments support mergers when they expect lower post-merger electoral vulnerability (Hyytinen et al., 2014). Furthermore, municipalities may adjust fiscal behavior in anticipation of the merger, motivated by the fact that future costs are shared, signalling that merger timing and participants correlate with fiscal behavior (Tyrefors Hinnerich, 2009). We therefore interpret our estimates as causal conditional on observables and pre-trends, and present additional checks to mitigate selection concerns, such as a comparison with municipalities that failed to merge as a control group. In addition, our treated group underwent mergers in the time window 2013-2018, allowing us to measure the causal effect of interest up to four years after the treatment. The interpretation of our results reflects short- to medium-term dynamics only.

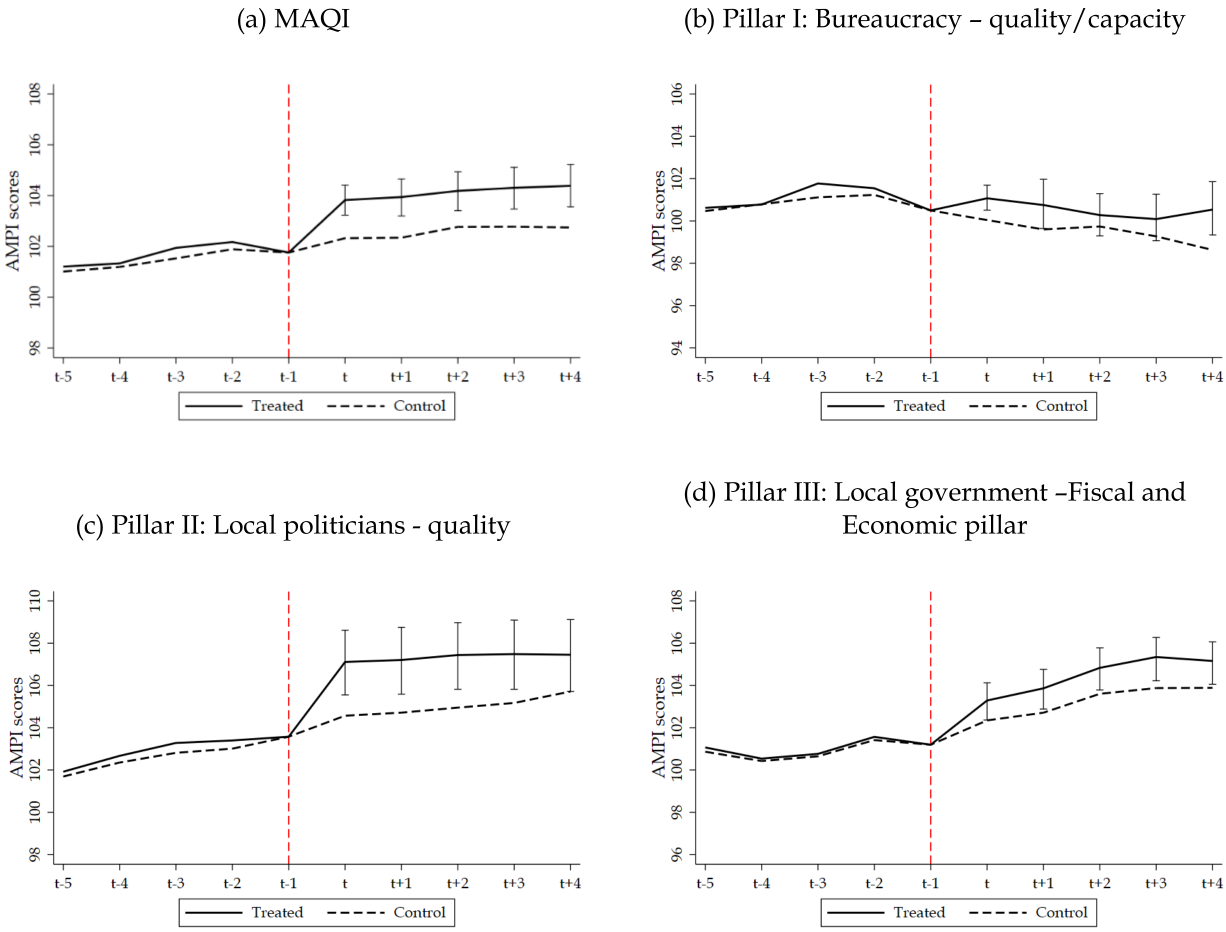
2.6. Results

2.6.1. Main estimates

Figure 2.4 illustrates the pre- and post-treatment evolution for both treated and control municipalities (after the matching and DiD procedure) for all dependent variables. The vertical black bars represent 95% confidence intervals for the average effect of enlarging jurisdiction size on administrative quality in each post-treatment time point. Confidence intervals are computed using a block-bootstrap procedure built for matching analysis in time-series cross-sectional settings (Otsu and Rai, 2017), where each municipality is a block. In other words, the bootstrap resampling to estimate standard errors is performed for each treated unit at a time. This graphical representation follows the approach outlined by Cattaneo et al. (2025).

We present the results on the impact of municipal mergers on the MAQI and its three separate pillars in Figure 2.4, which reports the ATT for each post-treatment year.

Figure 2.4. Impact of municipal mergers on local administrative quality



Notes: The vertical black bars report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

Overall, municipal mergers have a positive and statistically significant effect on local administrative quality at the 1% level, beginning in the merger year and continuing through the final post-treatment year of analysis (Panel a). Considering the average 2012 MAQI score of municipalities that merged, a significant increase of approximately 1.5 points corresponds to a shift from the 52nd to the 70th percentile of local administrative quality — where higher MAQI values indicate higher levels of municipal administrative quality. This positive impact is driven primarily by improvements in the pillar concerning the quality of local politicians (Panel c) and that concerning municipal fiscal and economic performance

(Panel d), as already suggested by the descriptive evidence in Figure 2.3 in the previous section.

Notably, the largest impacts are observed in Pillar II, with an immediate and significant increase of 2.51 points (from the 50th to the 63rd percentile) in the merger year. Although the magnitude of the effect diminishes slightly over time, these improvements remain statistically significant through T+4, reaching an increase of 1.62 points. The strong and immediate positive effect on political quality can be attributed to mandatory elections following each merger, when citizens elect a new mayor and local representatives.[45] This positive impact may stem from three potential explanations or a combination of them: (i) voters in the newly merged municipality respond to the increased responsibilities and broader scope of local government by selecting higher-quality politicians, (ii) the newly merged municipality is larger than the pre-merger municipalities, and this mechanically increases the average quality of local politicians due to the positive relationship between municipality size and politicians' quality (see Figure 2.A.1 in Appendix 2.A and Saarimaa and Tukiainen, 2016), and (iii) high-quality potential candidates are drawn to local politics by the opportunity to manage a larger municipality and by the higher salary that this often

[45] One possible explanation for this immediate effect is that merged municipalities hold local elections in the year of the merger, whereas control municipalities may hold elections in subsequent years. Over time, citizens might tend to elect local politicians who are more likely to be university graduates and/or white-collar professionals, potentially biasing our estimates. However, if this were the primary driver of the positive impact we observed, we would expect the effect to vanish over time — especially since, in Italy, both the council and the mayor are directly elected for five-year terms. This pattern is not what we find. Additionally, to ensure that differences in election timing are not driving our findings, we have replicated the Pillar II analysis by incorporating an exact matching procedure on the year of the municipal election. The magnitude of the estimates reported in Table B.2 in Appendix 2.B is generally smaller, suggesting that part of the increase in Pillar II observed in the early post-treatment years was driven by differences in the timing of elections. Nevertheless, the estimates confirm that the positive effect persists over time, indicating that municipal mergers led to a genuine, sustained improvement in the quality of politicians.

entails (see Cerqua et al., 2024). We attempt to empirically disentangle these potential explanations in Section 2.6.3.2.

Municipal fiscal and economic performance also benefits significantly from mergers, with positive and statistically significant coefficients that grow in magnitude up to three years after the merger. These improvements provide evidence of efficiency gains from economies of scale, which is in line with past literature on mergers (Blesse and Baskaran, 2016; Blom-Hansen et al., 2014; Reingewertz, 2012). Indeed, merged municipalities can enhance spending capacity and allocate a larger share of resources to investments — a direct evidence of economies of scale. While these improvements could be driven by public incentives rather than efficiency gains, in Section 2.6.3.1 we rule out such alternative explanations and provide additional evidence that improvements in Pillar 3 stem primarily from economies of scale rather than financial incentives.

Improvements in bureaucratic capacity and quality (Pillar I) occur more gradually than in the other pillars. Statistically significant increases at the 1% level are observed only in the merger year and four years afterward. This pattern is consistent with the institutional process of mergers. Initially, the administrative staff of the merging municipalities is simply combined, with no immediate changes in composition. The statistically significant effect observed in the merger year likely reflects increased work engagement and reduced absenteeism in response to the heightened workload and organizational demands during the merging process (Bowers et al., 2022). We formally test this hypothesis by examining the average number of absences among public employees as the dependent variable. The estimates reveal a statistically significant reduction of 2.77 days in average absences per employee immediately after the merger, whereas the coefficients for subsequent periods (from T+1 to T+4) are statistically indistinguishable from zero (see Table 2.B.1 in Appendix 2.B). This finding suggests that increased staffing leads to lower absenteeism, but only in the very short term. Furthermore, a possible additional reason why Pillar I reacts more slowly is that, despite incentives given by the central government, bureaucratic change is structurally constrained. Empirically, studies of European amalgamations consistently find savings primarily in general administration, with limited short-run effects on service delivery and personnel costs (Tavares, 2018; Allers and Geertsema, 2016). Consistent with the organizational change literature, short-run reorganization can be performance-disruptive before learning effects materialize (Andrews and Boyne, 2012). As already pointed out, the interpretation of our results only concern short- to medium-term patterns.

Optimal adjustments to staff composition emerge only gradually over time, as the newly merged municipality becomes better able to assess its personnel needs and implement staffing changes. This explains the delayed yet substantial improvement in bureaucratic capacity observed four years post-merger. Moreover, as shown in Figure 2.3, the positive impact arises from a smaller decrease — rather than an actual increase — in the quality and capacity of the bureaucracy in treated municipalities compared with those in the control group.[46] Overall, the results show that increased size is associated with higher administrative quality, suggesting that the efficiency gains from greater jurisdiction size may outweigh the potential drawbacks of reduced local autonomy.

In the following sections, we test the robustness of our findings (Section 2.6.2) and investigate their potential mechanisms (Section 2.6.3).

[46] Overall, the AMPI scores for the quality and capacity of the bureaucracy (Pillar I) show a negative trend over the last decade, declining from an average of 101.06 in 2012 to 99.37 in 2022.

2.6.2. Robustness and heterogeneity estimates

To yield unbiased causal estimates, the non-parametric DiD estimator requires the parallel trends assumption to hold. In this section, we begin by testing the plausibility of this assumption. Figure 2.B.1 in Appendix 2.B presents the covariate balancing — defined as the pre-treatment standardized mean difference between treated and control municipalities. The covariate balance, which concerns all dependent variables, remains stable across the five pre-treatment years, remaining very close to 0 in all periods. These findings indicate that the pre-treatment values for the treated and control units were both parallel and highly similar. This is also confirmed by the event-study graphs reported in Figure 2.4.

To further ensure the robustness of our findings, we conducted a series of sensitivity analyses on the main outcome variable — the MAQI — which are reported in Table 2.B.3 in Appendix 2.B. First, we replicated the estimates by expanding the matched set for each treated municipality to include 5 and 10 control units. Second, we refine the matched set of each treated unit employing alternative matching methods, namely, propensity score matching (PSM) and inverse propensity score weighting (IPW). Third, we excluded both time-varying and time-invariant covariates from the estimation process. Fourth, we performed the estimation using the Synthetic DiD method (Arkhangelsky et al., 2021) and the DiD with multiple time periods estimator proposed by Callaway and Sant'Anna (2021) as alternative evaluation approaches. Lastly, we collected data on municipalities where a referendum on merging with neighboring municipalities resulted in a negative outcome, and we ran our main estimates by (i) restricting the control group and (ii) assigning fake treatment to those municipalities.

Across all specifications, the results consistently indicate positive and statistically significant effects of mergers on municipal administrative quality. When we adopt the IPW or remove covariates from the estimation process, we obtain estimates that are smaller in magnitude but still statistically significant. The rest of the estimates are also highly aligned in terms of coefficients with those reported in Figure 2.4. Reassuringly, the placebo analysis does not show any statistically significant increase in administrative quality, confirming the robustness of our empirical approach.

We further inspect our findings by examining heterogeneity by municipalities' distance to socio-economic hubs and by NUTS-1 macro-region. Specifically, we run separate estimations for treated units classified by the Italian National Institute of Statistics as socio-economic "hubs", and for municipalities at different degrees of peripherality with respect to distance from hubs ("intermediate" distance; "peripheral"/"remote" areas).[47] We also run separate analyses for treated units located in the North, Centre, and South and Islands. In each case, we restrict the control group to municipalities with the same degree of peripherality or within the same NUTS-1 macro-region as the treated units. Results are reported in Table 2.B.4 of Appendix 2.B. Most treated municipalities lie at an intermediate distance from socio-economic hubs and are located in Northern Italy; for these municipalities, the estimates closely mirror our main results. Municipalities in the Centre also exhibit a significant increase in administrative quality, whereas those in the South and

[47] The Italian National Institue of Statistics provides the following classification: (i) Hub: Municipalities that function as service centers. (ii) Inter-municipal hub: Municipalities that serve an inter-municipal area. (iii) Belt: Municipalities adjacent to hubs or inter-municipal hubs. (iv) Intermediate: Municipalities whose distance from the nearest hub or inter-municipal hub lies between the median and the third quartile. In travel-time terms, they fall in an intermediate band. (v) Peripheral: Municipalities whose distance from the nearest hub or inter-municipal hub lies between the third quartile and the 95th percentile. (vi) Ultra-peripheral: Municipalities with the greatest distance from the nearest hub or inter-municipal hub, above the 95th percentile (see: https://www.istat.it/it/files/2022/07/FOCUS-AREE-INTERNE-2021.pdf, in italian) . We collapse this categorization into three groups: "hubs" (i-ii); intermediate (iii-iv); peripheral (v-vi).

Islands do not show statistically significant effects. More peripheral municipalities and hubs experience a smaller increase in administrative quality relative to our baseline estimates. Overall, these heterogeneous effects suggest that location-specific characteristics play a prominent role in shaping administrative quality gains from mergers.

2.6.3. Potential Mechanisms

In this section, we explore the potential mechanisms underlying the post-merger improvement in administrative quality that we observed. First, we examine the role of public incentives for mergers by analyzing whether municipalities (i) adjust inefficiently their staffing levels in response to their exemption from new hiring restrictions, and (ii) improve their financial conditions through increased transfers from the central government. Second, we investigate the local election channel by examining both demand- and supply-side mechanisms. On the demand side, municipal mergers may influence citizens' preferences toward more competent local politicians, potentially leading to the election of higher-quality representatives in subsequent elections. On the supply side, the increased municipal size following mergers often results in higher wages for local politicians, which may trigger a positive self-selection effect, drawing more qualified candidates into local government positions. Together, these mechanisms suggest that improvements in local political selection can operate through both voter preferences and candidate quality channels.

The testing of the potential mechanisms underlying the effects of our main results is essentially grounded in the concept of administrative quality, conceptualized through the Municipal Administration Quality Index. Accordingly, the analyses in this section focus primarily on examining the impact of mergers on the individual components of the index.

While our results point to a clear direction for interpretation, fully answering the questions we raise here would require additional analyses using further indicators. For example, a more complete picture of the economies of scale generated by municipal mergers should be assessed by analyzing workload per employee, as well as the efficiency or restructuring of the municipal bureaucratic–administrative apparatus. We plan to provide a comprehensive account of the mechanisms at play through additional analyses in a more complete version of this work, following further data collection and analysis.

2.6.3.1. The role of public incentives

We re-estimate our model using two indicators of Pillar I — the number of personnel per 1,000 inhabitants and the turnover rate — as outcome variables and report the estimates in Panel A of Table 2.3.[48] We start by exploring whether the exemption from the ban on new hirings granted to merged municipalities might have led to higher staffing levels. We find that the number of employees per capita does not increase in the post-merger period. Conversely, the turnover rate experiences a statistically significant decrease in three of the five post-treatment periods (see Panel A of Table 2.3), indicating that municipal mergers lead to reduced turnover rates. This is expected to positively impact performance outcomes,[49] as high turnover rates can lead to leadership gaps and disrupt institutional continuity (Carley, 1992; Lewis, 2011; O' Toole and Meier, 2003). These findings imply that merged municipalities do not increase their staffing size disproportionately through new

[48] As for the main estimates, we perform an exact matching between treated and control units in the same population category and NUTS-2 region. We then refine the matched set using the pre-treatment values of the outcome variable (i.e., the number of employees per 1,000 inhabitants and the turnover rate of public employees), as well as Pillar II, Pillar III, and the MAQI.

[49] Recall that, when computing the MAQI, a negative polarity is assigned to the turnover rate of public employees; that is, lower values of this indicator correspond to higher values of the composite index.

hires. This is an interesting result considering that merged municipalities are the only ones exempt from constraints or limitations on hiring new personnel — including fixed-term contracts — for up to five years after the merger year (Law 190/2014). This evidence suggests that newly elected politicians did not exert pressure to expand inefficiently the number of bureaucrats, in contrast with Alesina et al. (2000), who find that public employment can be exploited as a redistributive tool by local politicians.

We also explore whether financial incentives from the central government in the form of higher current transfers enhance the financial condition of merged municipalities, thereby driving the positive effect on Pillar III. To this end, we first test the effect of mergers on the two indicators of Pillar III that should be directly affected by increased current revenues. The estimates reported in Panel B of Table 2.3 show a positive impact on collection capacity; however, this effect is transitory (statistically significant only in the year of the merger). Collection capacity — which measures municipalities' financial autonomy and their ability to collect assessed revenues (Gagliarducci and Nannicini, 2013) — can improve through two channels: increased tax revenues and enhanced collection efficiency. The lack of improvement can be explained with regard to both channels. Regarding the first channel, we can rule out tax-driven improvements since merged municipalities can maintain territorially differentiated tax rates, typically preserving pre-merger levels (L. 56/2014). As for the second channel, our previous finding that merged municipalities do not increase their per capita staffing levels suggests no substantial enhancement of tax collection capabilities through additional personnel in tax offices. Moreover, we do not find any permanent effect on spending rigidity, suggesting that financial incentives are not sufficient to relax the most inflexible expenditures, such as those for personnel and loan repayments.

The substantially null effects of financial incentives on collection capacity and spending rigidity indicate that the increase in Pillar III is not driven by public incentives but rather by efficiency gains stemming from economies of scale.

Table 2.3. Impact of municipal mergers on local administrative quality: the role of public incentives

T	T+1	T+2	T+3	T+4
PANEL A – Pillar I outcomes				
Outcome variable: Number of personnel per 1,000 inhabitants				
0.16	0.32	0.32	0.41	0.26
(0.23)	(0.24)	(0.25)	(0.26)	(0.27)
Outcome variable: Turnover rate of public employees				
-0.04***	-0.05***	-0.01	-0.02	-0.07***
(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
PANEL B – Pillar III outcomes				
Outcome variable: Collection capacity				
0.03**	0.01	0.01	0.02	0.02
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Outcome variable: Spending rigidity				
-0.04*	-0.03	-0.02	-0.01	-0.02
(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Outcome variable: Spending capacity				
-0.01	0.02	0.02*	0.03**	0.04**
(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Outcome variable: Share of municipal investments				
-0.01	0.02*	0.03**	0.02**	0.01
(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Notes: Block-bootstrapped standard errors are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

To more directly test whether mergers bring about efficiency gains, we explore the effect of mergers on municipal spending capacity and the share of investment expenditure. Indeed, higher spending capacity and investment shares provide direct evidence of efficiency gains, as they indicate improved resource allocation and enhanced ability to fund local public goods (Reingewertz, 2012). The estimates are reported in the bottom rows of Table 2.3. For spending capacity, we observe a gradual strengthening of the positive effect over time — a pattern consistent with adjustment costs and learning effects in the post-merger period, during which efficiency gains materialize only after administrative integration is complete (Blom-Hansen et al., 2014). Similarly, we document a significant increase in the share of investment expenditures, reaching an increase of three percentage points in the second post-merger year. The delayed temporal pattern of this effect is consistent with the political cycle of merged municipalities, as investment decisions are likely to be shaped by newly elected local governments that take office following the merger. This timing suggests that investment policies reflect the strategic choices of the new administration rather than immediate post-merger adjustments.

2.6.3.2. Local elections channel

In Section 2.6.1, we provide statistical evidence that municipal mergers have led to an increase in Pillar II. In this section, we test whether this increase stems from a demand-side explanation, i.e., voters in the newly merged municipalities respond to the increased responsibilities and broader scope of local government by selecting higher-quality politicians; a supply-side explanation, i.e., high-quality potential candidates are drawn to local politics by the opportunity to manage a larger municipality and by the higher salary that this often entails;[50] or a mechanical explanation, i.e., that in the elections after merging, politicians from the smaller municipalities, who tend to be less educated (as shown in Figure 2.A.1 in Appendix 2.A), are not elected to the new council because they simply do not get

[50] The supply-side explanation originates from the fact that, in Italy, the salary of local politicians is determined by the population class to which a municipality belongs — the larger the population class is, the higher the salary. For small and medium-sized municipalities, the population categories are as follows: up to 3,000 inhabitants, 3,001 to 5,000 inhabitants, 5,001 to 10,000 inhabitants, and 10,001 to 30,000 inhabitants (for more details, see Cerqua et al., 2024).

enough votes when competing with candidates from the larger merging partner, and this mechanically increases the Pillar II value post-merger (see Saarimaa and Tukiainen, 2016).

To test these channels, we verify whether the newly created municipality passed the threshold for a salary increase and whether the pre-merge municipality was the most populous, splitting the sample accordingly: thus, our four groups of treated municipalities are i) those in which the merger resulted in a salary increase for local politicians and whose pre-merge municipality was the most populous; ii) those in which the merger resulted in a salary increase but whose pre-merge municipality was not the most populous; iii) those in which the merger did not result in a salary increase but whose pre-merge municipality was the most populous; and iv) those in which the merger did not result in a salary increase and whose pre-merge municipality was not the most populous. The estimates reported in Table 2.4 are particularly large and statistically significant for municipalities where the merger resulted in a salary increase but whose pre-merge municipality was not the most populous (group ii). We also observe a sizable and persistent positive effect — albeit not statistically significant — in treated municipalities where the merger resulted in a salary increase and whose pre-merge municipality was the most populous (group i). Conversely, municipalities where the merger did not lead to a salary increase (groups iii and iv) did not experience a relevant or persistent improvement in the quality of local politicians. These estimates suggest that the supply-side and mechanical channels operate jointly: the largest effects occur in the smallest pre-merge municipalities, consistent with the mechanical effect, but only when the merger is accompanied by a salary increase for local politicians, consistent with the supply-side effect.

This demonstrates that the effect observed on Pillar II is driven by a supply-side mechanism, whereby high-quality candidates are attracted to the political arena by the opportunity to earn a higher salary than was possible before the municipal merger. This result aligns with those of previous studies (see Gagliarducci and Nannicini, 2013) and further suggests that the largest benefits accrue to the smallest jurisdictions.

Table 2.4. Impact of municipal mergers on local administrative quality (Pillar II) — potential mechanisms

T	T+1	T+2	T+3	T+4
Main estimates displayed in Figure 2.4 (197 treated municipalities)				
2.51***	2.46***	2.45***	2.27***	1.62*
(0.76)	(0.78)	(0.82)	(0.86)	(0.88)
The 38 treated municipalities in which the merger resulted in a salary increase for local politicians and which were the most populous before the merger				
1.93	1.80	2.09	2.21	1.79
(1.69)	(1.67)	(1.80)	(1.82)	(1.84)
The 73 treated municipalities in which the merger resulted in a salary increase for local politicians and which were not the most populous before the merger				
3.93***	3.93***	3.93***	3.93***	3.93***
(1.36)	(1.36)	(1.36)	(1.36)	(1.36)
The 41 treated municipalities in which the merger did not result in a salary increase for local politicians and which were the most populous before the merger				
1.87	1.77	1.25	0.64	0.30
(1.65)	(1.25)	(1.70)	(1.72)	(1.89)
The 45 treated municipalities in which the merger did not result in a salary increase for local politicians and which were not the most populous before the merger				
1.30	1.24	0.90	0.62	-0.43
(1.40)	(1.52)	(1.58)	(1.60)	(1.71)

2.7. Conclusions

This paper examines the causal impact of increasing municipal jurisdiction size on administrative quality. Using the novel MAQI, we exploit the staggered implementation of Italian municipal mergers and employ a non-parametric difference-in-differences design to identify the effect of increased municipal size. Our estimates indicate that mergers lead to substantial improvements in administrative quality and capacity — primarily driven by enhanced competence among local politicians and improved economic performance of local governments — whereas gains in bureaucratic efficiency materialize more gradually. We further demonstrate two mechanisms behind these improvements: first, increased efficiency from economies of scale, and second, the positive self-selection of higher-quality local politicians attracted by the opportunity to earn higher wages. This evidence supports a supply-side mechanism rather than one driven by changes in voter preferences.

Our results inform the political debate on the optimal size of jurisdictions and municipal mergers, suggesting that policies promoting an increase in municipal size should consider not only cost rationalization but also the potential to strengthen local administrative capacity. Moreover, our findings may be particularly relevant in contexts where there is strong resistance to municipal mergers, such as in Denmark, France, Italy, Japan, Sweden, and the United States (see Jackson, 1987; Lidström, 2010; Mouritzen, 2010; Tricaud, 2025; Weese, 2015). For example, in Italy, widespread skepticism toward amalgamation often stems from deep-rooted local identities and cultural attachments ("*campanilismo*"). Our results indicate that the institutional quality gains from mergers provide a compelling rationale to overcome such resistance. Indeed, the documented improvements in administrative quality, political selection, and local government performance offer tangible benefits that might help convince skeptical citizens of the value of municipal consolidation beyond mere cost-saving considerations.

The main limitation of our study regards the validity of our findings for other institutional settings than Italy. We study Italian municipal mergers because municipal fragmentation is longstanding and mergers occur on a voluntary basis, and we expect closest comparability in countries with similar institutional arrangements, such as France. Potential mechanisms depend on institutional features that are mainly context dependent. Because the underlying mechanisms hinge on institutional features, they are inherently context-dependent. Mandatory, top-down consolidations (e.g., Denmark) may involve different dynamics and warrant case-specific analysis.

References – Chapter 2

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Appendix 2.A

The Municipal Administration Quality Index – Method, descriptive statistics, and literature supporting the inclusion of individual indicators.

The MAQI is computed using the Adjusted Mazziotta Pareto Index (AMPI) method (Mazziotta and Pareto, 2016), which synthesizes a set of indicators deemed non-substitutable, requiring balance across all the components. The AMPI was selected to enable consistent absolute temporal comparisons with a reliable methodology. Each indicator is rescaled to fall within two "goalposts" — a minimum and maximum value representing the range for each indicator across all observations and time periods. In line with Mazziotta and Pareto (2016), these "goalposts" are set with 100 as the reference value. Given x_{ij}^t — the value of the indicator j for the i-th municipality at time t — the corresponding normalized value r_{ij}^t is calculated as:

$$r_{ij}^t = \frac{(x_{ij}^t - min_{x_j})}{(max_{x_j} - min_{x_j})} * 60 + 70 \tag{2.3}$$

where min_{x_j} and max_{x_j} are the "goalposts" for the indicator j. Equation (2.3) consists of two parts. The first part of Equation (2.3) normalizes the indicator value for unit i by rescaling it, whereas the second part adjusts the normalized values to fall within the range of 70 to 130, with 100 as the reference point.[51] The generalized form of the AMPI is given by:

[51] Each indicator has a positive or negative correlation with the multidimensional concept of administration quality. The sign of this relationship is called *polarity*. If indicator j has positive polarity, its normalized values are equal to Equation (2.3). For an indicator with negative polarity, the complement to 200 of Equation (2.3) is calculated.

$$AMPI^{+/-} = M_{ri} \pm S_{ri} cv_{ri} \tag{2.4}$$

where M_{ri}, S_{ri}, and cv_{ri} are the mean, standard deviation, and coefficient of variation of the normalized values for each municipality i, respectively.[52] Compared with other indices, the AMPI is recognized for its robustness, showing reduced sensitivity to the inclusion or exclusion of specific indicators (Mazziotta et al., 2010; Mazziotta and Pareto, 2018).[53]

Each pillar's AMPI is calculated separately, and the scores are then averaged to derive the MAQI. The reference value is defined as the mean of each indicator across all municipalities in the baseline year, 2001. Consequently, a municipality exhibiting average values for each indicator in 2001 would have a MAQI score of 100. By using a consistent reference value throughout the analysis period, three types of comparisons are possible: (i) between municipalities within a given year, (ii) longitudinal comparisons for a single municipality, and (iii) cross-municipal comparisons over the entire time span. Each of these dimensions will be exploited in the empirical analysis to estimate the causal effects of mergers on the quality of local institutions.

The construction of a composite index requires careful choices about how indicators are normalized, aggregated, and weighted. Opting not to apply a weighting scheme effectively assigns equal importance to all indicators (Greco et al., 2019). Our choice of specific normalization and aggregation methods was guided by the goal of enabling robust absolute comparisons over time. The MAQI adopts an equal-weighting approach, treating each

[52] If the composite index is "increasing" or "positive", meaning higher index values indicate positive changes in the phenomenon (e.g., municipal administration quality), then AMPI- is applied in Equation (2.4).

[53] Cerqua et al. (2025) test the suitability of the methodology in this framework, showing its robustness and appropriateness.

indicator as equally important.[54] Additionally, MAQI includes a penalization mechanism that assigns greater weight to units displaying a more balanced distribution of indicator values (Mazziotta and Pareto, 2017). In other words, while each indicator contributes equally to a municipality's ranking, municipalities with imbalanced indicator values receive a lower overall score.

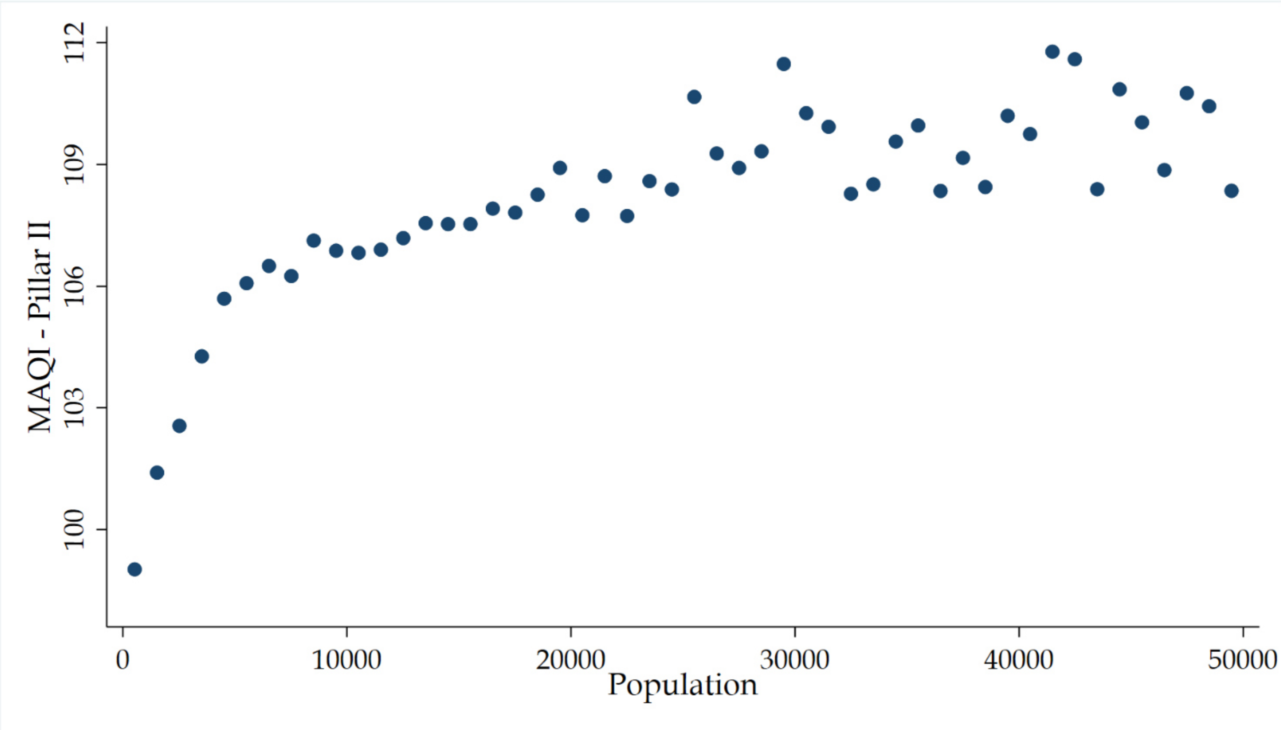
Table 2.A.1 presents descriptive statistics and references from the literature supporting the inclusion of each indicator. Each indicator was selected on the basis of its significance for assessing municipal administrative quality and its availability across the entire period of analysis. For detailed formulae used to compute each indicator and a comprehensive description of the MAQI, refer to Cerqua et al. (2025).

[54] The literature lacks specific recommendations for applying a differential weighting scheme to the phenomenon we are analyzing.

Table 2.A.1. Descriptive statistics and literature supporting the inclusion of each indicator

Pillar	Indicator	Mean	St. deviation	Literature
Pillar I: Bureaucracy – quality/capacity	Average years of education	11.60	1.86	Well-established tradition in political economy using education as a proxy of quality (Galasso and Nannicini, 2011; Bellodi et al., 2024).
	N° of bureaucrats per 1,000 inhabitants	6.21	3.67	Beyond efficiency losses, substantial and ongoing staff reductions may cause employees to feel overburdened, leading to uncooperative behaviors (Burden et al., 2012).
	Average n° of absences	30.50	7.77	Absenteeism is considered a counterproductive behavior (Edwards and Greasley, 2010).
	Turnover rate	0.13	0.18	High turnover rates can negatively impact performance otucomes (Carley, 1992; O'Toole and Meier, 2003; Heavey et al., 2013) and lead to leadership gaps (Lewis, 2011).
Pillar II: Local politicians - quality	Average years of education	13.62	2.08	Well-established tradition in political economy using education as a proxy of quality (Galasso and Nannicini, 2011; Bellodi et al., 2024)
	Gender balance index	0.59	0.32	Gender imbalance leads to democratic deficits (McNeil et al., 2017; DeHart-Davis et al., 2020), entailing significant societal costs and undermining local politicians' quality (see, e.g., Baltrunaite et al., 2014; Weeks and Baldez 2015; Besley et al., 2017).
	Proportion of white-collar workers	0.19	0.22	Politicians with white-collar backgrounds are typically more skilled (Gagliarducci and Nannicini, 2013).
Pillar III: Local government – Fiscal and Economic pillar	Spending rigidity	0.36	0.18	High municipal rigidity negatively impacts policy-making flexibility and the ability to withstand economic shocks (Openpolis, 2016; Grembi et al., 2016; Pavese and Rubolino, 2023; Gamalerio and Trombetta, 2024).
	Spending capacity	0.67	0.15	A reduced spending capacity threatens a smooth implementation of municipal policy agenda (Bellodi and Morelli, 2024).
	Collection capacity	0.69	0.15	Collection capacity gauges the efficiency of local governments in gathering confirmed revenues (Gagliarducci and Nannicini, 2013).
	Share of municipal budget for investments	0.24	0.15	A higher proportion of long-term investments correlates with competent local politicians in areas with weak informal institutions (Carreri, 2021) and is linked to reduced corruption levels (Mauro, 1995).

Figure 2.A.1. Relationship between MAQI Pillar II and population



This graph displays the positive relationship between politicians' Pillar II quality and population using a histogram-style conditional mean plot. The population variable is partitioned into 50 bins (one per 1,000 inhabitants), and for each bin the conditional mean of the MAQI – Pillar II score is plotted. The graph is based on the full sample from 2001 to 2022 with population up to 50,000 inhabitants.

Appendix 2.B

Additional robustness tests

Table 2.B.1. Impact of municipal mergers on absenteeism

T	T+1	T+2	T+3	T+4
Outcome variable: average number of absences among public employees				
-2.77***	-0.01	0.85	0.01	0.06
(0.89)	(1.02)	(0.93)	(0.89)	(0.90)

Notes: ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 2.B.2. Impact of municipal mergers on local politicians quality – robustness check

T	T+1	T+2	T+3	T+4
Main estimates (reported in Figure 2.4)				
2.51***	2.46***	2.45***	2.27***	1.62*
(0.76)	(0.78)	(0.82)	(0.86)	(0.88)
Addition of exact matching on local elections year				
1.47*	1.65*	1.72**	1.65*	1.52*
(0.87)	(0.85)	(0.86)	(0.86)	(0.86)

Notes: This robustness test is conducted by removing the geographical exact matching to account for the limited number of control municipalities available in this robustness exercise. This approach addresses the challenge of finding suitable matches for all treated municipalities.

Table 2.B.3. Impact of municipal mergers on local administrative quality – robustness checks

T	T+1	T+2	T+3	T+4
MAQI – Main estimates (reported in Figure 2.4)				
1.51***	1.60***	1.42***	1.53***	1.64***
(0.30)	(0.37)	(0.39)	(0.41)	(0.42)
Alternative matched set: 10 control units				
1.57***	1.70***	1.56***	1.68***	1.68***
(0.28)	(0.35)	(0.36)	(0.37)	(0.36)
Alternative matched set: 5 control units				
1.49***	1.63***	1.45***	1.58***	1.56***
(0.29)	(0.36)	(0.38)	(0.38)	(0.39)
Alternative refinement method: PSM				
1.50***	1.52***	1.44***	1.60***	1.48***
(0.29)	(0.35)	(0.37)	(0.37)	(0.37)
Alternative refinement method: IPW				
1.14***	1.21***	1.21***	1.33***	1.21***
(0.31)	(0.37)	(0.38)	(0.38)	(0.37)
No covariates				
1.32***	1.09***	1.08***	1.14***	1.01***
(0.29)	(0.36)	(0.39)	(0.39)	(0.39)
Synthetic DiD method				
1.23***	1.10***	1.05***	1.22***	1.22***
(0.21)	(0.23)	(0.24)	(0.24)	(0.24)
DiD with multiple time periods estimator				
1.59***	1.65***	1.66***	1.79***	1.76***
(0.26)	(0.31)	(0.32)	(0.32)	(0.31)
Control group: Includes only municipalities that conducted referenda on mergers between 2013 and 2018, which resulted in negative outcomes				
1.70***	1.96***	1.99***	1.76***	1.36***
(0.23)	(0.40)	(0.41)	(0.41)	(0.35)
Placebo analysis: A fake treatment is assigned to municipalities that held referenda on mergers between 2013 and 2018, which resulted in negative outcomes				
0.27	0.08	0.18	0.49	0.47
(0.24)	(0.28)	(0.31)	(0.32)	(0.37)

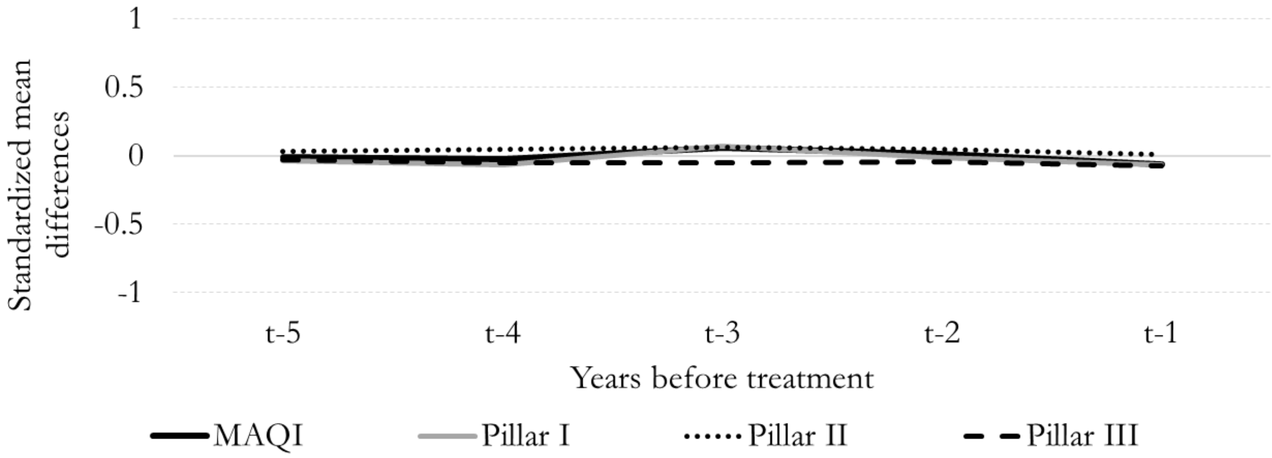
Notes: In all the estimates reported in the table, the MAQI is the outcome variable. When implementing the PSM, the Synthetic DiD, and the DiD with multiple time periods estimators, we exclude the three Pillars from the estimation, as they are linearly dependent on our outcome of interest. Block-bootstrapped standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 2.B.4. Impact of municipal mergers on local administrative quality – splits by NUTS-1 regions and degree of peripherality with respect to socio-economic focal centres

T	T+1	T+2	T+3	T+4
MAQI – Main estimates (reported in Figure 2.4)				
1.51***	1.60***	1.42***	1.53***	1.64***
(0.30)	(0.37)	(0.39)	(0.41)	(0.42)
Treated units: hubs (4 municipalities)				
6.43***	3.26	4.02	4.22	3.25
(2.59)	(2.93)	(3.84)	(3.65)	(3.09)
Treated units: Intermediate (148 municipalities)				
1.44***	1.28***	1.31***	1.58***	1.62***
(0.34)	(0.40)	(0.45)	(0.45)	(0.48)
Treated units: peripheral (45 municipalities)				
0.97	1.87**	1.63**	1.47*	1.40*
(0.61)	(0.79)	(0.70)	(0.76)	(0.74)
Treated units: North (150 municipalities)				
1.29***	1.55***	1.31***	1.37***	1.40***
(0.33)	(0.40)	(0.42)	(0.45)	(0.47)
Treated units: Centre (38 municipalities)				
2.34***	2.50***	2.44***	2.68***	2.66***
(0.62)	(0.70)	(0.74)	(0.69)	(0.67)
Treated units: South and Islands (9 municipalities)				
1.25	-1.39	-1.07	-0.71	0.32
(2.68)	(2.47)	(2.88)	(2.96)	(3.31)

Notes: In all the estimates reported in the table, the MAQI is the outcome variable. Block-bootstrapped standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Figure 2.B.1. Covariate balancing



Chapter 3. "Please, don't go": the role of local public human capital in post-disaster recovery

Abstract

We examine the nuanced interplay between local administrative capacity and post-earthquake economic recovery. By focusing on the aftermath of the 2016 Central Italy earthquake, and employing the synthetic difference-in-differences estimator, we shed light on the crucial role of low local public employee turnover as a mitigating factor in curtailing post-disaster job losses and the reduction of business activities. Our findings advance the disaster recovery literature by delving into municipal-level dynamics, highlighting the significance of specific human capital and local administrative stability in fostering socio-economic resilience.

Keywords: post-disaster management; local public employee quality; specific human capital; synthetic difference-in-differences.

JEL codes: C13; H11; J24 ; R10 ; Q54.

3.1. Introduction

Among the different types of disasters, earthquakes stand out as a special category of disruptive events in terms of both social and economic impact. The United Nations Office for Disaster Risk Reduction (UNDRR) estimates that between 1998 and 2017 earthquakes hit about 125 million people globally. Earthquakes are responsible for about 56% of total disaster-related deaths and for almost a quarter of total economic damages (CRED, 2017). Hence, they are often accompanied by deep social scars and may pose tremendous challenges in terms of economic recovery.

Destruction caused by earthquakes undermines the normal functioning of economic activities in the short to medium term, potentially propagating their effects upstream and downstream along the supply chain (Carvalho et al., 2021). As such, an urgent and open question regards whether, and to what extent, a well-functioning local public administration and an adequate administrative capacity can stimulate the recovery of the production system of the affected locations.

Understanding what could potentially alleviate the economic effects of disasters, by contributing to the recovery of the local productive fabric and the mitigation of losses, represents a matter of utmost importance. Post-disaster management is a crucial step for sustaining economic activity in earthquake areas. Clarifying whether, and how, local institutions shape the process of economic recovery is relevant for improving public responses. Furthermore, given that areas affected by earthquakes are often recipient of extra-ordinary economic resources for reconstruction, assessing the administrative performance in the post-disaster phase is also crucial for public finances. Lastly, (re)creating economic opportunities in earthquake damaged areas may retain workers who would otherwise relocate elsewhere, thus exacerbating the abandonment phenomenon. This may be especially relevant in the case of earthquakes in peripheral areas where emigration is already a main concern.

Despite the increasing decentralization of disaster management from the 'central' to the 'local' level (Lee, 2019), most of the literature adopts a country-level perspective to study potential post-disaster mitigating factors to speed up recovery (Botzen et al., 2019). Shifting our focus to municipalities, our contribution to the literature is threefold. First, by adopting an institutional perspective, we contribute to the literature on disaster recovery by examining the role played by administrative capacity and bureaucratic quality at the lowest level of government, i.e. the municipal level. Second, through our subnational approach, we also contribute to the debate regarding the effectiveness of public offices and bureaucrats, whose role is deemed central in the delivery of services and in the implementation of every-day routines and organisation of activities within the public administration (e.g., Xu, 2018; Decarolis et al., 2020; Fenizia, 2022; Muñoz and Prem, 2024). Specifically, we offer a novel perspective on municipal offices and their characteristics in the context of earthquake recovery, which can complement existing country-level evidence on the productivity and allocation of bureaucrats in response to natural disasters (e.g., Limodio, 2021). Third, we also shed light on the crucial role of task-specific human capital (Gibbons and Waldman, 2004) of municipal public employees during post-earthquake management. Starting from the seminal work by Becker (1964), most studies classify human capital into two types: generic and specific human capital. While the former mainly comes from formal education and is applicable to many different contexts and jobs, the latter is more linked (although not exclusively) to on-the-job training and is generally firm or job specific. In other words, while generic human capital includes some transferrable skills, specific human capital is non-transferable, when switching employer or occupation. Gibbons and Waldman (2004) clearly show that this specific human capital goes wasted when a worker switches jobs and is assigned to a new set of tasks.

Building on this idea, we test the role of both generic and specific public human capital in a post-earthquake setting. While for generic human capital we use the usual measures of administrative capacity, both in terms of quantity (number of public employees and changes over time) and quality (level of education of public employees), we propose a novel proxy for specific public human capital, i.e. the municipal employee turnover rate. In fact, when high turnover occurs, municipalities lose crucial expertise and experience to effectively deal with the exceptional tasks linked to post-disaster reconstruction.[55]

For this exercise, we focus on the last major earthquake occurred in Italy, i.e. the 2016-2017 Central Italy seismic sequence. This earthquake affected 138 municipalities across four adjacent NUTS2 regions - Abruzzo, Lazio, Marche, and Umbria - causing 299 fatalities (Brando et al., 2020) and damages amounting to 29 billion euro.[56] Considering municipal yearly data on the number of active enterprises and employees from 2004 to 2020, we create an original database including the seismic intensity experienced by the affected municipalities, measured by the Modified Mercalli Intensity (MMI) scale, and various metrics quantifying local bureaucratic quality and administrative capacity.

Drawing on the fact that, if places experience the same amount of damage, the timing of a large, sudden natural disaster is an exogenous event (Cavallo et al., 2013), our identification strategy leverages on the Synthetic Difference-in-Differences estimator (Arkhangelsky et al., 2021). This method combines attractive features of the Difference-in-Differences and the

[55] See section 3.2.3 for an in-depth discussion of the theoretical and empirical evidence supporting the use of turnover of local bureaucrats as a measure of task-specific human capital.
[56] See *https://sisma2016.gov.it/wp-content/uploads/2023/01/Rapporto-di-fine-mandato_DEFINITIVO_.pdf* for detailed information about damage assessment and the reconstruction process (in italian).

Synthetic Control estimators, enabling us to finely estimate the causal effect of a binary treatment (Clarke et al., 2024).

Our results show the influence of local bureaucratic turnover on the recovery of the economic fabric of the municipalities hit by an earthquake. One of the key findings is that the effective local management of central aid during emergency is strictly connected to low turnover, i.e. when municipalities operate without personnel discontinuity. This has fundamental policy implications for disaster management.

The remainder of this paper is organized as follows. Section 3.2 outlines the framework of post-disaster management, with a particular focus on Italy and the 2016-2017 earthquake, highlighting the role of local administrative bodies in stimulating post-earthquake economic recovery. Section 3.3 describes our database and our measures of local administrative capacity and bureaucratic efficiency. In section 3.4 we outline the methodology implemented to perform our empirical exercise. In section 3.5 we present our main findings and perform several robustness checks to validate our results. Section 3.6 addresses possible confounding factors in our identification strategy. Finally, section 3.7 concludes and highlights some possible policy implications.

3.2. Extreme events and post-disaster management

3.2.1. Post-disaster management

The *natural disaster management cycle* is a complex process encompassing four phases: mitigation (activities aimed at lessening disaster impact), preparedness (pre-disaster actions aimed at providing an adequate and timely response), response (operations immediately following the disaster to address urgent needs), and recovery (long-term activities aimed at supporting the recovery of the affected territory) (Bertazzi and Cherubini, 2017).

Governments adopt different political decisions dealing with the prevention, mitigation, and damage of natural disasters. For example, rich governments and governments that care about social welfare spend more on disaster prevention and mitigation (Cohen and Werker, 2008).

In the case of Italy, a complex integrated system regulated by the Civil Protection Code was implemented, which includes a series of activities referred to as "civil protection functions". While the civil protection code has been reformed in 2018 (just after the occurrence of the Central Italy earthquake), we refer to this up-to-date system of civil protection as this is the general framework tested and implemented during the reconstruction phase of the Central Italy earthquake.[57] The aim of these activities is removing obstacles to resuming normal living and working conditions as fast as possible, while also restoring essential services and reducing residual risks in the affected areas. During this initial phase a state of emergency is normally declared, which empowers public authorities to undertake urgent measures, enabling them to derogate from ordinary legislation.

Civil protection functions constitute a comprehensive system involving both public and private institutions. This system is based on the principle of subsidiarity, meaning that the first response to the emergency must happen at the local level, starting from municipal authorities. Simultaneously, an "emergency commissioner" can be appointed by the central government to oversee the subsequent physical and economic reconstruction. The emergency commissioner can rely on dedicated technical and administrative personnel and is endowed with extraordinary resources.

[57] Link to the civil protection code (in italian): https://www.protezionecivile.gov.it/en/normativa/legislative-decree-no--1-of-january-2--2018--civil-protection-code/.

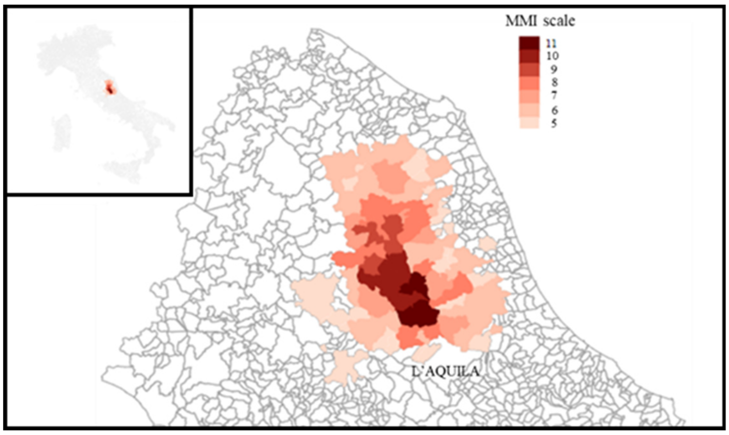
During the reconstruction process, the local administrations provide the necessary assets and regulate the functions of their technical offices, in cooperation with the emergency commissioner. This institutional framework is complemented by *ad-hoc* secondary legislation in the form of "ordinances" that are key regulatory instruments to manage the post-emergency phase, and at the same time, stimulate recovery.

3.2.2. The 2016-2017 Central Italy earthquake

The Central Italy earthquake was a seismic sequence comprising of four main seismic events, three on August 24th, October 26th and 30th 2016, and the last one on January 18th 2017. The magnitudes were 6.18 Mw, 6.07 Mw, 6.61 Mw, and 5.70 Mw on the Moment Magnitude scale (MMS), respectively.[58] Jointly, the seismic sequence affected 138 municipalities across four adjacent NUTS2 regions: Abruzzo, Lazio, Marche and Umbria. Figure 3.1 shows the seismic intensity experienced by the affected municipalities, measured using the Modified Mercalli Intensity (MMI) scale (Wood and Neumann, 1931). While the MMS captures the *power* of an earthquake in terms of energy released (measured through moment magnitude), intensity scales such as the MMI gauge the *effects* of an earthquake, measuring observable earthquake damage in a precise location. We use the MMI scale, as our interest is to measure municipality-level damages[59]. This is also in line with previous studies for Italy (Belloc et al., 2016; Cerqua et al., 2023).

[58] For simplicity, we refer to the seismic sequence of Central Italy as a single event (Central Italy earthquake).
[59] Intensity scales, such as the MMI scale, measure the effects brought about by seismic events on people, natural objects, buildings and other manmade objects, and the Earth's surface. Following the MMI scale, intensities from I to IV correspond to no damages; intensity V (Moderate) reflects very light damages; intensities VI and VII (strong and very strong) correspond to light to moderate damages in well-built ordinary structures; intensity VIII (Severe) indicates considerable damage in ordinary substantial buildings, as well as fall of walls; intensity IX (Violent) means that buildings are shifted off foundations and severe damage to well-built structures is experienced; intensities equals to X (Extreme) or more (up to XII) correspond to very heavy damages, up to total destruction, with practically all works of construction

Figure 3.1. Central Italy earthquake - seismic intensity (MMI scale)



Notes: 66 municipalities report very light damage (MMI<6), 46 municipalities experience light or moderate damage (MMI=6 or 7), and 24 register extensive damage (MMI>7). According to the MMI scale, the Central Italy earthquake registered the highest intensity (11) for two municipalities, Amatrice and Arquata del Tronto.

The first shake (August 24th) produced the most extensive destruction, resulting in 299 fatalities (Brando et al., 2020). The most devastated municipalities were Accumoli, Arquata del Tronto and Amatrice. In Amatrice, around 10% of people died (238 out of 2,500 inhabitants) (Massazza et al., 2019). While the earthquake on August 24th was highly destructive, but just in the immediate surroundings of the epicenter, the impact of the following seismic events was more distributed and affected a larger area, crossing the border North into the Marche region (Fiorentino et al., 2018).

In the years immediately after the earthquake, the reconstruction process progressed slowly. The civil protection code to deal with emergency, tested in the field during the post-disaster phase, contributed to generating uncertainty over administrative and procedural matters among local authorities. By the end of 2019, the share of the requests for reconstruction

damaged greatly or destroyed. According to the MMI scale, the Central Italy earthquake registers the highest intensity (11) for two municipalities, Amatrice and Arquata del Tronto.

funds was only 15.8% of what was expected.[60] To oversee the response and recovery phases, a state of emergency was declared after the first shake, and the first set of necessary activities has been carried out by the head of the Civil Protection Department, as required by emergency protocols. An emergency commissioner was then appointed to oversee the reconstruction, managing specific funds to support, bolster and expedite the socio-economic recovery. The decree-law 189/2016 established a comprehensive institutional framework for the reconstruction, with dedicated regional reconstruction offices (one for each affected region), to support the commissioner, and a coordinating cabinet comprised of the commissioner and the presidents of the regions.[61]

The presidents of the regions, provinces, as well as the local governments, play an important active role in the post-disaster reconstruction phase. Notably, local governments and their bureaucratic apparatus and administrative machinery hold a crucial position in receiving and approving applications for reconstruction funds at an early stage, subsequently forwarding paperwork to the regional reconstruction offices. This delicate phase entails the need for local public officials to develop, in a coordinated manner, the skills to provide technical and procedural advice to private citizens and businesses, to foster the recovery of the local economic fabric. One of the main obstacles to a prompt and effective recovery is often the lack of adequate human, technical and financial resources in local administrations. In small, and more peripheral, municipalities the mayors find it difficult to deal with the vastness and complexity of daily administrative activities necessary for the reconstruction, because of lack of dedicated personnel and resources. Meanwhile, a specific legislation gives

[60] See: https://sisma2016.gov.it/wp-content/uploads/2020/02/FlashRep_Restyling_13_febbraio_mappe_e_personale.pdf (in Italian).

[61] The text of the law decree 189/2016 can be accessed through the following link: https://www.gazzettaufficiale.it/eli/id/2016/10/18/16G00205/sg (in Italian).

new duties to these local administrations, sometimes with a lack of clarity in how to implement the new norms leading to misunderstanding of responsibilities, e.g. in tender procedures and/or project assignments.[62] In the 2016 earthquake case, the recognition of the role of municipalities as main implementers in the reconstruction phase meant that substantial funds were allocated to help strengthen municipal staff capacity to speed up the reconstruction effort. Additionally, the aim of the emergency commissioner was to simplify and streamline the procedures for granting reconstruction funds, making local authorities take on an increasingly central role over time.[63]

Several papers study the seismic sequence, concerning its seismic characteristics (Pino et al., 2019; Schiappapietra and Douglas, 2020), damage assessment (Brando et al., 2020; Fiorentino et al., 2018; Penna et al., 2019), post-disaster housing (Oggioni et al., 2019; Pezzica et al., 2022), electoral outcomes (Cerqua et al., 2023), population decrease (Dottori, 2024), and short-term – negative - impact on economic activity (Dottori and Micucci, 2019).

3.2.3. Local government, post-disaster management, and the role of local administrative capacity and bureaucratic efficiency

The destruction caused by natural disasters undermines the normal functioning of economic activities, potentially propagating upstream and downstream along supply chains (Carvalho et al., 2021) and generating negative direct (Aguirre et al., 2023; Kim and Lee, 2023) and short-run indirect economic effects.[64] It remains unclear whether potential local

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[62] See https://disasterlaw.ifrc.org/sites/default/files/media/disaster_law/2023-02/Italy%20-%20Final_0.pdf (chapter five) for a comprehensive overview of the crucial role of local authorities in the recovery phase after Central Italy earthquake.

[63] See https://sisma2016data.it/report-page/ for more details on the reconstruction and https://sisma2016.gov.it/provvedimenti-governo-e-parlamento/ for decree-laws concerning the earthquake (in Italian).

[64] See Botzen et al. (2019) for a comprehensive review of the empirical literature on the direct and indirect economic effects of natural disasters.

mediating factors can speed up the recovery of economic activities and the local production fabric. In addition, the way natural disasters affect economic activities is conceptually ambiguous. On one hand, natural disasters can curb entrepreneurial activity by increasing fear of failure and uncertainty (Altay and Ramirez, 2010). On the other, extreme events typically generate new markets and demand for new products, that can result in new entrepreneurial initiatives offering new products and services (Monllor and Murphy, 2017). The empirical literature on this topic is scant. Boudreaux et al. (2019, 2022) find that natural disasters decrease entrepreneurship just in the year after the event. Oh and Oetzel (2010) suggest that natural disasters have no impact on the number of subsidiaries of multinational corporations. If the theoretical relationship between natural disasters and economic activity is heterogenous, it becomes relevant to identify potential moderating factors that can tip the balance in either direction. For example, Boudreaux et al. (2023), investigating the role of quality of governance at the country-level, stress that high-quality governments positively moderate the effects of natural disasters on entrepreneurship.

By adopting an institutional perspective, we shift our focus to the mediating role of administrative capacity and bureaucratic efficiency at the lowest level of government, i.e. the municipal level, studying its mitigating role on losses incurred by the local productive system. A recent strand of literature stresses the importance of state capacity and public administration in generating development opportunities through effective governance and policy implementation (Besley and Persson, 2009; Acemoglu et al., 2015; Besley et al., 2022). The performance of public offices, in fact, is considered pivotal for efficient public procurement operations, effective delivery of public goods and services and, ultimately, citizen welfare (Decarolis et al., 2018; Fenizia, 2022). In this vein, bureaucrats embody the human capital of the public administration and, as such, they are responsible for the operations of complex institutions (Xu, 2018), which may be particularly challenging in the aftermath of disasters (Limodio, 2021). Alongside common measures of generic human capital, such as the level of education of local public employees, we acknowledge the role of task-specific human capital (Gibbons and Waldman, 2004) related to post-disaster management at the local level, exploring its implication on disaster-related economic losses. Evidence from labor and organization studies shows that experience, skill accumulation, and industry- and occupation-specific human capital enhance organizational survival and performance (Dahl & Reichstein, 2007; Sullivan, 2010). As bureaucrats exhibit low exit rates - once selected, they tend to remain within an organization - skill mismatches can emerge when technology and the external conditions change (Besley et al., 2022). In a post-disaster setting, local officials must rapidly acquire on-the-job, *ad-hoc* procedural knowledge to manage extraordinary tasks amid incomplete guidelines and legislations (see sections 3.2.1 and 3.2.2), making institutional memory and short-term routinization crucial. Whether individual capability becomes organizational capacity depends on mechanisms of coordination and aggregation (Besley et al., 2022). Yet personnel discontinuity – i.e., turnover - undermines institutional memory (Lewis, 2011) and can result in lower quality in public service delivery (Akhtari et al., 2022). Therefore, we consider higher turnover among municipal staff after an earthquake as a proxy for lower accumulation of post-disaster, task-specific experience, weakening administrative capacity precisely when it is most needed.

Most of the literature takes a country-level perspective to study potential post-disaster mitigating factors to speed up recovery from natural disasters. This strand of the literature suggests that country-level factors such as income, institutions, average education, urbanization, infrastructure, trade openness, financial development and integration can affect the severity of natural disaster impacts (Botzen et al., 2019; Felbermayr and Groschl, 2014). Although the role of disaster management is increasingly being decentralized from the ‘central’ to the ‘local’ level (Lee, 2019), and despite the key role that local governments play in connecting central government plans and funding with their socio-economic fabric (Rosas et al., 2021), municipal capacity is overlooked.[65]

Identifying internal staff, external resources, or both, to manage the financial side of recovery is crucial for local governments (Becker, 2009). Investigating the response of small businesses to disasters, Runyan (2006) finds that lack of access to capital for reconstruction - managed by local administrative offices - hinder recovery. Kusumasari et al. (2010) and Fengler et al. (2008) stress the importance of strengthening local governments capabilities not only during, but also after natural disasters. Effective administrative and development management mechanisms (e.g., land use controls, redevelopment, building permits, mutual aid agreements) are all important to foster recovery (Olshansky et al. 2006), and local governments can become overwhelmed with their responsibilities (Smith and Wenger, 2007). The relevance of internal organizational network within local administrations is emphasized in various studies (Kapucu 2006; Comfort 2007; Horwitz 2008; Crow et al., 2018). Mutual trust and continuous collaboration are considered crucial internal factors to shorten the recovery period after the disaster, and the lack of bureaucratic capacity can trigger coping mechanisms, such as non-compliance through delaying decisions and failing to meet deadlines (Compton and Meier, 2017). In light of this, the empirical assessment of the role of municipal administrative capacity during the recovery phase after an extreme event becomes crucial.

[65] Even more if we consider only quantitative studies, as the majority of this research is qualitative by design.

3.3. Data

3.3.1. Data and sample description

We implement our analysis using municipal level data, organized in a panel, from 2004 to 2020.[66] We measure local economic activity dynamics with data from the Italian National Institute of Statistics (ISTAT) on the number of active enterprises and employees for each municipality-year observation.[67] We use as main dependent variables the number of active enterprises and the number of employees in logarithmic form for each municipality-year data point. Although we lack access to firm-level data, the panel structure of our dataset allows us to catch the aggregated dynamics of the recovery of the local productive system and entrepreneurship activity for each municipality. Furthermore, complementing the analysis on business activities with employment recovery is relevant to understanding the overall progression of disaster recovery (Ewing et al, 2004; Runyan, 2006).

To measure municipal administrative capacity and bureaucratic quality, we draw data from the Annual Account from the Italian General Accounting Office. These data contain information on the number of public employees, their rank, education, type of contract, and data on hiring and lay-offs from 2001 to 2021 for each municipal administrative body. As we are interested in splitting the sample of treated municipalities (those affected by the Central Italy earthquake) into consistent groups based on their levels of administrative capacity and bureaucratic quality for measuring recovery differentials (see section 3.2), we

[66] If we consider yearly data, data provided by the Italian National Institute of Statistics are only available from 2004. Even if the last time point of our analysis is 2020, we are able to capture short to medium term economic recovery.

[67] We have data on companies and employees for all the economic sectors besides the public administration and agricultural ones. However, none of the of the local labour systems of the municipalities hit by the earthquake is specialized in agricultural activities (for more information, see: https://www.istat.it/it/archivio/150320).

gather information on employee turnover rate, the share of employees holding a university degree, and the change in the number of employees after the occurrence of the earthquake (i.e., from 2017 to 2020) for the municipalities within the affected area.[68]

We use earthquake data from the National Institute of Geophysics and Volcanology (INGV) database,[69] which provides macroseismic data points registering the locality and the macroseismic intensity of each earthquake, as well as physical damages and the level at which it has been felt by people (Rovida et al., 2022). In addition, we collect data on the seismic risk associated with each municipality. According to the official seismic risk classification, municipalities are divided into four categories, representing different levels of seismic risk.[70] Our treated municipalities fall in the first and second category, characterized by the highest seismic risk.

Finally, we include some socio-economic variables for each municipality from 2004 to 2020. To account for municipalities' economic and demographic characteristics, we consider average income per capita, the population size in logarithmic form, and the share of foreigners. As the degree of urbanization can influence entrepreneurial rates (Di Addario and Vuri, 2010) we also include the classification of municipal peripherality with respect to socio-economic focal centres.[71]

Our final sample is composed by 7,867 municipalities out of a total of 7,903 municipalities.[72] Table 3.1 provides descriptive statistics for our sample and the definition of variables

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[68] Data on local public employees are not available for three municipalities in the crater: Palmiano, Poggiodomo, and Polino. We exclude these municipalities from the analysis.

[69] The database can be accessed through the following link: https://emidius.mi.ingv.it/CPTI15-DBMI15/.

[70] https://www.protezionecivile.gov.it/it/normativa/opcm-n-3274-del-20-marzo-2003/ (in Italian).

[71] This classification has six values according to the commuting distance to urban centres. Value 1 corresponds to centres, value 6 to ultra-peripheral municipalities. See https://www.agenziacoesione.gov.it/wp-content/uploads/2021/01/Nota_metodologica_Aree_interne-2-1.pdf for more information (in Italian).

[72] We only exclude 36 municipalities due to missing values.

included in the analysis. The municipalities in the crater are, on average, less populated, with a lower number of active enterprises, employees, and average income per capita with respect to Italian municipalities. On the contrary, they are characterized by higher seismic risk and share of foreigners.

Table 3.1 - Descriptive statistics and definition of variables included in the analysis

	Italian municipalities (7,867)				Municipalities in the crater (136)			
Variable	Mean	St. dev	Min	Max	Mean	St. dev	Min	Max
Number of active enterprises (log)	5.12	1.47	0	12.54	4.84	1.37	1.79	8.56
Number of employees (log)	6.18	1.71	0	13.87	5.78	1.57	2.19	9.93
Intensity of Central Italy earthquake (MMI scale)	0.24	1.06	0	11	4.78	3.03	0	11
Seismic risk	2.75	0.91	1	4	1.74	0.44	1	2
Average per capita income	16,910.94	4,090.11	5,096.84	63,894.68	15,381.69	2,467.58	10,206.55	23,029.72
Population size (log)	7.86	1.33	3.33	14.85	7.49	1.25	4.68	10.94
Share of foreigners	0.06	0.04	0	0.39	0.08	0.04	0	0.22
Periphery score	3.70	0.99	1	6	3.68	1.03	1	5

Variable	Definition	Source	Time period
Number of active enterprises (log)	Number of active businesses in the municipality – logarithmic form	Statistical register of active enterprises (ASIA) - ISTAT	2004-2020
Number of employees (log)	Number of employees in the municipality – logarithmic form	Statistical register of active enterprises (ASIA) - ISTAT	2004-2020
Intensity of Central Italy earthquake (MMI scale)	Seismic intensity – Modified Mercalli Intensity (MMI) scale	National Institute of Geophysics and Vulcanology (INGV)	2016
Seismic risk	Seismic hazard classification – classes from 1 to 4	O.P.C.M. 3274	2003
Average per capita income	Average income per capita in the municipality	Ministry of Economy and Finance (MEF)	2004-2020
Population size (log)	Number of residents in the municipality – logarithmic form	Italian National Statistics Institute (ISTAT)	2004-2020
Share of foreigners	Share of foreigners with respect to total population in the municipality	Italian National Statistics Institute (ISTAT)	2004-2020
Periphery score	Municipal peripherality with respect to socio-economic focal centers	ISTAT - National Strategy for the Italian internal areas	2011

3.3.2. Measures of administrative capacity and bureaucratic quality

We compute metrics measuring administrative capacity and bureaucratic quality for all the municipalities hit by the Central Italy earthquake. We measure turnover of public employees as follows:

$$\frac{1}{4}\sum_{t=2017}^{T=2020}\frac{N°\ Hires_{it} +\ N°\ Departures_{it}}{N°\ Employees_{it}}$$

where i refers to municipalities in the crater and t to years from 2017 to 2020. As we are interested in capturing aggregated post-disaster dynamics, we average our metric across time. As anticipated, this measure of civil servants turnover captures the (dis)continuity in the local public administration, so that high turnover rates undermines institutional memory (Lewis, 2011) and indicate instances in which there is lower accumulation of post-disaster, task-specific experience.

To measure civil servants quality, we follow a common practice in political economy using education as a proxy (see, for example, Bellodi et al., 2023; Galasso and Nannicini, 2011), calculated as the share of employees with a university degree. As for the turnover metric, we compute the share of graduates for each year from 2017 to 2020 and then we average it across time. Considering that in the recovery phase an adequate number of personnel can make the difference (Kusumasari et al., 2010), we also measure the average yearly change in the number of municipal employees as follows:

$$\frac{1}{3}\sum_{t=2017}^{t+1;T=2020}\frac{N°\ employees_{it+1} - N°\ employees_{it}}{N°\ employees_{it}}$$

Lastly, we include data on the number of additional employees and technicians assigned by the emergency commissioner to each municipality in the crater. In 2019, to face the delay and slowness of the reconstruction, the emergency manager decided to assign additional employees to each municipality.[73] We create a variable indicating the share of additional public employees assigned to each municipality with respect to the total number of municipal employees. Table 3.2 summarizes our metrics of bureaucratic quality and administrative capacity.

Table 3.2. Metrics measuring bureaucratic quality and administrative capacity

Metric	**Definition**
Turnover	Employee hires and employees who leave with respect to the total number of personnel
Graduates	Share of municipal civil servants holding a university degree
Number of employees	Change in the number of civil servants (gain/loss of personnel) over time
Additional employees	Share of additional public employees assigned by the emergency manager in 2019 with respect to total personnel

Notes: The metrics concerning turnover, graduates and the number of employees are computed as averages between the years following the earthquake, i.e. years from 2017 to 2020, mimicking what happened during the reconstruction phase.

[73] These data are available here: https://sisma2016data.it/report-page/.

3.4. Methodology

We perform our analysis by implementing the Synthetic Difference-in-Differences (SDID) estimator (Arkhangelsky et al., 2021). This methodology combines the features of the Difference-in-differences (DID) and the Synthetic Control (SC) to estimate the causal effect of a binary treatment W_{it} on an outcome Y_{it}. Since the municipalities affected by the Central Italy earthquake exhibit rather distinctive socio-economic characteristics compared to the full set of control units, this methodology is particularly well suited to our empirical setting. It enables the construction of a synthetic counterfactual that optimally combines control units and thereby substantially relaxes the reliance on the parallel-trends assumption.

Consider a balanced panel of N units and T time periods. Among the N units, $N_{treated} < N$ are affected by a binary treatment W_{it}. We are interested in measuring the average treatment effect of exposure to the treatment (ATT, defined as τ) on an outcome Y_{it}. As preliminary step, the SDID estimator computes weights $\widehat{\omega}^{sdid}$ aligning pre-exposure trends in the outcome of treated and control units, as well as time weights $\hat{\gamma}_t^{sdid}$ to emphasize pre-exposure periods most similar to the post-exposure ones. $\widehat{\omega}^{sdid}$ and $\hat{\gamma}_t^{sdid}$ are then used in a two-way fixed effects regression to estimate the ATT as follows:

$$\left(\hat{\tau}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}\right) = \underset{\tau,\mu,\alpha,\beta}{\operatorname{argmin}}\{\textstyle\sum_{i=1}^{N}\sum_{t=1}^{T}(Y_{it} - \mu - \alpha_i - \beta_i - W_{it}\tau)^2 \widehat{\omega}_i^{sdid}\hat{\gamma}_t^{sdid}\} \qquad (3.1)$$

With respect to SDID, the standard DID consists of estimating the same two-way fixed effects procedure assigning equal weights to all time periods and groups, while the SC procedure introduces optimal unit-specific weights, but does not consider time weights and unit fixed effects α_i. In the SDID method, covariates adjustment is a pre-processing task, which removes the impact of changes in covariates from the outcome Y_{it} prior to calculating the synthetic control (Clarke et al., 2024).

In our setting, $W_{it} = 1$ if municipality i belongs to the crater of the Central Italy earthquake. Our treatment period goes from 2016 - the year of the occurrence of the first shake - to 2020, the last time point of our analysis. We decide to adopt a standard setting instead of a staggered design as three out of four shakes occurred in 2016 and the last one took place in the beginning of 2017.[74] Additionally, the last shake is the mildest in terms of damage (see section 3.2.2) and all the municipalities in the crater suffered damage from previous tremors.

To detect recovery differentials according to different levels of municipal bureaucratic quality and administrative capacity, we proceed as follows:

1) First, we split our treated municipalities into different groups, according to their different intensity of exposure to the treatment, measured by the MMI scale.[75]

[74] Recall that our yearly data refers to the end and not the beginning of the year.

[75] The MMI scale measures the observed damage recorded in each municipality (see Section 3.2.2). We rule out the possibility that MMI-recorded damage in each jurisdiction is driven by municipal vulnerability or preparedness by examining the correlation between earthquake intensity and: (i) the average age of the municipal building stock (corr. = −0.017); (ii) the index of buildings in good condition (corr. = 0.142); (iii) the number of active enterprises in the year prior to the earthquake (corr. = 0.093); and (iv) the turnover rate of public employees (corr. = −0.055). All coefficients are close to zero, indicating no meaningful association and suggesting that preparedness and vulnerability do not determine the damage each municipality experiences. Consistent with this, the geographical distribution of damage is concentrated in municipalities near the epicentre, implying that earthquake intensity plays the predominant role in shaping observed damage.

Specifically, we divide treated municipalities into three homogeneous groups: MMI < 6 (municipalities that experienced very light damage); MMI = 6 or 7 (municipalities that experienced light to moderate damage); MMI > 7 (municipalities that experienced considerable damage, up to total destruction).

2) Second, we compute the median value of our metrics measuring bureaucratic quality and administrative capacity (for example, employee turnover rate) for each group and divide municipalities into two sub-groups - above and below the median - according to their values of bureaucratic quality and administrative capacity.

3) Lastly, we compute the ATT using the SDID estimator for each sub-group, calculating the effect of the earthquake on our outcomes of interest according to different levels of administrative capacity and treatment intensities. We aim at comparing sub-groups having the same intensity of exposure to treatment but different levels of administrative capacity.

By performing separate estimations, we are comparing recovery dynamics with respect to each sub-group counterfactual. When running our estimates, we exclude from the control group all the municipalities in the crater not belonging to the treated sub-group. In our empirical strategy, we exploit the fact that post-disaster top-down financial aid are available to treated municipalities equally, and municipalities with the same intensity of damage have access to an equal amount of economic aid. In this way, we can detect the mediating role of bureaucratic quality and administrative capacity.

We perform our estimation using the population size in logarithmic form, income per capita, the share of foreigners, municipal peripherality, and the seismic class as covariates. As the earthquake occurred in 2016 and we have data up to 2020, we can capture short-to-medium term recovery dynamics. All our results and interpretations about the role of municipal bureaucratic quality in the recovery phase refer to this time span.

3.5. Results

We begin this section by showing the estimated treatment effect on the entire sample of treated municipalities, then focusing on the analyses split by earthquake intensity and levels of bureaucratic quality and administrative efficiency.

3.5.1. Overall effect of the earthquake

Table 3.3 reports the impact of the Central Italy earthquake on our outcome variables of interest. We show the average treatment effect on the treated for the entire sample of treated municipalities, then narrowing it down by separately examining the effect of the earthquake on municipalities that experience very light damage (MMI < 6), municipalities that experience light to moderate damage (MMI = 6 or 7), and the most severely affected municipalities (MMI > 7).[76]

Table 3.3. Overall effect of the earthquake

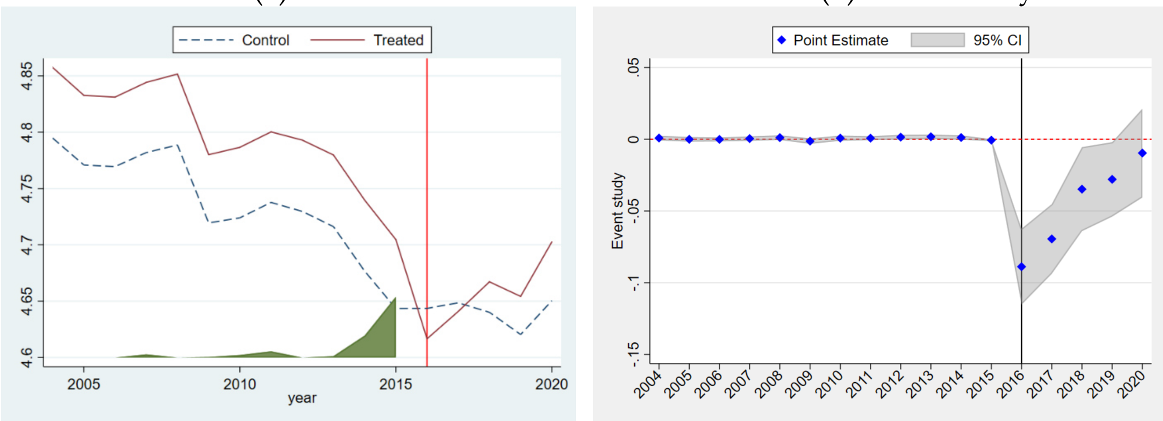
ATT	Entire crater	MMI < 6	MMI = 6 or 7	MMI > 7
Active enterprises (log)	-0.016* (0.009)	-0.013 (0.008)	-0.029* (0.015)	-0.073*** (0.022)
Employees (log)	-0.005 (0.011)	0.016 (0.014)	-0.002 (0.021)	-0.065** (0.029)

Notes: ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

[76] When restricting the sample of treated units, we exclude from the analysis those municipalities belonging to the crater not considered as treated.

Figure 3.2. Impact of the earthquake on active enterprises (log) - MMI > 5 - outcome trend and event study

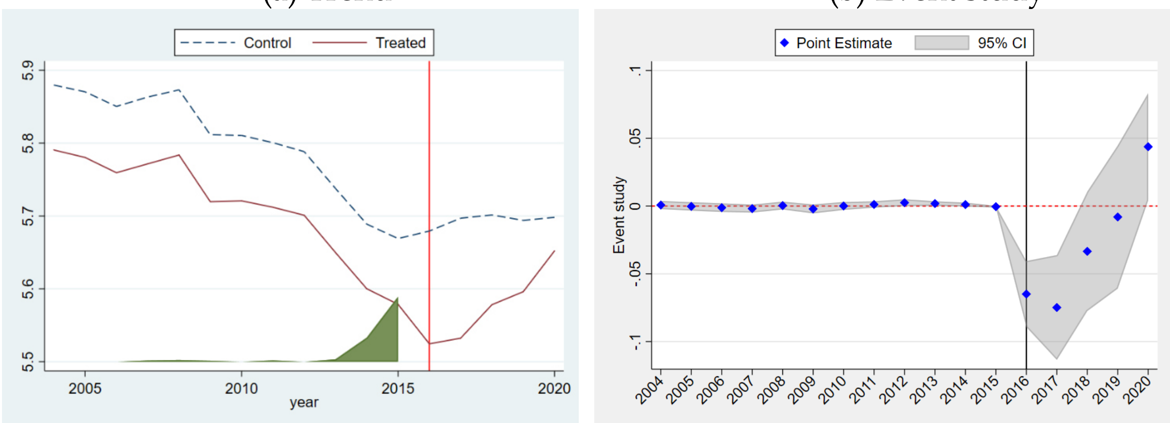
(a) Trend (b) Event study



Notes: Figure 3.2 (a) shows the number of active enterprises' trends from 2004 to 2020 for both treated and control groups. Figure 3.2 (b) shows the ATT for each year from 2004 onwards. Grey bandwidths represent 95 percent confidence intervals computed with block-bootstrapped standard errors (100 replications).

Figure 3.3. Impact of the earthquake on the number of employees (log) - MMI > 5 - outcome trend and event study

(a) Trend (b) Event study



Notes: Figure 3.3 (a) shows the number of employees trends from 2004 to 2020 for both treated and control groups. Figure 3.3 (b) shows the ATT for each year from 2004 onwards. Grey bandwidths represent 95 percent confidence intervals computed with block-bootstrapped standard errors (100 replications).

Overall, Table 3.3 suggests that the earthquake has a negative impact on the number of active enterprises across the entire sample of treated units (column 1). This negative effect increases in magnitude and significance when considering municipalities severely impacted by the disaster. If we consider the treated group of municipalities with MMI values higher than 7, an estimated coefficient of -0.073 for the number of active businesses corresponds to losses equal to the 7% of enterprises. Additionally, if the damage (MMI scale) increases, the reduction in the number of enterprises is also related to a negative and significant decrease in the number of employees, confirming a general downturn of economic activities in the most affected municipalities.

Italy has been affected by two other significant earthquakes in recent years, the L'Aquila earthquake in 2009 and the Emilia-Romagna earthquake in 2012. Thus, we repeat our estimates excluding from the analysis those municipalities hit by these two events, as they may not adequately represent appropriate counterfactual units within our framework. Estimates in Table 3.A.1 in Appendix 3 are consistent with the results of Table 3.3.

As customary in this context, we support our estimates with Figures 3.2 and 3.3, showing outcome trends (Figure 3.2 (a) for the number of active enterprises and Figure 3.3 (a) for the number of employees) and the average treatment effect on the treated (ATT) for each post-treatment period using an event study-style graph (Figure 3.2 (b) for the number of active enterprises and Figure 3.3 (b) for the number of employees). Figures 3.2 and 3.3 report results for treated units hit by the earthquake experiencing at least light damage (MMI > 5). Figure 3.2 (a) and Figure 3.3 (a) show the evolution of our outcome variables of interest over time for both the treated and the control group. If we do not observe parallel trends between the solid and dashed lines after 2015, we expect to detect a significant effect of our treatment. Figure 3.2 (b) and 3.3 (b) report the difference between treated group and control group's trends (ATT) for each time point. The blue markers represent our point estimates while the grey bandwidths are the 95 percent confidence intervals, estimated with block bootstrapped standard errors. The years just after the event register a significant drop both for active enterprises and employees, driving the negative average treatment effect on treated municipalities in the medium term. These results support the idea that severe natural disasters slow down economic activity in the aftermath of their occurrence.

3.5.2. The role of local governments

Among the treated municipalities, 66 suffered very light damage (MMI < 6), 46 experience light or moderate damage (MMI = 6 or 7), and 24 register extensive damage (MMI > 7). We replicate our estimates for each of these groups, splitting them in sub-groups according to their level of bureaucratic quality and administrative capacity. Table 3.4 reports the earthquake's impact on active enterprises and employees according to municipalities' bureaucratic quality. Panel A presents the estimates for the turnover metric, Panel B for the share of highly educated employees, Panel C for the gain/loss of employees over time, and Panel D for the additional employees appointed by the emergency manager in 2019.

Table 3.4. Impact of the earthquake - sample split by municipal bureaucratic quality and administrative capacity

Panel A: Turnover						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.021**	-0.001	-0.006	-0.045***	-0.060*	-0.084***
	(0.010)	(0.014)	(0.014)	(0.017)	(0.036)	(0.026)
Employees (log)	0.029	0.001	-0.015	-0.014	-0.036	-0.091***
	(0.021)	(0.022)	(0.018)	(0.029)	(0.054)	(0.027)
Panel B: Graduates						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low graduates	High graduates	Low graduates	High graduates	Low graduates	High graduates
Active enterprises (log)	0.015	0.002	-0.033**	-0.022	-0.070*	-0.074***
	(0.012)	(0.013)	(0.015)	(0.018)	(0.038)	(0.024)
Employees (log)	0.025	0.004	-0.014	-0.015	-0.082*	-0.048
	(0.029)	(0.019)	(0.024)	(0.024)	(0.049)	(0.041)
Panel C: Number of employees						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Loss	Gain	Loss	Gain	Loss	Gain
Active enterprises (log)	0.012	0.006	-0.029***	-0.025	-0.085***	-0.059*
	(0.019)	(0.011)	(0.009)	(0.025)	(0.038)	(0.031)
Employees (log)	0.012	0.017	0.003	-0.003	-0.084*	-0.042
	(0.013)	(0.023)	(0.024)	(0.025)	(0.048)	(0.032)
Panel D: Additional employees assigned in 2019						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low increase	High increase	Low increase	High increase	Low increase	High increase
Active enterprises (log)	0.014	0.015	-0.005	-0.045*	-0.055**	-0.091***
	(0.010)	(0.016)	(0.010)	(0.024)	(0.026)	(0.032)
Employees (log)	0.017	0.017	-0.003	0.005	-0.051**	-0.078
	(0.013)	(0.027)	(0.018)	(0.033)	(0.022)	(0.054)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Starting from Panel B (share of graduates), it seems that highly educated civil servants do not make a difference in limiting losses in the number of enterprises and employees. Looking at the gain or loss of employees (Panel C), municipalities with values of MMI > 5 report a negative and significant coefficient at the 1% level for the number of active enterprises with respect to their counterfactual only in the case they undergo greater personnel losses (Panel C, columns "Loss" for MMI = 6 or 7, and MMI > 7). This is in line with studies highlighting the role of an adequate number of local employees to manage the recovery phase (Kusumasari et al., 2010).

Sub-groups in Panel D are constructed according to a targeting measure adopted by the emergency commissioner in 2019 to unblock municipalities where reconstruction was lagging. Specifically, extra technical/administrative staff were assigned proportionally more to municipalities facing heavier delays and implementation bottlenecks, not simply to those with more damage. With our outcome window 2004–2020 and the treatment occurring in 2016, Panel D therefore cannot identify any effect of those 2019 staff additions. Rather, it shows if - within a given damage class - the municipalities that later received more additional staff are those that had experienced larger earthquake-induced losses in the aftermath of the shock.[77]Overall, looking at groups of municipalities that experienced higher damage (MMI = 6 or 7; MMI > 7, Panel D), there is not a clear evidence in magnitude and significance of losses between those that benefited the most from additional employees, questioning the rationale by which top-down human capital incentives have been allocated.

The most interesting results concern public employee turnover (Panel A), as they show a clear and noteworthy pattern. Among municipalities severely hit by the

[77] In other words, Panel D only describes heterogeneity in earthquake impacts by checking if the rationale followed by the emergency commissioner in assigning additional employees is consistent with a selection-on-need interpretation. No causal interpretation of the 2019 staffing assignment itself is intended.

earthquake (MMI>7), those with higher levels of turnover experience the most substantial decrease in the number of enterprises with respect to their counterfactual. The economic downturn in these municipalities is further confirmed by a significant reduction in the count of employees. We do not observe the same for municipalities with lower turnover rates, characterized by a smaller decrease, and significant only at the 10% level, only in the number of business activities. Municipalities experiencing light to moderate damage (MMI=6 or 7) show the same pattern, as we estimate a negative and significant loss in the number of enterprises only for municipalities with high turnover rates. When the damage is very light (MMI<6), municipalities experience an increase in the number of economic activities only when turnover levels are low, showing that lower turnover rates could lead to more effective recovery fund management.

When high turnover occurs, municipalities lose the expertise and experience of departing public employees that have developed a critical knowledge of post-disaster extraordinary tasks. After a disaster, the concept of single-loop learning (Argyris, 1976) - the most common learning form within organizations, wherein individuals learn about a problem and consequently develop or implement tools or processes to cope with that particular issue (Crow et al., 2018) - becomes relevant for managing and stimulating local development during recovery. Turnover undermines this process by eroding institutional memory (Lewis, 2011) and reducing the quality of public service delivery (Akhtari et al., 2022). Consistent with this, Carley (1992) finds that organizations learn less as turnover increases. Heavey et al. (2013) further illustrate the negative association between turnover and various performance outcomes.

While the turnover rate of local civil servants seems to have a role in containing economic losses, coefficients reported in table 3.4 are not directly comparable, as we run different regressions for each sub-group. Thus, we further inspect the mediating role of turnover by reporting the ATT for each post-treatment time point in tables 3.5 and 3.6. These tables show a clear difference between high and low turnover groups concerning the timing of recovery. Highly damaged municipalities (MMI > 7) with high turnover experience a negative and significant reduction in the number of business premises up to three years after the earthquake, while municipalities with low levels of turnover do not show any statistically significant reduction from two years after the event onwards. We observe a similar pattern for the MMI = 6 or 7 and MMI < 6 groups. Each group characterized by high rates of turnover experience a slow recovery with respect to their counterfactual, while low-turnover groups spend less time to recover. Overall, tables 3.5 and 3.6 provide evidence that low-turnover municipalities experience a quicker recovery of their economic fabric than high-turnover ones.

Table 3.5. Event study (active enterprises)

Active enterprises (log)	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
T (2016)	-0.009	-0.037**	-0.051***	-0.075***	-0.128***	-0.126***
	(0.018)	(0.015)	(0.013)	(0.024)	(0.030)	(0.042)
T+1	0.007	-0.021	-0.016	-0.053***	-0.111***	-0.138***
	(0.014)	(0.013)	(0.012)	(0.027)	(0.030)	(0.037)
T+2	0.029**	0.011	0.026**	-0.055**	-0.051	-0.084**
	(0.013)	(0.017)	(0.012)	(0.021)	(0.049)	(0.037)
T+3	0.032	0.011	-0.004	-0.016	-0.028	-0.075**
	(0.020)	(0.014)	(0.017)	(0.024)	(0.040)	(0.030)
T+4	0.042**	0.021	0.009	-0.038	0.013	-0.004
	(0.017)	(0.018)	(0.027)	(0.038)	(0.040)	(0.024)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 3.6. Event study (employees)

Employees (log)	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
T (2016)	0.015	-0.031	-0.026**	-0.053**	-0.087***	-0.118***
	(0.024)	(0.028)	(0.011)	(0.022)	(0.023)	(0.042)
T+1	-0.002	-0.020	-0.013	-0.048*	-0.107*	-0.182***
	(0.018)	(0.032)	(0.014)	(0.026)	(0.058)	(0.044)
T+2	0.037**	0.017	0.031*	-0.031	-0.035	-0.129***
	(0.018)	(0.023)	(0.019)	(0.039)	(0.072)	(0.037)
T+3	0.043*	0.011	0.039**	0.010	-0.041	-0.063
	(0.026)	(0.024)	(0.019)	(0.052)	(0.081)	(0.046)
T+4	0.058***	0.028	0.037	0.045	0.081*	0.040
	(0.020)	(0.027)	(0.027)	(0.040)	(0.045)	(0.044)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Given the interesting patterns estimated, in the rest of the paper we focus our attention on the mediating effect of turnover, testing the validity of our results.

3.5.3. Robustness checks and additional analysis

We test the robustness of our results by performing several additional analyses. Tables and figures reporting our robustness checks are presented in Appendix 3, while estimates performed with an alternative estimator to corroborate our results are reported in the main text.

A first concern regarding our empirical strategy relates to the fact that control units may not represent a valid counterfactual for our treated group. Table 3.A.2 in Appendix 3 reports results of several estimations to rule out that our control units are a biased counterfactual group. In Panels A and B, we repeat our estimates excluding from the control units municipalities affected by other earthquakes (L'Aquila earthquake, 2009; Emilia-Romagna earthquake, 2012) and municipalities outside the crater which submitted funds' requests to regional reconstruction offices,[78] respectively. Results are in line with our main estimates, and the positive and significant coefficient measuring earthquake's impacts on employees confirms the upturn among municipalities with low turnover rates and experiencing very light damage (MMI<6). In Panel C, we restrict the sample of control units to municipalities having the same seismic classification as our treated group. By doing so, we compare treated municipalities to those with comparable earthquake exposure risk, considering differences in the expectation of the occurrence of a natural disaster (Hazlett and Mildenberger, 2020; Cerqua et al., 2023) and possible civic capital differentials (Buonanno et al., 2023). Despite we do not observe significant point estimates for municipalities with MMI<6, results for municipalities experiencing

[78] See https://sisma2016data.it/report-page/ for a comprehensive list of municipalities that applied for reconstruction funds.

higher levels of damage are in line with our main findings.[79] We also check if distance to the earthquake's crater matters. Following the approach implemented by Masiero and Santarossa (2021) and Cerqua et al. (2023), we narrow down control units to municipalities closest to the crater, i.e. municipalities belonging to regions within 200, 300, 400, and 500 kilometers from the epicenter of the Central Italy earthquake. Panels D, E, F, and G in table 3.A.2 in Appendix 3 confirm that our results are unaffected by the dissimilarity of more distant regions. Lastly, we check if high turnover is linked to lower economic activity levels, independent of the earthquake. We collected turnover-rate data for units not affected by the earthquake,[80] and then restricted the control group to units whose pre-earthquake turnover rates match those of the treated municipalities. Reassuringly, Panel H of Table 3.A.2 in Appendix 3 shows results consistent with our main estimates.

Another relevant issue regards that alternative inference approaches may yield different results. We tackle this problem running a placebo procedure to estimate the variance of our point estimates and implementing a non-parametric generalization of the difference-in-differences developed by Imai et al. (2023) as alternative estimator. Panel B in table 3.A.3 in Appendix 3 shows our SDID estimates with placebo standard errors. This approach consists of excluding treated units and then randomly assign the same treatment structure to control units as a placebo treatment. Before running our estimates, we exclude from the analysis those municipalities hit by other

[79] We repeat the estimation procedure combining panel A, B, and C of table 3.A.2, i.e. by excluding control units with a different seismic classification than treated units, municipalities hit by other quakes, and municipalities outside the crater that asked for reconstruction funds, at the same time. Results are in line with our main estimates also in this case.

[80] In doing so, we exclude from the control group 155 municipalities due to missing data in turnover rates.

earthquakes, as assigning fake treatment to these municipalities could bias our results. Again, placebo inference is in line with our core findings. Panel A in the same table reports our main estimates excluding covariates. Performing the SDID estimator with unit and time weights alone, without conditioning on covariates, returns close estimates to our main results, underlining the relevance of pre-treatment outcome history in our setting.

We also check the validity of our results implementing as alternative methodology a non-parametric matching DID estimator (Imai et al., 2023). Following Cerqua et al. (2023), we limit the matched set of each treated unit to those units with the same seismic risk and excluding control units affected by other earthquakes. Then, we further refine our matched set using the Mahalanobis distance between treated and control units, computed using our time-varying covariates and outcome history. We match each treated unit with the five most similar units according to Mahalanobis distance. Results reported in Tables 3.7 and 3.8 are in line with our main estimates. Given that the ATT is reported for each post-treatment year, we observe that municipalities characterized by high turnover and with MMI values higher than 5 suffer the effect of the earthquake more persistently over time, consistently with estimates reported in tables 3.5 and 3.6.

Table 3.7. Alternative estimators (active enterprises)

Panel Match estimator - Imai et al. (2023)						
Active enterprises (log)	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
	-0.016	-0.029**	-	-	-	-0.124**
T (2016)			0.057***	0.071***	0.122***	
	(0.016)	(0.013)	(0.015)	(0.024)	(0.038)	(0.052)
	0.003	-0.015	-0.025	-0.049**	-0.096**	-
T+1						0.146***
	(0.017)	(0.014)	(0.016)	(0.022)	(0.040)	(0.039)
T+2	0.023	0.018	0.009	-0.046**	-0.031	-0.075*
	(0.018)	(0.016)	(0.014)	(0.024)	(0.054)	(0.039)
T+3	0.026	0.026	-0.015	-0.005	-0.010	-0.056
	(0.023)	(0.019)	(0.022)	(0.023)	(0.052)	(0.046)
T+4	0.039**	0.039**	0.005	-0.024	0.046	0.014
	(0.019)	(0.018)	(0.030)	(0.033)	(0.045)	(0.033)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 3.8. Alternative estimators (employees)

Panel Match estimator - Imai et al. (2023)						
Employees (log)	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
	0.010	-0.033	-0.030**	-0.062**	-	-
T (2016)					0.100***	0.139***
	(0.024)	(0.027)	(0.016)	(0.024)	(0.028)	(0.048)
	-0.015	-0.019	-0.007	-0.060**	-0.124**	-
T+1						0.215***
	(0.027)	(0.031)	(0.019)	(0.033)	(0.063)	(0.057)
T+2	0.028	0.015	0.031	-0.044	-0.048	-0.131**
	(0.028)	(0.025)	(0.026)	(0.038)	(0.083)	(0.056)
T+3	0.036	0.004	0.030	0.002	-0.063	-0.039
	(0.036)	(0.029)	(0.026)	(0.050)	(0.094)	(0.061)
T+4	0.043	0.039	0.034	0.029	0.079	0.062
	(0.029)	(0.031)	(0.032)	(0.045)	(0.064)	(0.061)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Another possible concern regards the arbitrariness and subjectivity through which we split our sample of treated units. We repeat our estimation procedure considering different MMI thresholds and levels of low/high turnover. Panel A in table 3.A.4 in Appendix 3 shows the estimates excluding the 10% of treated units just below/above the median for each MMI group. If excluding these units drastically changes our results, low and high turnover would not be the right mediating factor we should account for. Reassuringly, estimates in Panel A of table 3.A.4 show the same pattern as our main results.

We also check the distribution of our metric measuring turnover rates. Although SDID estimations are not biased by unit-level shifts (Clarke et al., 2024), many outliers could drive our findings, biasing our results. Figure 3.A.1 in Appendix 3 shows the box plot of our measure of turnover for municipalities with MMI>5. Overall, there is only one outlier – the municipality of Capitignano - beyond the maximum score of turnover. We exclude that outliers can play a role in conditioning our estimates.

Although our treated municipalities are grouped into three classes consistently with a precise damage pattern according to their MMI levels, we also perform estimations with treated municipalities divided by different MMI thresholds. In this way, we rule out that our results are driven by the arbitrariness of our groups' specifications. Panel C in table 3.A.4 in Appendix 3 reports the results for different MMI thresholds, i.e. MMI = 6 to 8, MMI = 5 to 8, MMI > 5, and MMI > 6. Once again, all these results are consistent with the idea that municipalities characterized by higher turnover levels suffer the most the effect of the earthquake on their enterprises, in line with our main estimates. We also repeat the estimation by excluding from the treated group 14 municipalities hit by both L'Aquila 2009 earthquake and the Central Italy earthquake. Panel B in table 3.A.4 in Appendix 3 confirms the robustness of our main results also in this case. Lastly, two factors could potentially invalidate our analysis. First, while the SDID estimator includes time fixed-effects to control for common shocks in each year, we repeat our estimation by excluding our last post-treatment year (2020), as the Covid19 pandemic could have heterogeneously impacted the economic activity of different jurisdictions. Estimates reported in table 3.A.4, panel D, in Appendix 3 are in line with our main results. Second, the slow recovery of municipal economic activity could have influenced public employee turnover, endogenously generating our main results. We address this concern by showing that: i) the trend of the average annual municipal turnover rate of municipalities hit by the earthquake mimics the overall trend of our entire sample, and ii) our results do not change if we split the sample with respect to pre-earthquake levels of turnover rates. Concerning point i), table 3.A.5 in Appendix 3 shows that there is a general increase of turnover over time, and this trend is observable despite the earthquake's occurrence in a municipality. Even more importantly, Panel E of table 3.A.4 in Appendix 3 shows that when we split the sample by pre-disaster turnover rates results fully align with our main estimates.[81]

3.6. Alternative mechanisms and possible confounding factors

In this section, we explore and rule out alternative mechanisms that could introduce bias into our results, as other confounding factors beyond turnover levels might influence the recovery phase following a natural disaster.

[81] We compute pre-earthquake turnover rates mirroring the metric that measures post-disaster turnover, i.e., by averaging the rates of turnover of the years 2012 (T-4) to 2015 (T-1).

One potential confounding factor can be represented by the distribution of damage levels among sub-groups. For instance, when dividing treated municipalities with MMI > 7 according to their turnover rates, there is a possibility that all municipalities with highest levels of damage could be grouped into the high turnover category, thereby affecting our results (for example, all the municipalities that experienced total destruction could be grouped in the high turnover group of municipalities, biasing our estimates). Table 3.A.6 in Appendix 3 shows the share of municipalities in each sub-group that experienced a certain level of damage according to the MMI scale (MMI > 5). The table does not reveal any noteworthy disparities in the distribution of damage levels among sub-groups.

Another possible confounding factor in our setting can be represented by regional disparities. As detailed in section 3.2, the earthquake impacted municipalities located in four neighboring regions: Abruzzo, Lazio, Marche, and Umbria. During the recovery phase, the emergency commissioner received support by four *ad-hoc* reconstruction offices, one for each region. Other than municipal turnover, these regional offices could have contributed to the variation in recovery speed and dynamics, thereby influencing regional recovery differences. In table 3.A.7 in Appendix 3, we show that municipalities in our sub-groups are evenly distributed across regions, with the highest share for municipalities located in the Marche region across all sub-groups. It seems unlikely that regional variations, other than turnover, are hidden mediating factors in recovery.

An additional concern regards the political context and its attributes (Mulligan et al., 2019; Cohen and Werker, 2008). In our setting, possible hidden confounding factors could be represented by local electoral discontinuity after the earthquake (i.e., change in the mayor and the local council) and local political alignment with superior levels of government. High turnover and low turnover groups could have differing proportions of municipalities that experienced electoral discontinuity, expressed by the election of new mayors and local councils during the recovery phase. Although technicians, administrative staff, and public employees may not be affected by administrative changes, this factor could represent a relevant issue in managing the emergency phase and reconstruction funds due to transfer of power during emergency times. We check the number of municipalities in low and high turnover groups that in the year of the quake or just after it, i.e. in the time span 2016-2018, experienced electoral discontinuity.[82] In general, the number is low for both groups (14 municipalities in the low turnover group and 10 in the high turnover group) and there are no relevant differences or patterns between sub-groups (refer to Table 3.A.8 Appendix 3).

Local political alignment with regional or national governments might also introduce bias in favor of municipalities aligned with the political stance of superior levels of governance. In our sample of treated municipalities, just two of them are administered by the same political party of the central or regional government (Macerata and Narni).[83] We can exclude political alignment as a potential confounding factor.

[82] Data about local electoral results are publicly available on the website of the Italian ministry of the Interior (https://elezioni.interno.gov.it/)

[83] An important role in the Italian local elections is played by the so-called Local lists (*Liste Civiche*). These lists do not have a precise political orientation but can be defined as ad hoc parties that pursue and represent local goals and wishes (Cerqua and Zampollo, 2023). Many candidates, mainly in small cities or villages, as in our sample of treated municipalities, are supported only by a Lista Civica.

Another relevant concern regards the pre-treatment composition of the economic fabric in our treated municipalities. Municipalities experiencing earthquake damage could recover better or worse than others because of their economic specialization. For example, certain industries, such as manufacturing, might be disproportionately affected compared to jobs that can be conducted remotely. If low and high turnover groups exhibit substantial disparities in terms of pre-treatment economic specialization, this factor could drive recovery variations other than turnover itself. In Table 3.A.9 in Appendix 3, considering only municipalities that experienced consistent damage, we report the average shares of the five most prominent economic sectors in the year just before the earthquake for municipalities with MMI values higher than 5 divided by turnover rates.[84] The most notable difference is for the sector of accommodation and food service activities (sector I), accounting for 9.5% of enterprises in low turnover municipalities, and for the 17.9% in high turnover municipalities. To rule out that recovery differentials are driven by a different pre-treatment composition of the economic fabric, we repeat our analysis using the share of enterprises in the economic sector of accommodation and food service activities as additional covariate and excluding enterprises in this sector from the analysis.

Using the share of enterprises in sector I as covariate in the SDID estimation procedure is appropriate because covariate adjustment in this setting is a pre-processing task that removes the impact of the low/high share of enterprises in sector I (i.e., accounting for different sectoral shares) on our outcome variables, prior to calculating the

[84] In order to divide economic activities in economic sectors we follow the 2-digits ATECO-2007 classification provided by the Italian Institute of Statistics (ISTAT). See https://www.istat.it/en/archivio/17959 for more information about the classification.

synthetic control (Clarke et al., 2024). In other words, including the share of business premises of sector I as an additional covariate allows us to rule out the effect of low/high share of enterprises in sector I as a first step, then calculating our effect of interest.[85] Results reported in Table 3.A.10 in Appendix 3 closely align with our main results. We also perform the estimation excluding from the analysis business activities belonging to sector I, i.e. computing the total number of active enterprises and employees without considering sector I. Also in this case, results in Table 3.A.11 in Appendix 3 shows a consistent pattern with our main estimates, ruling out that the prior composition of the economic fabric has a role in generating recovery differentials.

3.7. Conclusions

The identification of possible local mediating factors speeding up or slowing down economic recovery after a disaster is a complex endeavor. Leveraging the exogeneity linked to earthquake occurrences, we assess local recovery differentials in the aftermath of the 2016-2017 Central Italy earthquake implementing the Synthetic Difference-in-Differences estimator. Our study extends the disaster recovery literature beyond traditional national-level analyses, delving into the nuanced dynamics at the municipal level. We emphasize the pivotal role of local administrative capacity in the post-disaster recovery process, underscoring the significance of stable local administrative teams. Low rates of public employee turnover help mitigating losses

[85] Given the positive correlation between a higher share of businesses in sector I and higher public-employee turnover (see Table 3.A.9 in Appendix 3), splitting the sample by low/high sector-I shares would likely reproduce our main estimates but would not reassure us that pre-existing sectoral composition is not a confounding factor.

of jobs and in the number of active enterprises during the post-disaster short to medium term. Our findings acknowledge the relevance of task-specific human capital at the local level to foster economic recovery.

While we provide robust results after performing several robustness checks and ruling out potential 'hidden' confounding factors, our study has some limitations. Although we are able to grasp aggregated dynamics of the economic landscape, we lack information regarding companies' economic performance (production, investments, and productivity). Secondly, accessing firm-level data would allow us to precisely account for entrepreneurial rates. This supplementary data could represent a value-added to corroborate our findings and deepening the answer to our research question. Third, our analysis would benefit from additional data on the performance, pre-entry experience, and expertise of local civil servants. We believe that access to this information would open promising and relevant directions for future research. Fourth, beyond the economic dimension, successful post-disaster recovery hinges on social cohesion (Aldrich, 2012) and timely reconstruction of buildings (Hornbeck and Keniston, 2017). Examining these dimensions more closely would strengthen the study.

Our study enriches the disaster recovery literature by shedding light on the importance of administrative factors and specific human capital at the municipal level. These findings hold implications for policy formulation and disaster management strategies that aim to enhance local socio-economic resilience and facilitate swifter recovery in the aftermath of seismic events. Looking ahead, the insights from this research can contribute to more targeted and effective interventions that bolster the socio-economic fabric of communities affected by earthquakes. Specifically, we argue that preserving and augmenting municipal administrative human capital should be treated as a core resilience instrument, and targeted measures should include (i) stabilizing and retaining experienced technical staff (e.g., converting time-limited reconstruction contracts into permanent posts; using retention incentives where legally admissible), which recent Italian provisions for the 2016 earthquake explicitly supported; (ii) codifying procedures and investing in modular disaster-response training and standardized command protocols to protect institutional memory and shorten learning curves; and (iii) pooling scarce expertise through inter-municipal cooperation and, where appropriate, shared reconstruction offices that centralize technical capacity for clusters of small municipalities. These instruments are most urgent for smaller jurisdictions - where capacity constraints are binding. Further research could delve into the specific mechanisms through which administrative stability translates into post-disaster economic revival, as well as on the plausibly differential impact of disasters on jurisdictions with similar level of specific human capital but different socio-demographic characteristics. Additionally, exploring the transferability of these findings to different disaster contexts and regions could amplify their impact.

References – Chapter 3

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Appendix 3

Table 3.A.1. Impact of the earthquake on active enterprises and employees - exclusion of municipalities hit by L'Aquila and Emilia-Romagna earthquake

	Entire crater	MMI <6	MMI = 6 or 7	MMI > 7
Active enterprises (log)	-0.015**	0.014	-0.028**	-0.073***
	(0.006)	(0.011)	(0.013)	(0.019)
Employees (log)	-0.005	0.016	-0.003	-0.065**
	(0.009)	(0.016)	(0.016)	(0.030)

Notes: ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 3.A.2. Sample restriction - alternative samples of control units

	MMI < 6		MMI = 6 or 7		MMI > 7	
Panel A: Exclusion of municipalities hit by other earthquakes						
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.021**	-0.001	-0.006	-0.045**	-0.061*	-0.082***
	(0.010)	(0.012)	(0.013)	(0.018)	(0.033)	(0.021)
Employees (log)	0.031*	0.001	0.014	-0.014	-0.037	-0.091***
	(0.017)	(0.021)	(0.016)	(0.024)	(0.057)	(0.029)
Panel B: Exclusion of municipalities outside the crater requesting reconstruction's funds						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.020**	-0.002	-0.008	-0.046***	-0.061*	-0.084***
	(0.009)	(0.012)	(0.015)	(0.016)	(0.032)	(0.030)
Employees (log)	0.030*	-0.001	0.012	-0.014	-0.036	-0.091***
	(0016)	(0.023)	(0.014)	(0.025)	(0.044)	(0.026)
Panel C: Equal seismic risk						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.006	-0.007	-0.011	-0.050***	-0.062*	-0.087***
	(0.011)	(0.014)	(0.013)	(0.014)	(0.033)	(0.031)
Employees (log)	0.019	-0.001	0.011	-0.014	-0.040	-0.087***
	(0.016)	(0.022)	(0.015)	(0.027)	(0.043)	(0.034)
Panel D: Regions < 200km						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.023**	0.001	-0.004	-0.050**	-0.066*	-0.085***
	(0.012)	(0.014)	(0.016)	(0.020)	(0.039)	(0.023)
Employees (log)	0.022	0.010	0.016	-0.011	-0.032	-0.083***
	(0.020)	(0.022)	(0.018)	(0.028)	(0.059)	(0.035)
Panel E: Regions <300km						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.010	-0.008	-0.012	-0.055***	-0.070**	-0.091***
	(0.011)	(0.014)	(0.016)	(0.020)	(0.030)	(0.029)
Employees (log)	0.010	-0.001	0.008	-0.018	-0.042	-0.089***
	(0.020)	(0.021)	(0.017)	(0.032)	(0.046)	(0.033)
Panel F: Regions <400km						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.012	-0.005	-0.010	-0.052***	-0.066*	-0.088***
	(0.011)	(0.010)	(0.012)	(0.015)	(0.039)	(0.026)
Employees (log)	0.013	-0.001	0.009	-0.016	-0.041	-0.089***
	(0.016)	(0.021)	(0.015)	(0.027)	(0.060)	(0.034)
Panel G: Regions <500km						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.012	-0.004	-0.011	-0.045***	-0.058	-0.090***
	(0.013)	(0.011)	(0.011)	(0.016)	(0.044)	(0.025)
Employees (log)	0.012	-0.002	0.007	-0.024	-0.044	-0.096***
	(0.016)	(0.020)	(0.012)	(0.028)	(0.061)	(0.033)
Panel H: Control groups with the same level of Turnover of treated group						
	MMI<6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.019*	-0.002	-0.011	-0.053***	-0.062**	-0.092***
	(0.011)	(0.011)	(0.014)	(0.019)	(0.029)	(0.024)

Employees (log)	0.026 (0.020)	-0.007 (0.017)	0.011 (0.014)	-0.020 (0.029)	-0.043 (0.047)	-0.098*** (0.031)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 3.A.3. Alternative inference

Panel A: No covariates						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.020*	-0.003	-0.007	-0.046***	-0.061*	-0.086***
	(0.011)	(0.014)	(0.014)	(0.016)	(0.033)	(0.026)
Employees (log)	0.030	0.001	0.013	-0.015	-0.038	-0.090***
	(0.021)	(0.022)	(0.017)	(0.029)	(0.055)	(0.027)
Panel B: Placebo						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.021	-0.001	-0.006	-0.045***	-0.061**	-0.082***
	(0.014)	(0.014)	(0.017)	(0.016)	(0.026)	(0.025)
Employees (log)	0.031	0.001	0.014	-0.014	-0.036	-0.091**
	(0.023)	(0.023)	(0.024)	(0.024)	(0.040)	(0.040)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Standard errors (Block-bootstrapped in Panel A; Placebo in Panel B) are reported in parentheses.

Table 3.A.4. Arbitrariness - Different thresholds and specifications

Panel A: Drop of observations just below/above the median						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.019*	-0.001	-0.007	-0.042*	-0.060	-0.080***
	(0.010)	(0.014)	(0.016)	(0.023)	(0.041)	(0.030)
Employees (log)	0.022	-0.001	0.014	-0.002	-0.038	-0.069***
	(0.017)	(0.024)	(0.016)	(0.032)	(0.057)	(0.022)
Panel B: Exclusion of municipalities hit by both L'Aquila and Central Italy earthquake						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.022**	-0.001	-0.006	-0.052**	-0.060*	-0.083**
	(0.011)	(0.010)	(0.014)	(0.023)	(0.033)	(0.032)
Employees (log)	0.029	0.011	0.015	-0.001	-0.036	-0.079**
	(0.018)	(0.017)	(0.017)	(0.037)	(0.054)	(0.036)
Panel C: Different MMI thresholds						
	MMI = 6 to 8		MMI = 5 to 8		MMI > 5	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	-0.024**	-0.054***	-0.011	-0.015*	-0.031**	-0.047***
	(0.012)	(0.013)	(0.010)	(0.008)	(0.013)	(0.012)
Employees (log)	-0.001	-0.023	0.008	0.001	-0.010	-0.022
	(0.015)	(0.021)	(0.011)	(0.009)	(0.018)	(0.014)
	MMI > 6					
	Low turnover	High turnover				
Active enterprises (log)	-0.044**	-0.073***				
	(0.022)	(0.018)				
Employees (log)	-0.042	-0.052*				
	(0.030)	(0.030)				
Panel D: Exclusion of 2020 due to the Covid19 outbreak						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.015	-0.007	-0.011	-0.047***	-0.079**	-0.104***
	(0.011)	(0.014)	(0.011)	(0.015)	(0.035)	(0.029)
Employees (log)	0.023	-0.006	0.009	-0.029	-0.067	-0.123***
	(0.021)	(0.021)	(0.015)	(0.028)	(0.058)	(0.029)
Panel E: Split by pre-treatment levels of turnover						
	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	0.026***	-0.010	-0.017	-0.037*	-0.014	-0.118***
	(0.010)	(0.011)	(0.011)	(0.021)	(0.023)	(0.033)
Employees (log)	0.003	0.022	0.012	-0.012	-0.022	-0.098**
	(0.012)	(0.024)	(0.023)	(0.026)	(0.036)	(0.048)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Figure 3.A.1. Public employee turnover rate distribution (MMI>5)

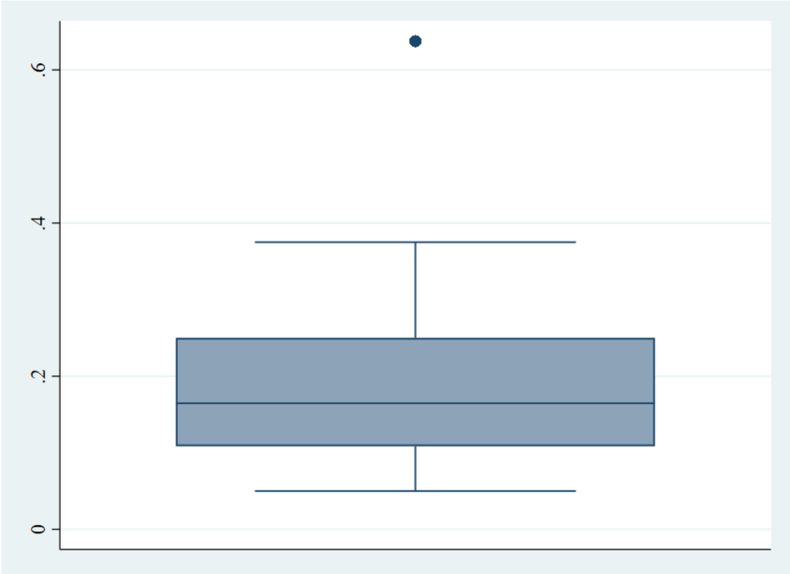


Table 3.A.5. Average annual turnover rate

	Entire sample	Municipalities in the earthquake's crater
2012	0.086	0.086
(T-4)	(0.135)	(0.122)
2013	0.062	0.073
(T-3)	(0.124)	(0.151)
2014	0.081	0.088
(T-2)	(0.142)	(0.168)
2015	0.087	0.100
(T-1)	(0.147)	(0.147)
2017	0.136	0.134
(T+1)	(0.183)	(0.251)
2018	0.162	0.207
(T+2)	(0.191)	(0.281)
2019	0.215	0.242
(T+3)	(0.228)	(0.242)
2020	0.224	0.212
(T+4)	(0.234)	(0.259)

Notes: Standard deviations are reported in parentheses.

Table 3.A.6. Damage levels' distribution

	MMI = 6 or 7			MMI > 7	
MMI	Low turnover	High turnover	MMI	Low turnover	High turnover
6	82.6%	79.2%	8	58.4%	66.7%
	(19)	(19)		(7)	(8)
7	17.4%	20.8%	9	25%	8.3%
	(4)	(5)		(3)	(1)
			10	8.3%	16.7%
				(1)	(2)
			11	8.3%	8.3%
				(1)	(1)

Notes: The table reports the share of municipalities in each sub-group according to their level of damage. The exact number of municipalities is reported in parentheses.

Table 3.A.7. Regions of belonging

Region	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Abruzzi	9.1%	18.2%	17.4%	29.2%	_	25.0%
	(3)	(6)	(4)	(7)		(3)
Lazio	24.2%	9.1%	_	8.3%	16.7%	_
	(8)	(3)		(2)	(2)	
Marche	51.5%	63.6%	69.6%	54.2%	66.6%	66.7%
	(17)	(21)	(16)	(13)	(8)	(8)
Umbria	15.2%	9.1%	13.0%	8.3%	16.7%	8.3%
	(5)	(3)	(3)	(2)	(2)	(1)

Notes: The table reports the share of municipalities in each sub-group according to municipalities' regions of belonging. The exact number of municipalities for each region is reported in parentheses.

Table 3.A.8. Local electoral discontinuity

	MMI < 6		MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover	Low turnover	High turnover
Electoral discontinuity	15.1%	12.1%	26.1%	8.3%	25.0%	33.3%
	(5)	(4)	(6)	(2)	(3)	(4)
Electoral continuity	84.9%	87.9%	73.9%	91.7%	75.0%	66.7%
	(28)	(29)	(17)	(22)	(9)	(8)

Notes: The table reports the share of municipalities in each sub-group experiencing electoral discontinuity/continuity, considering elections from 2016 to 2018 with respect to past electoral results. The exact number of municipalities is reported in parentheses.

Table 3.A.9. Composition of the productive fabric

	Low turnover	**High turnover**
Economic sectors; MMI > 5	Active Enterprises	Active enterprises
C. Manufacturing activities	11.6%	11.2%
F. Constructions	16.7%	20.2%
G. Wholesale and retail	25.4%	22.5%
I. Accomodation and food service acitivites	**9.5%**	**17.9%**
M. Professional, scientific, and technical activites	11.5%	8.6%
Total	74.7%	80.4%

Notes: The table reports the average share of economic activities for the five most represented economic sectors for municipalities with low and high turnover rates. Most striking differences are reported in bold.

Table 3.A.10. SDID estimator with share of economic activities in sector I (accommodation and food service activities) as additional covariate

	MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	-0.007	-0.047***	-0.061*	-0.087***
	(0.014)	(0.017)	(0.036)	(0.027)
Employees (log)	0.014	-0.014	-0.036	-0.091***
	(0.017)	(0.029)	(0.054)	(0.028)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Table 3.A.11. Exclusion of business activities and employees belonging to sector I

	MMI = 6 or 7		MMI > 7	
	Low turnover	High turnover	Low turnover	High turnover
Active enterprises (log)	-0.004	-0.036*	-0.056*	-0.067***
	(0.013)	(0.020)	(0.031)	(0.017)
Employees (log)	0.012	-0.028	-0.028	-0.083***
	(0.014)	(0.029)	(0.043)	(0.028)

Notes: Treated municipalities are split according to their within-group position above or below the median value of our metrics of interest, creating two sub-group of equal numerosity. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Block-bootstrapped standard errors are reported in parentheses.

Chapter 4. Post-disaster regional institutional quality and geographical mobility

Abstract

We investigate whether regional institutional quality influences post-disaster population flows. Exploiting the occurrence of the Irpinia earthquake – which struck at the border of the Italian regions of Campania and Basilicata, characterised by starkly different institutional quality – we are able to isolate the effect of regional governance on migration patterns within a counterfactual framework, using a novel municipal dataset on population flows over an extended time span. We find no effect on net migration flows, yet the composition of those flows changes markedly. Higher regional quality and denser civic networks reduce out-migration of incumbents. Complementary evidence from municipal industrial censuses and a synthetic-control analysis at the regional level reveals a stronger rebound in value added per worker and GDP per capita where regional institutional quality is higher, suggesting that higher in-migration in places with lower institutional quality is a result of a demand surge mechanism, without benefits for the local economy. Taken together, high-quality local institutions and social capital can dampen both push and pull migration forces while supporting economic recovery.

Keywords: regional institutional quality; migration flows; post-disaster management; non-parametric difference-in-differences.

JEL codes: H11; H12; J24; O1.

4.1. Introduction

Disasters caused by natural hazards are among the most pervasive shocks to local economies (UNDRR, 2025). Their economic and demographic repercussions are expected to intensify as climate change amplifies both the frequency and severity of extreme events (IPCC, 2023). A large body of comparative literature documents that their consequences are mediated by the quality of the surrounding economic and political environment (Strömberg, 2007). For instance, cross-country evidence shows that richer and better-governed nations suffer dramatically fewer fatalities and economic loss after comparable shocks (Kahn, 2005; Toya and Skidmore, 2007; Cevik and Tovar Jalles, 2025), and that catastrophic events depress long-run economic growth where governance weaknesses impede reconstruction (Cavallo et al., 2013).

The sizable heterogeneity that exists within national borders has received far less systematic attention, even though the locus of post disaster recovery and service delivery is typically sub national. In this context, we still know little about whether post-disaster sub-national institutional quality shapes population flows and, if so, through which margins of mobility (in-flows, out-flows, or both). Household post-disaster location choices are highly sensitive to the quality and speed of service restoration, as well as to perceived safety (Deryugina et al., 2018), and historical evidence showed that the dominant adjustment margin to catastrophic shocks can be migration – via both retention failures and diverted in-flows – with durable economic consequences for places (Hornbeck, 2012). While there is quite unanimous evidence on the positive relationship between local institutional quality and in-migration (see, for example, Banzhaf and Walsh, 2008; Ketterer and Rodríguez-Pose, 2015), the influence of local formal and informal institutions on migration flows after a disaster is not straightforward. On one side, efficient delivery of local public services decreases the opportunity-cost of staying (Mustafa et al., 2022). On the other side, discretionary processes prolong demand surge (Olsen and Porter, 2011) and capacity shortfalls, attracting itinerant rebuilding labour (GAO, 2022; Kim and Shahandashti, 2022). Local social capital can also have a role in post-disaster migration patterns, interacting with formal institutions.[86]

In this paper, we exploit the discontinuity at the border in sub-national institutional quality after the occurrence of an earthquake on November 23, 1980, known as the Irpinia earthquake, that simultaneously hit two adjacent NUTS-2 regions located in southern Italy – Campania and Basilicata –, to study municipal migration flows. Campania and Basilicata experienced similar physical damage but starkly different post-disaster regional governance. Whereas Campania's reconstruction became synonymous with rent seeking and mafia infiltration, Basilicata distinguished itself in civic capital ranking for unusually high administrative capacity and community engagement (Leonardi et al., 1987; Putnam et al., 1993), as well as more transparent spending and strategic investments. By leveraging a newly digitised panel dataset spanning from 1958 to 2000 on municipal population flows, we exploit this unique empirical setting to isolate the effect of post-earthquake sub-national institutional quality within a counterfactual framework.

We find that post-earthquake regional institutional quality does not alter municipal net migration flows, but it does reshape its composition. Specifically, Basilicata's citizens are less likely to leave, while potential in-migrants are simultaneously deterred. Our results bring out a mechanism in which effective public administration and dense civic networks lower the opportunity-cost of remaining for insiders while discretionary processes prolong

[86] See Section 4.3 for a comprehensive literature review on this subject.

demand surge (Olsen and Porter, 2011), acting as a catalyst for non-local supply of labour (GAO, 2022; Kim and Shahandashti, 2022). Consistently with this finding, we provide complementary evidence that Basilicata's regional economy and productivity rebound more strongly with respect to Campania, highlighting within-country and within-disaster heterogenous recovery paths due to local institutional quality.

In the next section, we discuss the main findings of the literature on local institutional quality, social capital, and migration flows, with specific reference to the post-disaster setting. In Section 4.3, we provide details about our case study, the Irpinia earthquake, as well as on the different levels of regional institutional quality of Campania and Basilicata. Section 4.4 details the data and the identification strategy. We present our results in Section 4.5. Section 4.6 concludes.

4.2. Literature review and conceptual framework

The literature widely discusses the relationship between institutions and migration flows. In this paper, we are focusing on this subject from a sub-national perspective and within a specific framework – the post-disaster setting. We first present a selection of literature on the general relationship between local institutional quality, social capital and geographical mobility, then narrowing the focus on what concerns the post-disaster setting.

4.2.1. Institutions and migration flows

A large body of work treats migration as a response to spatial differences in economic opportunity, amenities, and institutions, highlighting the mediating role of local social structures. Seminal contributions emphasize the interplay of formal rules and community norms in shaping local development paths (Storper, 2005; Rodríguez-Pose and Storper, 2006). Recent empirical evidence shows how these channels are in place at the sub-national level, affecting the composition of net migration flows through both the inflow and outflow margins.

Local institutional shortcomings often increase out-migration. Nifo and Vecchione (2014) show that low levels of local institutional quality – with specific reference to the rule of law and the effectiveness of regional policies – incentivise the outflow of skilled migrants. In parallel, direct evidence that higher local quality of government attracts and retains human capital further supports the composition channel: high-quality institutions attract and retain skilled residents (Ariu et al., 2016), regions with better governance experience stronger 'voting with one's feet' (Banzhaf and Walsh, 2008; Tiebout, 1956), and additional evidence shows that high-skill movers select higher-quality jurisdictions (Ketterer and Rodríguez-Pose, 2015).

Emigration has been shown to be amplified by local formal rules, such as the deterioration in public order (Cullen and Levitt, 1999) and weak environmental enforcement (Li, 2023). On the contrary, formal rules that raise entry costs select in-migrants. For example, tighter constraints dampen in-flows and contribute to favour higher-income and higher-skill entrants, slowering spatial convergence (Ganong and Shoag, 2017; Hsieh and Moretti, 2019).

Social capital interacts with these institutional forces. Bridging ties across places reduce search and integration costs, creating multi-lateral migration flows (Bailey et al., 2018). Granular evidence shows that stronger intercommunity bridging is associated with more internal mobility and migration flows (Lőrincz and Németh, 2022). By contrast, local embeddedness and bonding ties lower the propensity to emigrate at the individual level (Hotchkiss and Rupasingha, 2021) and may retain relatively lower-skill residents more strongly, shifting the skill mix of net flows (D'Ingiullo et al., 2023). Overall, local social capital prevents geographical mobility (David et al., 2010).

4.2.2. Institutions and post-disaster migration flows

A growing strand of literature analyses disaster-induced migration. Using US county to county flows in the 1920s–30s, Boustan et al. (2012) find that young men moved away from tornado-prone but are attracted from flood-stricken areas. They find a possible explanation – but not testing it – for differential migration responses by disaster type in public investment in rebuilding and protecting flood-prone areas. Hornbeck (2012) demonstrates that Dust Bowl erosion triggered large, persistent out-migration and land use shifts, with limited local adjustment even decades later. Extending the evidence to the full 20th century, Boustan et al. (2020) show that severe disasters raise county level out-migration by roughly 1.5 percentage points. At the same time, recovery may influence return migration of former residents. Return migration has been found to be the primary force behind changes in the socio-economic and ethnic composition after a disaster, confirming targeted in-flows of workers linked to pre-existing systems of ties, rather than generalised attraction of new outsiders (Groen and Polivka, 2010).

Sub-national institutions shape this pattern in various ways. First, where regional and local governments are more capable – such as through efficient delivery of public services – residents face lower expected losses from staying, so exit declines. Studies for European regions demonstrate that higher quality of government improves resilience and accelerates recovery after adverse shocks (Ezcurra and Rios, 2019; Rios and Gianmoena, 2020), and post-disaster evidence shows that timely public aid reduces migration, lowering the opportunity-cost of staying (Mustafa et al., 2022), while weaker and fragmented recovery increases displacement (Comerio, 2014). Second, the way through which local institutions manage the reconstruction process can influence migration patterns. Large disasters generate demand surge (Olsen and Porter, 2011) – reconstruction demand exceeding local capacity and higher cost to repair building damage – attracting non-resident workers motivated by the possibility of increasing their earnings (Belasen and Polachek, 2008; 2009; Sisk and Bankston, 2014). Delayed or discretionary processes, associated with lower institutional quality, prolong demand surge and capacity shortfalls, sustaining conditions that attract itinerant rebuilding labour (GAO, 2022; Kim and Shahandashti, 2022). Third, local social capital interacts with formal rules. While bridging ties can channel return migration along pre-existing corridors (Curtis et al., 2015), bonding ties act as informal insurance for residents, lowering their search and reintegration costs and increasing overall satisfaction for the management of the post-disaster phase, thus curbing out-migration (Aldrich, 2011; 2012; Aldrich and Meyer, 2015; Nakagawa and Shaw, 2004). The same dense local networks can raise outsiders' entry costs if they do not have local ties (Aldrich and Crook, 2008; Beckham et al., 2023).

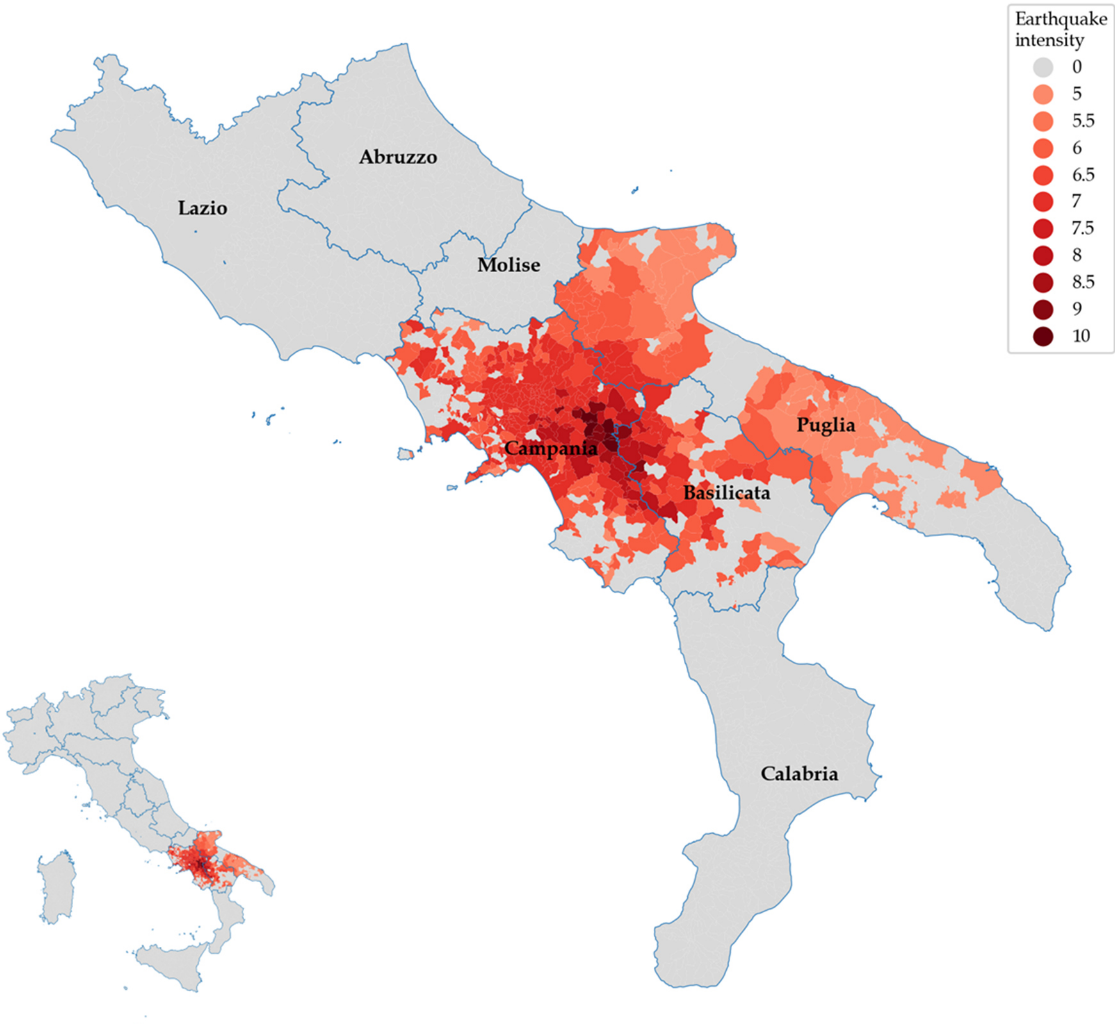
4.3. Earthquakes and regional institutional quality differentials

4.3.1. The Irpinia Earthquake

On November 23, 1980, an earthquake of magnitude 6.81 Mw occurred in southern Italy. The earthquake's epicenter was located at the intersection of the municipalities of Teora, Conza della Campania, and Castelnuovo di Conza, located in the NUTS-2 region of Campania, near the regional border with Basilicata. That earthquake, known as the Irpinia earthquake, was the most disruptive seismic event occurred in Italy in the last 100 years in terms of loss of human lives, property assets, economic activity, and cultural heritage.

According to the Italian National Institute of Geophysics and Vulcanology, it caused 2,735 casualties and more than 9,000 injured people. 687 municipalities – approximately 8.5% of the total number of Italian municipalities – were hit by the earthquake, 37 of which were classified as 'devastated' and 314 as 'severely damaged' (Guidoboni et al., 2018; 2019). Figure 4.1 shows the geographical distribution of the intensity of the earthquake at the municipal level, measured through the Mercalli-Cancani-Sieberg (MCS) macro seismic scale. The MCS scale was developed by Sieberg (1930), who merged its own macro seismic scale with the Mercalli (1902) and Cancani (1904) ones. It is composed of 12 grades, in ascending order of severity. The first degree refers to earthquakes that are detected only by instruments. Degrees from the second to the fifth describe how much people felt the shake and potential effects on household objects, without registering any structural damage. Degrees from the sixth to the twelfth describe effects on buildings and the natural environment. The highest intensity registered for the Irpinia earthquake was ten, corresponding to the total destruction of 75% of municipal buildings. Figure 4.A.1 in Appendix 4.A shows a picture of the municipality of Conza della Campania, hit with an intensity equal to ten, just after the earthquake.

Figure 4.1. The Irpinia earthquake



Notes: Earthquake intensity is measured through the MCS macro seismic scale (Sieberg, 1930).

The most affected areas, located in the inland regions of the southern Apennines, were peripheral towns with high emigration rates (De Lucia et al. 2020), where economic activity was limited to agriculture and small businesses (Guidoboni and Valensise, 2011). Table 4.1 shows the damage distribution by region. Municipalities located in Campania and Basilicata registered the highest damage due to the earthquake.

Table 4.1. Municipal damage distribution by NUTS-2 region

	Campania (541 municipalities)	**Basilicata** (127 municipalities)	**Puglia** (252 municipalities)
Earthquake intensity (MCS scale)			
0	166	66	140
5	10	6	61
5.5	2	1	5
6	97	22	35
6.5	18	5	1
7	198	18	10
7.5	3	0	0
8	30	7	0
8.5	4	0	0
9	7	2	0
10	6	0	0

In the immediate aftermath of the earthquake there was a severe lack of coordination among emergency rescue teams. In the municipality of San Gregorio Magno – heavily damaged by the quake – the first aids arrived three days after the event. Two days after the event, the central government was unable to provide the full list of hit municipalities (Guidoboni et al., 2018). Seven months after the event, the central government issued the law 219/1981, providing guidelines and funds to deal with the reconstruction process.[87] The law includeded four types of interventions: i) reconstruction of the housing stock, ii) reconstitution of the productive fabric, iii) promotion of small and medium-sized enterprises to be located in the crater area, and iv) implementation of a public housing program in Naples. Regional governments together with an emergency manager were

[87] The text of the law (in Italian) is accessible at the following link: https://www.gazzettaufficiale.it/eli/id/1981/05/18/081U0219/sg.

appointed to coordinate municipal requests for funds.[88] The reconstruction process was marred by significant mafia infiltration and embezzlement of funds. Nine years after the earthquake, a parliamentary inquiry chaired by MP Scalfaro - alongside the well-known '*Mani Pulite*' investigation, which in Irpinia was dubbed '*Mani sul Terremoto*' - uncovered issues of discretionary power, public money mismanagement, and bribery.[89]. To cite a few examples, the parliamentary commission found that the number of yacht owners in Avellino - a NUTS-3 region in Campania - increased from 4 to 100, and that the football stadium in San Gregorio Magno, a town of 3,000 inhabitants, cost more than the stadium in Naples would have during the same period.

4.3.2. The Basilicata Case

In 1970, on the eve of the regional elections, Basilicata was described as the "subsidized region," the "tail light of Italy," the "stagnant region," and the "reservoir of Italy's labor force" (Leonardi et al., 1987). The establishment of the regional government and its gradual acquisition of governing and legislative autonomy transformed both the political image and the administrative reality of the regional authority in Basilicata. In particular, from the late 1970s and throughout the post-earthquake reconstruction period, what Leonardi et al. (1987) termed the 'Basilicata case' began to unfold. Their analysis was part of a broader research project, which culminated in the renowned study by Putnam, Leonardi, and Nanetti (1993), *Making Democracy Work*. In this work, the research team developed, among other things, a composite index measuring and comparing regional institutional

[88] See Section 4.3.2 for a detailed description of the duties and the actual contribution of the regional government during the reconstruction phase.

[89] See https://www.senato.it/legislature/10/leggi-e-documenti/attivita-non-legislative/documenti-non-legislativi?documentoId=30412 to access the full text of the parliamentary inquiry (in Italian), and https://www.theguardian.com/world/2016/aug/28/italy-earthquake-mafia-construction-contracts

performance between 1978 and 1985.[90] The index - based on a data collection and elaboration effort spanning over twenty years - consists of 12 indicators evaluating, for each regional government, policy processes, policy pronouncements, and policy implementation. Figure 4.2 graphically represents the structure of the index, while Appendix 4.B provides an in-depth description of all included indicators.

Figure 4.2. Structure of the index of regional institutional performance (Putnam et al., 1993)

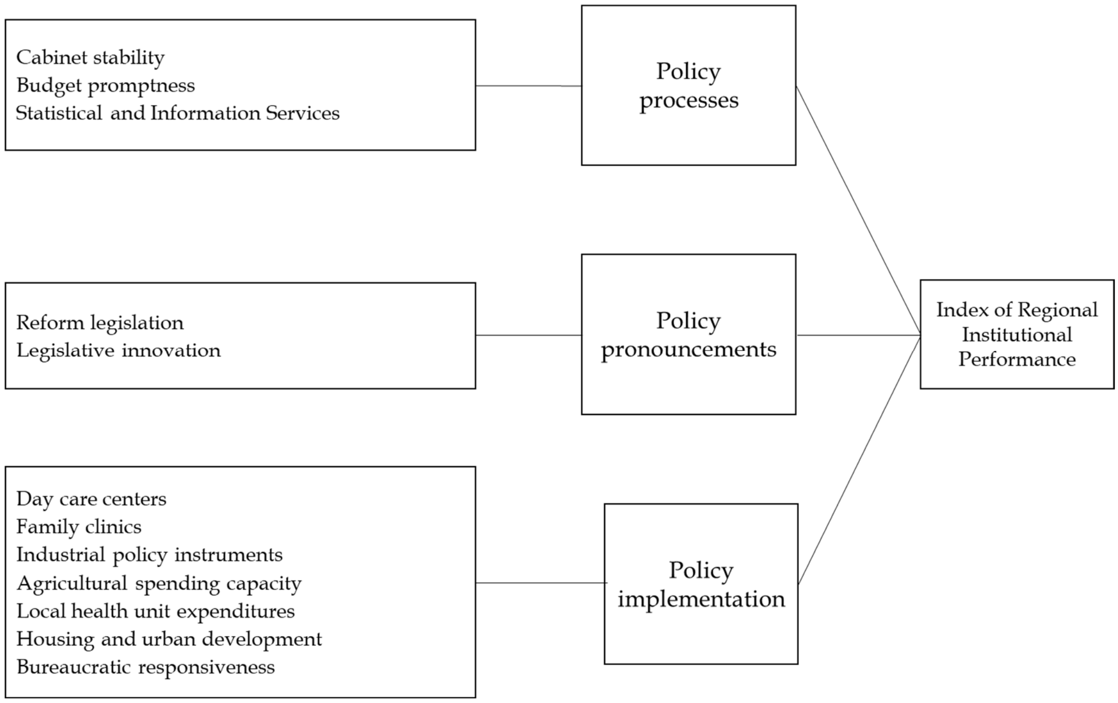


Figure 4.3 shows the composite index's regional rankings. Basilicata's institutional performance placed the region at a significantly higher level than would have been expected given its highly disadvantaged socioeconomic context, civic culture, and social stability

[90] The research encompassed seven different studies: Five rounds of surveys and interviews with regional councilors and observers (i.e., journalists, mayors, provincial presidents, industrialists, regional officials, political leaders) of the regional authority; Three mass surveys of the population in various regions, conducted using a national sample; Case studies on political and institutional matters to gain deeper insight into the regional political reality; Content analysis of regional legislation; Case studies on regional planning activities; A study using an experimental approach on the response of regional bureaucracies to citizens; A correspondence survey of observers.

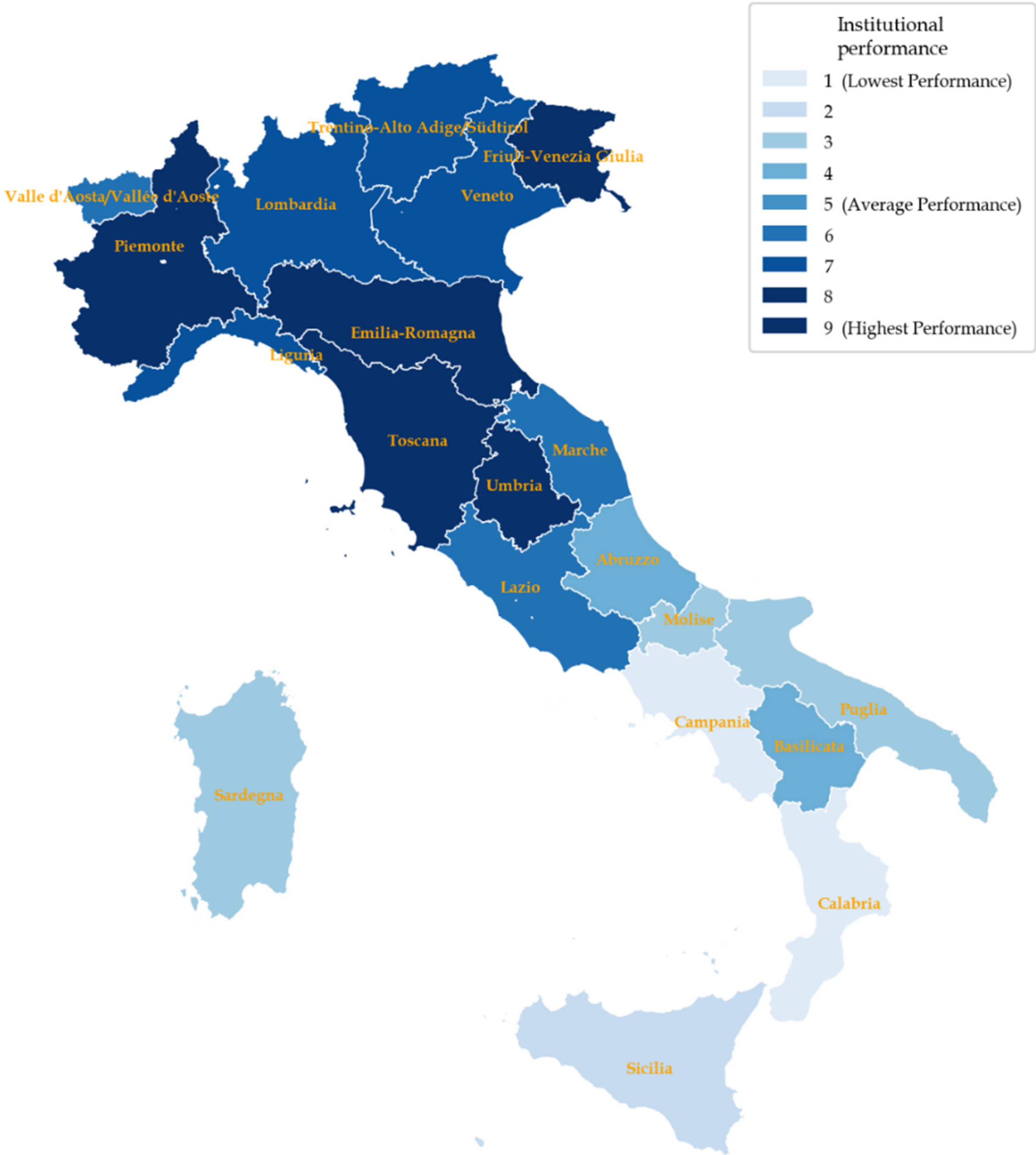
(Leonardi et al., 1987). In other words, among all Italian regions, Basilicata most clearly stood out as an overachiever relative to its physical, human, and cultural resources. This suggests that the 'region effect' was disproportionately strong.

The post-earthquake reconstruction phase, following the 1980 Irpinia earthquake, contributed to the consolidation of a regional identity, both externally and locally (Leonardi et al., 1987). Externally, Basilicata sought to limit the central state's control over the reconstruction process. Government Law 219/1981 adopted an approach that was almost the opposite of the one taken in response to the 1976 Friuli earthquake, where the regional government had legislated directly to manage the reconstruction.[91] Although both Campania and Basilicata were initially deemed incapable of managing post-earthquake resources, annual government audits revealed stark differences between the two regions and demonstrated Basilicata's superior legislative and implementation capacity. Internally, the region attempted to reclaim the decision-making powers that the national reconstruction law had removed by playing an active role in protecting and promoting local entrepreneurs' interests and in providing technical support to municipalities. Basilicata adopted a development model defined by Leonardi et al. (1987) as community-based, endogenous, small-scale, and integrated, which was clearly reflected in the region's policy interventions. More broadly, internal factors such as the affirmation of regional autonomy, deep roots in the local community, constructive relations with local authorities, decision-making capacity, consensus-building, and the gradual depolarization of the political landscape

[91] See https://www.consiglio.regione.fvg.it/cms/export/sites/consiglio/pagine/4/pubblicazioni/Pubblicazioni-allegati/Legislazione-regionale-ricostruzione-post-terremoto-1976-2000.pdf (in italian).

enabled Basilicata to achieve relatively high institutional performance and quality, especially when compared to its structural disadvantages.

Figure 4.3. Institutional performance in the Italian regions, 1978-1985



4.4. Data and Method

4.4.1 Data

The ideal setting to answer our research question would require data on population flows and economic activity at the municipal level over a long time span. We combine data from several data sources, including an original dataset on annual population dynamics for all Italian municipalities spanning from 1958 to 2000 (Ascani et al., 2025). This panel dataset has been created by complementing data from 1971 onwards, provided by the Italian National Institute of Statistics (ISTAT), with a rigorous digitization effort of documents reporting information on the number births, deaths, newly registered citizens (in-flows), and cancellations from the population registry (out-flows) for each municipality-year observation from 1958 to 1970. Specifically, once per year, each municipal administrative office had to fill in a form with information on the total population change resulting from both natural population change and net migration flows. ISTAT was responsible for collecting these documents, then organizing them into a book. Figures 4.A.2 and 4.A.3 in Appendix 4.A report the template that each municipality had to fill in and a sample page of ISTAT books, respectively.[92]

Data on economic activity have been collected from municipal industry and employment censuses. Specifically, ISTAT provides data on the number of business premises and employees on a ten-year basis, starting from 1951 onwards.[93] We collect these data up to 2001.

[92] Books reporting yearly municipal population change can be accessed from the Italian National Institute of Statistics digital library (https://ebiblio.istat.it/SebinaOpac/.do).
[93] These data are accessible at the following link: https://ebiblio.istat.it/SebinaOpac/resource/i-censimenti-delle-attivita-produttive-dal-1951-al-1991-dati-comunali/IST0012219.

Last, earthquake data are drawn from the Italian National Institute of Geophysics and Vulcanology (INGV).[94] INGV provides macroseismic data points registering the locality and the macroseismic intensity of each earthquake, as well as physical damages and the level at which it has been felt by people (Rovida et al., 2022). For each municipality, we have data on the damage caused by the earthquake measured by the MCS scale (see Section 4.3.1).

In order to estimate the effect of regional institutional quality and performance on post-earthquake population dynamics, we restrict the sample only to those municipalities in the NUTS-2 regions hit by the Irpinia earthquake, Campania and Basilicata (see next Section of a detailed description of our identification strategy). While some municipalities in the NUTS-2 region of Puglia were hit by the earthquake (see Section 4.3.1), we excluded those municipalities from the analysis as they did not report any extensive damage, and our identification strategy exploits different levels of regional institutional performance in Campania and Basilicata.[95]

Table 4.2 provides municipal descriptive statistics by region. Municipalities in Campania are, on average, larger in terms of population and with and higher number of enterprises and employees. The average net migration flow is negative for municipalities located both in Campania and Basilicata.

[94] Data on the Irpinia earthquake, including the full list of municipalities hit by the earthquake and the reported damage are available at the following link: https://ebiblio.istat.it/SebinaOpac/resource/i-censimenti-delle-attivita-produttive-dal-1951-al-1991-dati-comunali/IST0012219.
[95] See Section 4.4.2 for a detailed description of our identification and empirical strategy.

Table 4.2. Descriptive Statistics

	Campania (541 municipalities)		Basilicata (127 municipalities)	
Variable	**Mean**	**St. deviation**	**Mean**	**St. deviation**
Population	9,957.3	52,110.5	4,905.9	7,408.3
N° of births	178.5	976.6	78.6	126.4
N° of deaths	81.7	471.1	42.1	50.7
Inflows	231.0	715.4	88.6	183.7
Outflows	254.4	1,028.0	124.3	170.8
Net Migration Flows (Inflows – Outflows)	-23.3	478.3	-35.6	94.4
N° of business premises	382.6	2,095.4	215.1	394.2
N° of employees	1,443.4	11,081.7	672.7	2,072.1
Earthquake intensity	4.7	3.2	3.1	3.33

4.4.2. Method

Our goal is to estimate the effect of higher levels of post-earthquake regional institutional quality and performance on population dynamics. As extensively discussed in Section 4.3.2, Basilicata has higher institutional quality than the vast majority of regions located in Southern Italy, including Campania (see Figure 4.3 in Section 4.3.2). Leonardi et al. (1987) provide an in-depth description of the virtuous post-earthquake management of the regional council of Basilicata, despite the narrow autonomy granted by the central government. The occurrence of the Irpinia earthquake at the regional border of Campania and Basilicata allows us to exploit higher/lower regional institutional performance to isolate its effect on net migration flows.

In order to estimate our effect of interest, we adopt a non-parametric generalization of the Difference-in-Differences (DiD) estimator developed by Imai et al. (2023). This method introduces a matching approach tailored for time-series cross-sectional data, i.e. panel data of geographical data, providing a flexible framework to estimate both short- and long-term average treatment effects on the treated (ATT), even with a limited number of pre-treatment time periods. For each unit (municipality) $i = 1, \dots, N$ and year $t = 1958, \dots, 2000$, we observe our outcome variable of interest — net migration flows — Y_{it}, a vector of time-varying covariates Z_{it}, a vector of time-invariant characteristics V_i, and a treatment dummy variable X_{it}, taking the value of one if a municipality located in Basilicata is hit by the Irpinia earthquake. The treatment status is assigned from 1980 onwards, i.e., from the year of the occurrence of the earthquake municipalities remain treated up to the last year of analysis. We assign the treatment status only to Basilicata municipalities hit by the earthquake as we want to isolate the effect of post-disaster regional institutional performance on our outcome of interest. Specifically, for each treated unit, we build a counterfactual unit having the very same characteristics in terms of damage due to the earthquake, pre-treatment levels of economic activity and population dynamics, drawing from the sample of Campania municipalities. In doing so, conditioning on observables, the treated and counterfactual units differ only for their levels of regional institutional quality.

We set ten pre-treatment periods (lags, L, from 1970 to 1979) and twenty-one post-treatment periods (leads, F, from 1980 to 2000). Following Imai et al. (2023), we estimate the ATT as follows:

$$\delta(F, L) = E\{Y_{i,t+F}\left(X_{it} = 1, X_{i,t-1} = 0, \{X_{i,t-l}\}_{l=2}^{L}\right) - Y_{i,t+F}(X_{it} = 0, X_{i,t-1} = 0, \{X_{i,t-l}\}_{l=2}^{L} | X_{it} = 1, X_{i,t-1} = 0\} \quad (4.1)$$

where $Y_{i,t+F}\left(X_{it}=1, X_{i,t-1}=0, \{X_{i,t-l}\}_{l=2}^{L}\right)$ is the potential outcome in the case of treatment and $Y_{i,t+F}(X_{it}=0, X_{i,t-1}=0, \{X_{i,t-l}\}_{l=2}^{L})$ is the potential outcome in the absence of treatment. $\{X_{i,t-l}\}_{l=2}^{L}$ represents the realized history.[96] Applying this methodology involves four stages:

1. For each treated unit, we apply a matching method to create a matched set, M_{it}, of control units based on the vector of time-invariant characteristics V_i. Specifically, we perform an exact matching with respect to earthquake intensity and pre-earthquake economic activity, i.e., number of business premises and number of employees. To measure economic activity, we take the nearest pre-treatment time point to the year of the occurrence of the earthquake in which we observe the number of enterprises and employees – 1971 – and we divide these variables in groups.[97] We restrict the matched set only to those control units belonging to the same group of economic activity that experienced the same damage due to the earthquake.
2. We refine each matched set M_{it} by computing the Mahalanobis distance between the treated unit and control units in the matched set with respect to the vector of time-varying covariates Z_{it} pre-treatment time points and the outcome history. In particular, we calculate the standardized distance between treated and control units on total population and net migration flows and then we average it over the ten pre-treatment time points considered. This refinement method allows us to account for

[96] For example, δ(7,10) represents the average causal effect of post-earthquake regional institutional quality on the outcome, seven years after the treatment, while assuming that the potential outcome depends on the treatment history up to ten years earlier.

[97] The variable registering the number of business premises per municipality i has been divided into six groups: municipalities with less than 11 enterprises (i < 10); 9 < i < 50; 49 < i < 150; 149 < i < 300; 299 < i < 1000; 999 < i < 3000; i > 2999. The variable reporting the number of employees per municipality i has been divided into seven groups: municipalities with less than 10 employees; 9 < i < 50; 49 < i < 150; 149 < i < 500; 499 < i < 1000; 999 < i < 3000; i > 2999.

past outcomes and time-varying covariates without relying on strict parametric assumptions. The algorithm matches each treated unit with the 5 most similar control units based on the Mahalanobis distance, assigning equal weight to each unit in the refined matched set.

3. After refining the matched set, we estimate the counterfactual post-treatment outcome for each treated unit by calculating the weighted average of the control units in the refined matched set.
4. Last, we implement the DiD estimator to calculate the treatment effect for each treated unit by computing the difference between the actual and counterfactual changes in outcomes. Following equation 1, we then derive the ATT by averaging the treatment effect across all treated observations. More formally, we compute the ATT as follows:

$$\hat{\delta}(F,L) = \frac{1}{\sum_{i=1}^{N}\sum_{t=L+1}^{T-F} D_{i,t}} \sum_{i=1}^{N}\sum_{t=L+1}^{T-F} D_{i,t} \left\{ \left(Y_{i,T+F} - Y_{i,T-1}\right) - \sum_{i' \in M_i} \omega_{it}^{i'} \left(Y_{i',T+F} - Y_{i',T-1}\right) \right\} \quad (4.2)$$

where $\omega_{it}^{i'}$ denotes the non-negative normalized weight such that $\omega_{it}^{i'} \geq 0$ and $\sum_{i' \in M_i} \omega_{it}^{i'} = 1$.

We opted for an evaluation method explicitly accounting for pre-treatment trend differences in covariates and not relying on parametric assumptions. This method relies on three identifying assumptions – absence of interference; absence of carryover effects; parallel trends assumption –, milder than those of many common methods, such as the linear regression with fixed effects, the standard DiD estimator and the parametric DiD with multiple time periods estimators (Imai et al., 2023; Chiu et al., 2024; Xu, 2024). The absence of interference assumption among the treated and control municipalities (Cox, 1958) is plausible in our context as is unlikely that post-earthquake management of the Basilicata regional council would affect jurisdictions located in Campania. The assumption about absence of carryover effects is satisfied as post-earthquake institutional performance is in place just after the treatment. Last, considering ten pre-treatment years enhances the credibility of the parallel trend assumption after conditioning on outcome history. Furthermore, as demonstrated in Section 4.4 there are no pre-treatment imbalances in outcome trends. This empirical setting could be handled with alternative methodologies, such as a geographical difference-in-discontinuity approach (Grembi et al., 2016; Eggers et al. 2018). The clear advantage of our empirical strategy stands on building a refined matched set of control units, explicitly taking into account an exact matching on earthquake damage, allowing us to isolate the effect of post-disaster regional institutional quality.

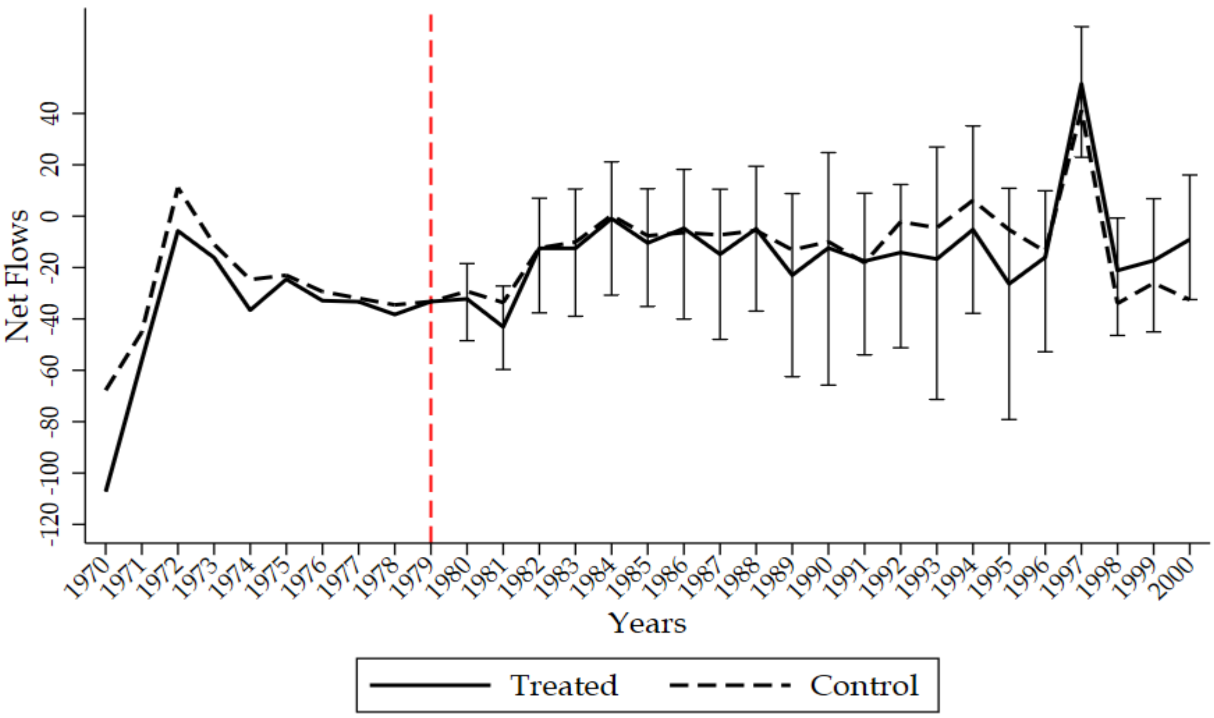
4.5. Results

Figure 4.4 illustrates the pre- and post-treatment evolution for both treated and control municipalities – after the matching DiD procedure – for migration flows. We consider as treated those municipalities located in the Basilicata region experiencing the earthquake with an intensity of six or more, according to the MCS intensity scale.[98] The vertical black bars represent 95% confidence intervals for the average effect of post-earthquake regional institutional quality on net migration flows in each post-treatment time point. Confidence intervals are computed using a block-bootstrap procedure built for matching analysis in time-series cross-sectional settings (Otsu and Rai, 2017), where each municipality is a block. In other words, the bootstrap resampling to estimate standard errors is performed for each

[98] See Section 2 for detailed information on the Irpinia earthquake and its damage.

treated municipality at a time. The graphical representation presented in Figure 4.4 follows the approach outlined by Cattaneo et al. (2025).

Figure 4.4. Impact of post-disaster regional institutional quality on migration flows



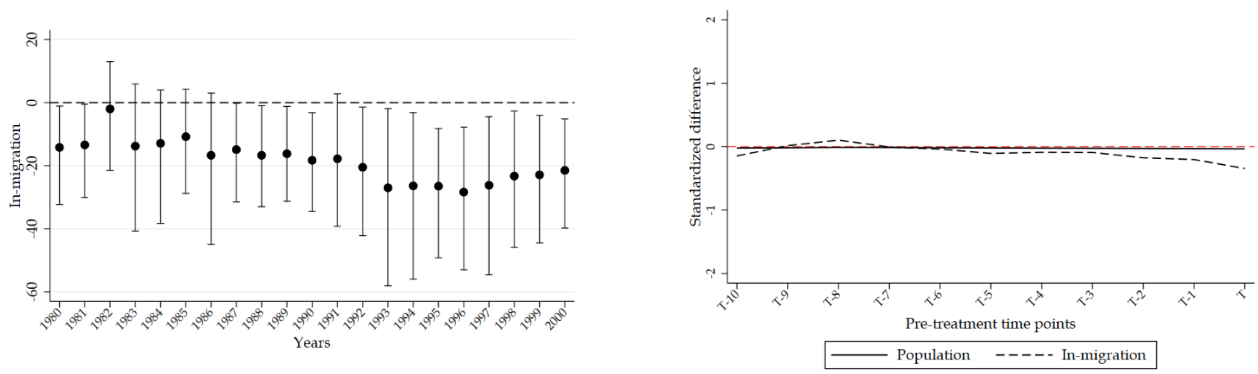
Notes: The vertical black bars report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

Overall, higher regional institutional quality after the Irpinia earthquake does not have any effect on net migration flows. The outcome difference between municipalities located in Basilicata and Campania is statistically negligible in almost all the twenty post-treatment years. The absence of any effect on average municipal migration flows is still in place when restricting the treated and control groups only to those municipalities with the highest degree of damage, as reported in Figure 4.A.4 in the Appendix.

We run separate estimations for the two components of migration flows - i.e., in-migration and out-migration - to inspect any difference in municipal in-flows and out-flows between treated and control units.[99] Figures 4.5 and 4.6 graphically show results for in-migration and out-migration, respectively. Each figure represents point estimates and confidence intervals for all the post-treatment time points (Panel a), and the covariate balancing (Panel b), i.e., the pre-treatment standardized mean difference between treated and control municipalities, allowing us to test the plausibility of the parallel trends assumption. Specifically, figures 4.5(a) and 4.6(a) show the results of the same empirical strategy detailed in section 4.4.2, using as separate outcomes in-migration and out-migration. Considering that treated units are municipalities in the earthquake crater located in Basilicata and control units are matched control municipalities in Campania, the goal of these estimations is to isolate the effect of regional institutional quality on post-disaster inflows (figure 4.5 – a) and outflows (figure 4.6 – a).

Figure 4.5. Impact of post-disaster regional institutional quality on in-migration

(a) Post-treatment point estimates (b) Covariate balancing

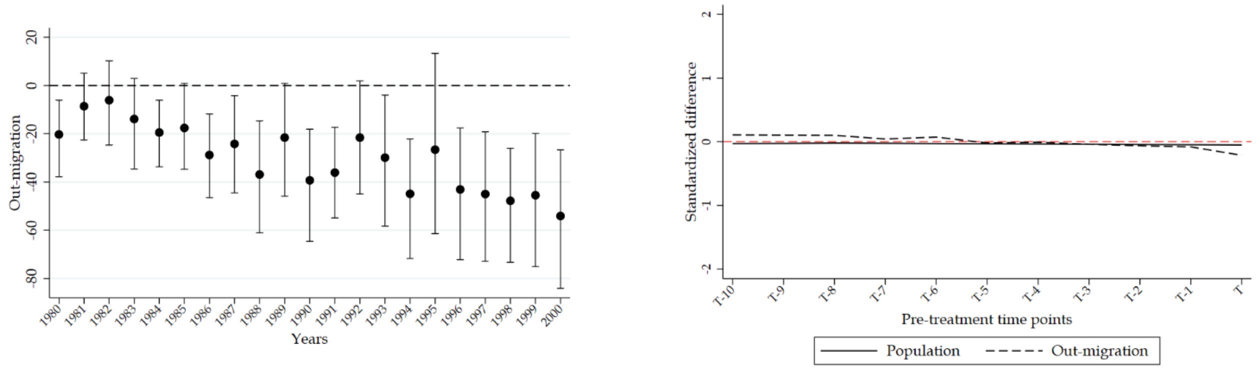


Notes: The vertical black bars in Panel (a) report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

[99] Following our main empirical strategy, for each treated unit we restrict the matched set of control units only to those municipalities located in Campania belonging to the same group of economic activity that experienced the same damage due to the earthquake. We further refine the matched set by computing the standardized distance between treated and control units on total population and the outcome (In-migration and out-migration).

Figure 4.6. Impact of post-disaster regional institutional quality on out-migration

(a) Post-treatment point estimates (b) Covariate balancing



Notes: The vertical black bars in Panel (a) report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

The balancing remains fully within the (-1, 1) range of standardized mean differences across the ten pre-treatment time points in both Panel b of Figures 4.5 and 4.6. The imbalance level for the lagged values of our dependent variables remains consistent throughout the pre-treatment period, supporting the plausibility of the parallel trends assumption for the proposed estimator. As clearly shown in Figures 4.5 and 4.6, the absence of any average treatment effect on the treated for net migration flows is the result of a combination of negative effects both for in- and out-migration. Specifically, starting from four years after the earthquake onwards, higher regional institutional quality induces Basilicata citizens located in municipalities hit by the earthquake to out-migrate less as compared to their counterfactual. On the contrary, there is less in-migration – although the effect is less pronounces –, leading to null effects in net migration flows. To clearly show how the composition of migration flows changes, we report the post-treatment point estimates for net flows, in-migration, and out-migration together in Figure 4.A.5 in Appendix 4.A. Although the composition of migration flows changes, as there is a statistically significant decrease in both registrations and cancellations, their difference does not result in a significant change in net flows.

These patterns are consistent with the idea that more capable local governments decrease the opportunity-cost of staying for Basilicata residents (Mustafa et al., 2022), while weaker and fragmented recovery increase displacement of Campania citizens, generating persistent demand surge that attract non-resident workers (Belasen and Polachek, 2008; 2009; Comerio, 2014). At the same time, higher civic capital in Basilicata with respect to Campania (Putnam et al., 1993) and bonding ties act as informal insurance for residents, lowering their search and reintegration costs and increasing overall satisfaction for the management of the post-disaster phase, thus curbing out-migration (Aldrich, 2011; 2012; Aldrich and Meyer, 2015; Nakagawa and Shaw, 2004).

We further inspect whether the demand surge can be the main driver of this pattern by analysing local economic activity dynamics. By doing so, we are able to understand if anectdotal evidence on Campania's delayed and discretionary processes translates into worse economic recovery and possible in-migration of non-resident workers. First, we replicate our empirical strategy using our dataset measuring local economic activity.[100] Specifically, we set three lags (1951 to 1971) and three leads (1981 to 2001)[101] and, for each treated unit, we perform an exact matching based on earthquake intensity and population in 1971, i.e. the first time point just before the treatment.[102] We then refine each matched set based on the outcome history. We consider as treated those municipalities located in the

[100] See Section 3.1.
[101] Recall that data on local economic activity are census data, available on a ten-year basis from 1951.
[102] Municipalities have been divided into seven groups according to their population: municipalities with less than 1000 inhabitants (i < 1000); 999 < i < 3000; 2999 < i < 5000; 4999 < i < 10000; 9999 < i < 30000; 29999 < i < 70000; i > 69999.

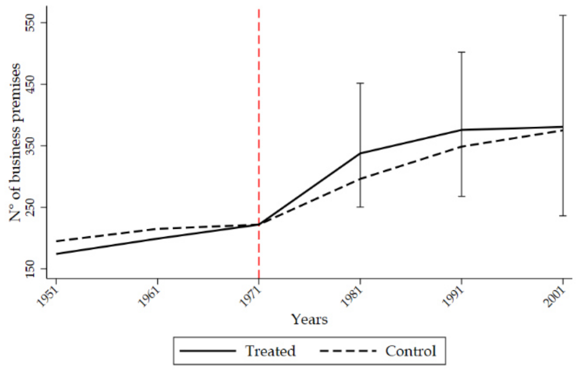
Basilicata region experiencing the earthquake with an intensity of six or more, and we run three separate estimations using as outcomes the total number of business premises, the total number of employees, and the average number of employees per enterprise.[103]

Figure 4.7 shows the impact of regional institutional performance on local economic activity, measured through the number of municipal business premises (Panel a), the number of municipal employees (Panel b), and the average number of employees per firm (Panel c). Point estimates for the number of business premises and employees are positive but not statistically significant, while the average number of employees per firm reports statistically significant results at the 90% level from 1991 onwards. The labour-market census, albeit noisy, yields point estimates that align with the importance of regional institutional quality for a better recovery.

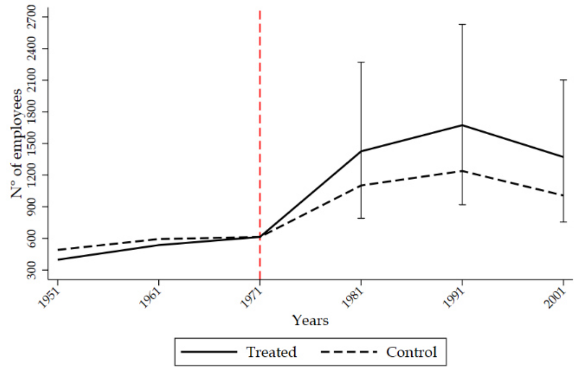
[103] When testing the effect of post-earthquake regional institutional quality on the average number of employees per business premise, we refine the matched set based on the outcome history and the total number of business premises.

Figure 4.7. Impact of post-disaster regional institutional quality on local economic activity

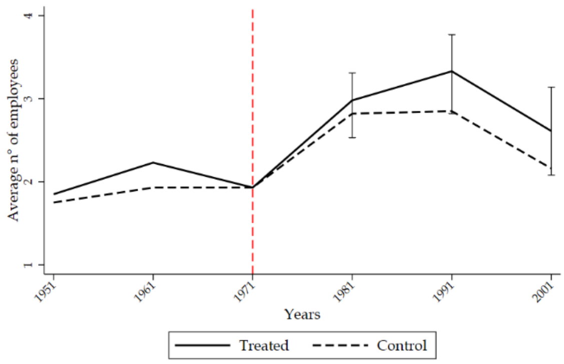
(a) Number of business premises



(b) Number of employees



(c) Average number of employees per enterprise



Notes: The vertical black bars in Panel (a) report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

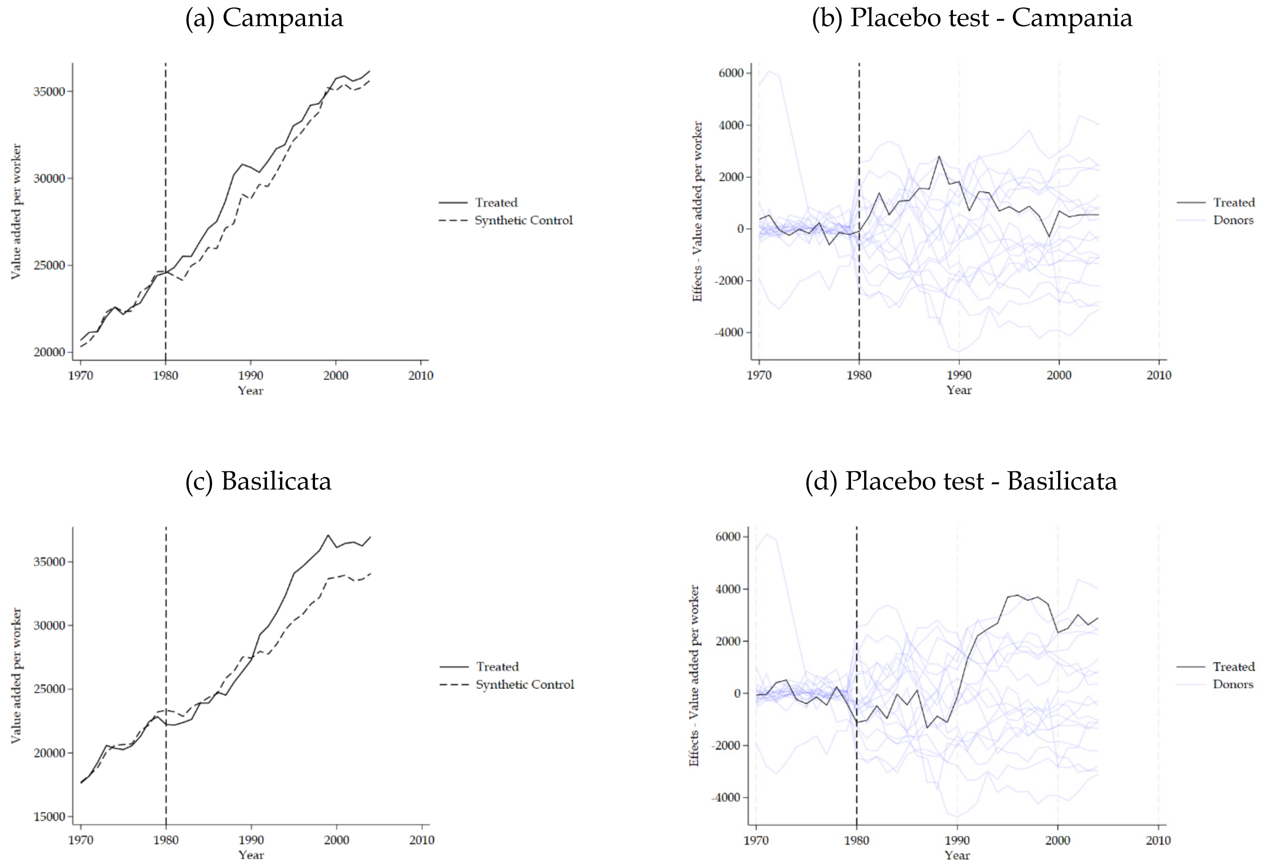
Despite their geographical granularity, census data does not contain any information on productivity measures at the firm or municipal level. This information would allow us to test if post-disaster sub-national institutional quality plays a prominent role in the actual recovery of the area hit by the disaster. We partially tackle this issue by estimating the effect of the earthquake on the NUTS-2 regional GDP per capita and value added per employee. Specifically, we replicate the empirical exercise conducted by Barone and Mocetti (2014), but we analyse our outcome of interest separately for Campania and Basilicata. Using the synthetic control method (Abadie and Gardeazabal, 2003; Abadie et al., 2010), we compare actual regional productivity figures to a synthetic counterfactual trajectory depicting what productivity would have been in the absence of the 1980 Irpinia earthquake. In this framework, we cannot isolate post-earthquake regional institutional quality as the treatment; instead, our treatment is the occurrence of the Irpinia earthquake in 1980. We collect annual data at the NUTS-2 regional level from the CRENOS database (https://crenos.unica.it/crenos/) for the timespan 1970 to 2004.[104] These data include GDP, labour units, population, and total value added.[105] Weights to build the synthetic control are chosen to minimize a penalty function – given by the mean square prediction error (MSPE) – depending on pre-treatment outcome patterns. The MSPE is minimized over the pre-treatment period 1970-1979.

Figure 4.8 shows the effect of the earthquake on the value added per worker for both Campania (Panel a) and Basilicata (Panel c). When running the estimation for Campania, we exclude Basilicata from the donor pool, and vice versa. The pre-treatment trend of the outcome variable mostly overlaps with the synthetic control for both Campania and Basilicata, underscoring the credibility of the synthetic control as a counterfactual estimator. Campania and Basilicata have quite different post-earthquake value added per worker dynamics. Concerning Campania, in the aftermath of the earthquake there is a divergent (positive) trend with respect to the counterfactual, while from 1995 onwards the positive effect of the earthquake on value added per worker starts decreasing, becoming negligible. Basilicata experiences no effect in the short-run; nevertheless, starting from 1990, the value added per worker positively diverges with respect to its synthetic control. In Panels b and d of Figure 4.8 we assign fake treatment to all other regions and running the synthetic

[104] Regional data does not allow us to distinguish between municipal earthquake intensity. However, the majority of jurisdictions have been hit by the quake, both in Campania and Basilicata.
[105] GDP and value added are calculated at constant 1995 euro-equivalent prices.

control method as a placebo test. Overall, results in Figure 4.8 indicate a negligible effect on value added per worker in the long-run for Campania and a positive effect for Basilicata.

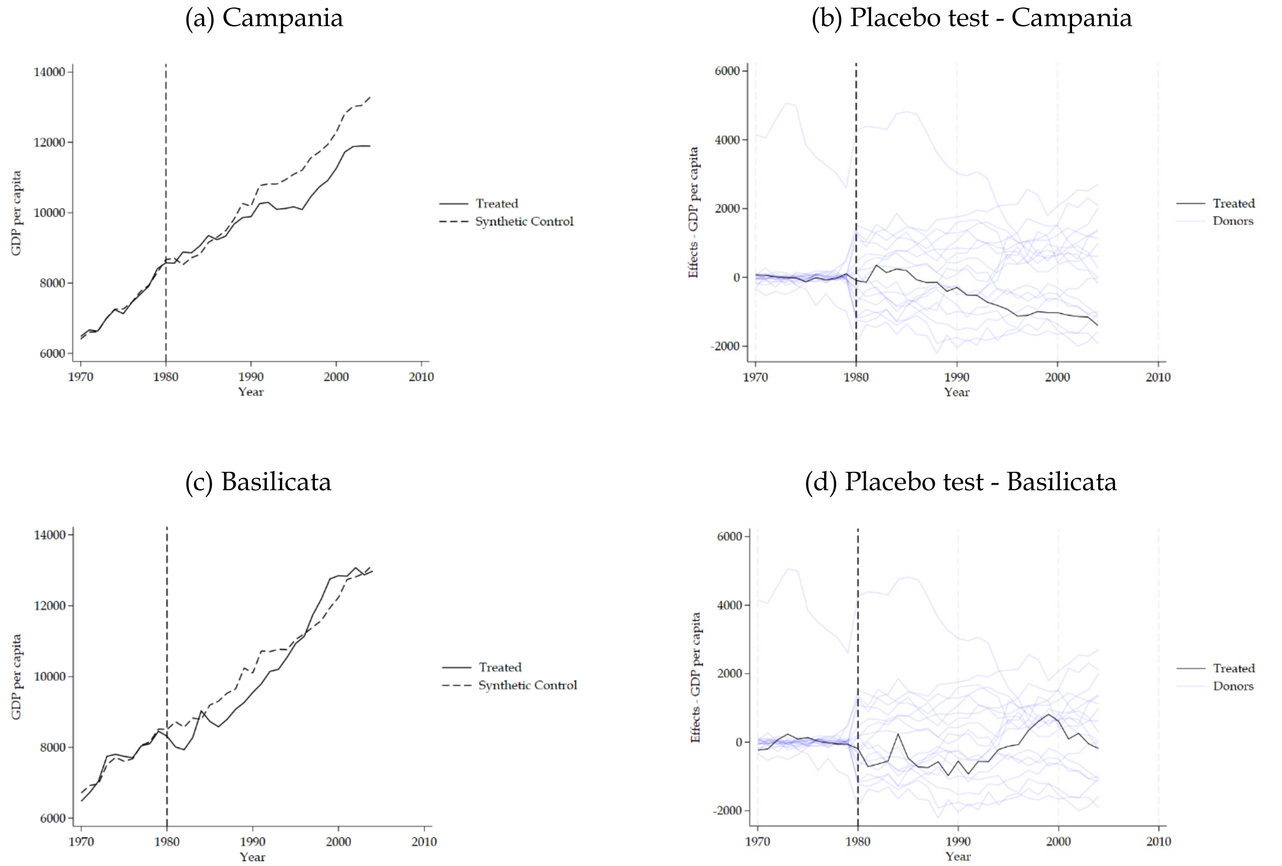
Figure 4.8. Impact of the Irpinia earthquake on regional value added per worker



Notes: Baseline results: value added per worker 1970-2004. The graphs report the value added per worker of the treated regions (Campania in Panel (a) and Basilicata in Panel (c)) and their corresponding synthetic control. Panel (b) and Panel (d) report the outcome difference between the treated regions and their synthetic controls (black lines) as well as the same differences for all other regions (to which a fake treatment is assigned once at a time) in light blue.

We perform the same empirical exercise using GDP per capita as an outcome, and we report results in Figure 4.9. Results for GDP per capita are in line with what observed in Figure 4.9. In the long-run, Campania experiences a negative effect on GDP per capita due to the earthquake, while for Basilicata the effect is negligible. Consequently, the negative effect on GDP per capita due to the Irpinia earthquake reported by Barone and Mocetti (2014) is almost entirely due to the bad performance of Campania.

Figure 4.9. Impact of the Irpinia earthquake on regional GDP per capita



Notes: Baseline results: GDP per capita 1970-2004. The graphs report the GDP per capita of the treated regions (Campania in Panel (a) and Basilicata in Panel (c)) and their corresponding synthetic control. Panel (b) and Panel (d) report the outcome difference between the treated regions and their synthetic controls (black lines) as well as the same differences for all other regions (to which a fake treatment is assigned once at a time) in light blue.

Taken together, the migration and economic evidence point to the relevance of post-earthquake regional institutional quality and local social capital in preventing out-flows and promoting long-run economic recovery. Basilicata's post-quake trajectory illustrates a 'stay-and-rebuild' equilibrium: the local economy expands without large out-migration, confirming that higher institutional quality and bonding networks can shrink the migration pipe even as they lift the regional economy. On the contrary, our results show that higher in-migration registered in Campania could be due to local institutional shortcomings leading to demand surge, without benefits for the optimal recovery of the local economy.

4.6. Conclusion

Post-disaster migration flows can have severe consequences on places hit by natural hazards, shaping their prosperity and influencing the recovery of local economies. Local formal and informal institutions can influence post-disaster migration patterns variously. Good local governance deters residents to emigrate (Mustafa et al., 2022), while delayed or discretionary processes prolong demand surge, attracting worker from outside (Kim and Shahandashti, 2022). In parallel, local bonding ties act as informal insurance for residents, curbing out-migration (Aldrich, 2012) and raising outsiders' entry costs (Aldrich and Crook, 2008; Beckham et al., 2023). The role and effect of local institutions need solid evidence to inform policymakers to better manage economic recovery. This paper leverages a unique natural experiment to study the influence of regional institutional quality on post-disaster municipal migration flows. The occurrence of the Irpinia earthquake at the border of two very different regions in terms of institutional quality and performance allows us to isolate the role of sub-national governance. By using a novel granular dataset containing information on migration flows at the municipal level over a long timespan, we find that post-disaster regional institutional quality matters less for the quantity of municipal migration than for its composition, providing within-country evidence that institutional quality affects the direction rather than the volume of disaster-induced migration. Equally damaged areas with stronger regional institutions experience less outflows. We provide complementary evidence that higher regional institutional quality is associated with a better recovery of the local economy, suggesting that the positive relationship between lower institutional quality and in-migration is a result of a demand surge mechanism, without benefits for the local economy. Looking ahead, subnational institutional quality will increasingly shape whether climate hazards translate into displacement or adaptive staying, as projections indicate rising internal climate mobility through mid-century (World Bank, 2021). In light of our results, a pragmatic agenda is to link mobility-sensitive adaptation audits to comparable subnational quality-of-government indicators and to direct national or supra-national financing toward capabilities that manage human mobility as a core dimension of resilience (OECD, 2025).

Our identification strategy does not allow us to isolate the effect of regional institutional quality on post-earthquake GDP and value-added per worker. In addition, NUTS-2–level data do not allow us to precisely assign the treatment, not enabling a direct comparison between areas with higher and lower institutional quality, because Basilicata and Campania include jurisdictions that did not experience earthquake damage. While our estimates with census data provide positive post-treatment coefficients, they lack statistical significance and do not represent valid proxies for measuring post-earthquake local economic recovery. Good measures of municipal economic recovery and measures of institutional quality at a more granular level would represent a step forward to comprehensively answer our research question.

In the next steps of this research, we plan to strengthen the validity of our empirical strategy by running alternative identification strategies, such as the geographic difference-in-discontinuity approach with the municipal level dataset, and using alternative outcomes, such as population-normalized metrics for population flows. Furthermore, we plan to run an in-depth investigation with additional evidence on the mechanisms this study has unveiled, especially to better identify the effect of institutional quality on economic recovery.

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Appendix 4.A

Figure 4.A.1. Effect of the earthquake in the municipality of Conza della Campania

Notes: Picture from Moscaritolo (2020).

Figure 4.A.2. Annual total Population Change – Form

Numero del Comune

Mod. ISTAT/P/2

ISTITUTO CENTRALE DI STATISTICA

MOVIMENTO DELLA POPOLAZIONE RESIDENTE

nell'anno 1958

Comune .... Provincia ....

	M	F	MF
1 - Popolazione residente al 1° gennaio			
2 - Movimento naturale della popolazione residente			
3 - Differenza tra nati e morti (+ o —).			
4 - Iscrizioni e cancellazioni anagrafiche per trasferimento di residenza			
5 - Differenza tra iscritti e cancellati (+ o —) . .			
6 - Incremento o decremento (punto 3 + o — punto 5)			
7 - Popolazione residente al 31 dicembre 1958 . .			

2.1. - Nati vivi :	M	F	MF
nel Comune			
in altro Comune (atti trascritti)			
all'estero (atti trascritti) . . .			
Totale nati vivi . . .			

2.2. - Morti :	M	F	MF
nel Comune			
in altro Comune (atti trascritti)			
all'estero (atti trascritti) . . .			
Totale morti			

4.1. - Iscritti :	M	F	MF
da altri Comuni			
dall'estero			
Totale			

4.2. - Cancellati :	M	F	MF
per altri Comuni			
per l'estero.			
Totale			

8 - Schede di famiglia al 31-12-1958 N°..................

9 - Schede di convivenza al 31-12-1958 N°..................

IL SINDACO

Bollo

....

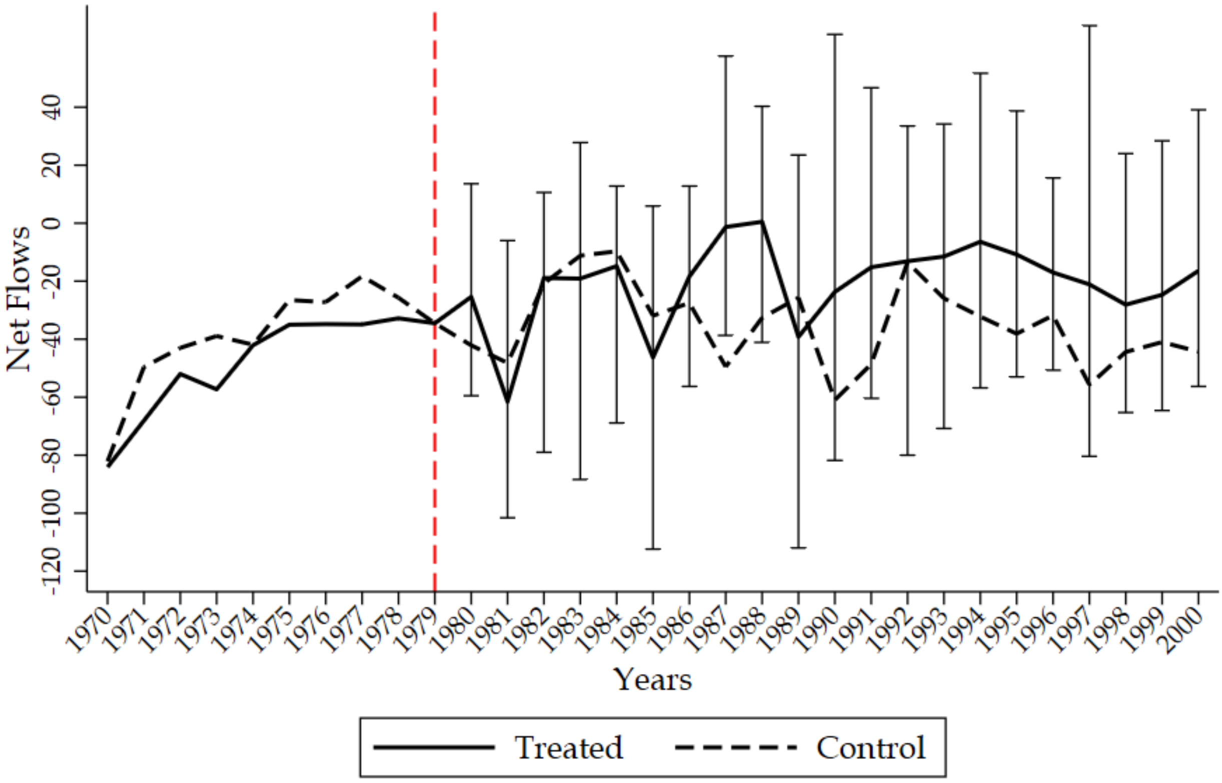
Figure 4.A.3. Annual total Population Change – Sample page of ISTAT book

86 II - DATI PER COMUNE

L'AQUILA

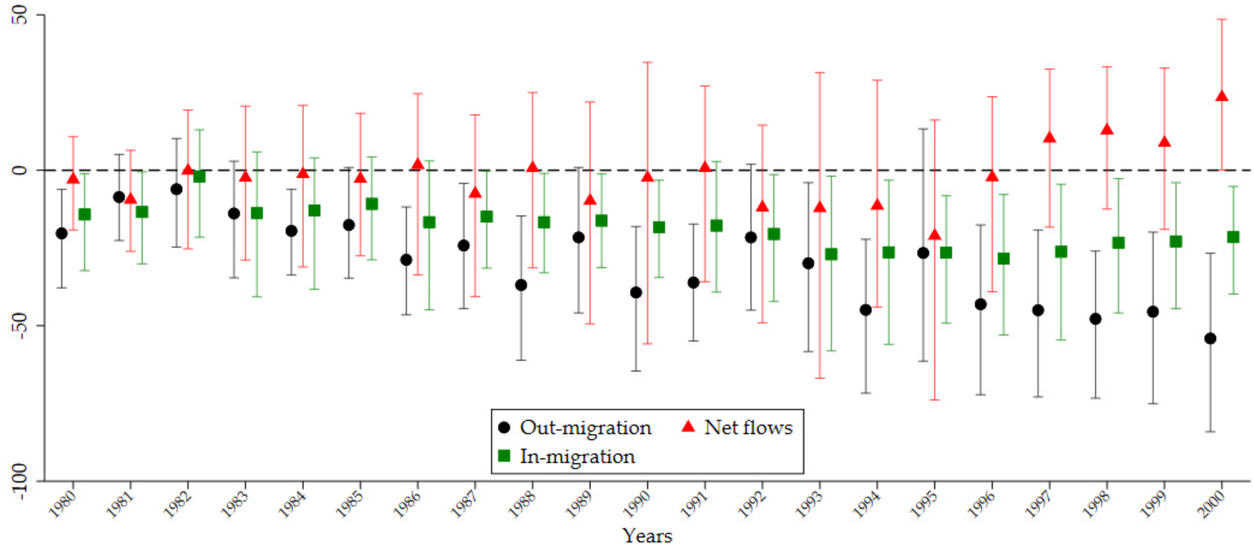
COMUNI	POPOLAZIONE RESIDENTE al 31 dic. 1957	ISCRIZIONI E CANCELLAZIONI ANAGRAFICHE NELL'ANNO 1958 — Per movimento naturale: Nati vivi	Per movimento naturale: Morti	Per trasferimento di residenza — Iscritti: da altro Comune	Iscritti: dall'estero	Cancellati: per altro Comune	Cancellati: per l'estero	POPOLAZIONE RESIDENTE al 31 dicembre 1958: M	F	MF
33 Cèrchio	2.548	42	36	31	—	64	—	1.233	1.288	2.521
34 Civita d'Àntino	1.469	23	14	12	—	60	—	725	705	1.430
35 Civitella Alfedena	626	8	9	3	—	5	—	318	305	623
36 Civitella Roveto	3.408	73	34	36	8	72	—	1.708	1.711	3.419
37 Cocullo	1.035	16	14	8	4	25	—	472	552	1.024
38 Collarmele	1.481	28	20	10	5	28	43	682	751	1.433
39 Collelongo	2.221	40	18	5	—	49	—	1.029	1.170	2.199
40 Collepietro	809	13	10	9	1	10	—	399	413	812
41 Corfinio	1.497	17	17	40	1	52	81	674	731	1.405
42 Fagnano Alto	1.528	18	29	18	8	38	—	732	773	1.505
43 Fontècchio	966	6	13	15	1	15	—	469	491	960
44 Fossa	1.046	14	8	18	2	10	12	511	539	1.050
45 Gagliano Aterno	1.118	8	14	14	6	14	1	493	624	1.117
46 Giòia dei Marsi	2.910	62	30	52	1	54	—	1.428	1.513	2.941
47 Goriano Sicoli	1.267	19	16	16	1	21	—	601	665	1.266
48 Introdàcqua	2.937	30	42	24	—	26	133	1.346	1.444	2.790
49 L'ÀQUILA	57.253	902	541	1.379	39	884	117	27.919	30.112	58.031
50 Lecce nei Marsi	2.311	47	17	15	—	31	—	1.130	1.195	2.325
51 Luco dei Marsi	5.386	81	52	38	9	153	—	2.699	2.610	5.309
52 Lùcoli	2.879	38	37	33	—	116	—	1.385	1.412	2.797
53 Magliano de' Marsi	3.984	58	30	47	6	119	1	1.947	1.998	3.945
54 Massa d'Albe	2.647	55	20	18	—	54	—	1.295	1.351	2.646
55 Molina Aterno	806	7	5	10	1	12	—	394	413	807
56 Montereale	6.367	124	65	71	1	161	83	3.048	3.206	6.254
57 Morino	2.142	42	22	38	—	44	—	1.110	1.046	2.156
58 Navelli	1.579	6	14	11	—	34	18	733	797	1.530
59 Ocre	1.234	16	14	31	1	40	1	605	622	1.227
60 Ofena	1.726	12	13	24	—	49	98	807	795	1.602
61 Opi	843	22	8	16	2	34	—	415	426	841
62 Orìcola	930	9	9	18	—	36	—	468	444	912
63 Ortona dei Marsi	2.493	38	24	22	2	69	—	1.247	1.215	2.462
64 Ortùcchio	2.381	52	23	29	2	92	—	1.172	1.177	2.349
65 Ovìndoli	2.308	30	29	27	1	52	50	1.129	1.106	2.235
66 Pacentro	3.008	52	36	26	6	36	37	1.452	1.531	2.983
67 Pereto	1.091	28	22	21	—	66	—	573	479	1.052
68 Pescassèroli	2.794	41	27	40	—	88	—	1.300	1.460	2.760
69 Pescina	5.865	114	53	76	5	147	—	2.879	2.981	5.860
70 Pescocostanzo	1.985	28	12	13	1	42	—	975	998	1.973
71 Pettorano sul Gìzio	3.445	36	24	19	4	53	233	1.592	1.602	3.194
72 Pìzzoli	3.271	64	35	73	1	132	—	1.462	1.780	3.242
73 Pòggio Picenze	1.347	14	10	8	1	23	—	686	651	1.337
74 Prata d'Ansidònia	1.374	12	21	13	4	22	5	669	686	1.355
75 Pràtola Peligna	10.707	171	82	149	14	195	8	5.499	5.257	10.756
76 Prezza	2.565	23	22	10	3	6	—	1.303	1.270	2.573
77 Raiano	4.147	49	43	39	6	97	5	2.087	2.009	4.096
78 Rivisòndoli	1.228	16	10	14	3	24	4	580	643	1.223
79 Roccacasale	1.430	20	18	10	6	49	—	683	716	1.399
80 Rocca di Botte	682	6	7	44	—	18	—	359	348	707

Figure 4.A.4. Impact of post-disaster regional institutional quality on migration flows



Notes: The treated and control groups are restricted only to those municipalities experiencing an earthquake intensity of eight or more, according to the Mercalli intensity scale. The vertical black bars report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

Figure 4.A.5. Impact of post-disaster regional institutional quality on migration flows.



Notes: The treated and control groups are restricted only to those municipalities experiencing an earthquake intensity of eight or more, according to the Mercalli intensity scale. The vertical black, green, and red bars report 95% confidence intervals for the outcome of the estimated counterfactual scenario. Confidence intervals are computed using a block-bootstrap procedure (see Imai et al., 2023).

Appendix 4.B

Details on the indicators composing the index of regional institutional performance (Putnam et al., 1993)

Putnam et al. (1993) evaluate the policy processes, policy pronouncements/decisions, and policy implementation of each regional government, measuring institutional performance from 1978 to 1985. Following Putnam et al. (1993), we provide detailed information on all the indicators composing the index below. See Figure 4.2 in the main text for a graphical representation of the structure of the composite index.

After having computed the index, Putnam et al. (1993) test if 'objective' measures of institutional performance correspond to the views of Italians about their regional governments. Specifically, six times between January 1977 and December 1988, or roughly once every two years, they asked Italians, "How satisfied or unsatisfied are you with the way in which this region is governed?". They show the remarkably strong concordance between the two measures, 'objective' and 'subjective' (see Figure 3.2 in Putnam et al., 1993).

(i) Policy processes:

- Cabinet stability. Each regional government is led by a cabinet that must retain majority support in the legislature. Some regions had highly stable cabinets and thus were able, in principle, to pursue a coherent line of policy. Others, by contrast, found it hard to patch a coalition together and harder to keep it together. The cabinet stability indicator is the number of different cabinets installed in each region during the 1975-1980 and 1980-1985 legislative periods.

- Budget promptness. Beginning in 1972, all regions were supposed to complete action on their annual budgets by January 1, the start of the fiscal year. Virtually none met this target, and in the early 1980s all regions were hampered by delays beyond their control in the national budget cycle. However, the average delay varied considerably from region to region. The budget promptness metric answers the following question: On average, during the period 1979-1985, when was the budget actually approved by the regional council?

- Statistical and Information Services. Other things being equal, a government with better information about its constituents and their problems can respond more effectively. Thus all twenty regions were rated according to the breadth of their statistical and information facilities.

(ii) Policy pronouncements/decisions:

- Reform Legislation. In three diverse policy areas - economic development, territorial and environmental planning, and social services – Putnam et al. (1993) examined the entire legislative output of each region during the period 1978 to 1984. Their analysis used three criteria: comprehensiveness (the degree of broadness of the corpus of regional law produced in terms of social needs); coherence (the degree to which the various legislative initiatives were coordinated and internally consistent); creativeness (the degree to which it identified new needs, experimented with new services, or created incentives for new forms of private initiative). Each region was graded from 1 to 5 in each of the three policy sectors.

- Legislative Innovation. In Italy, as in the United States, many legislative ideas tend to diffuse across subnational governments, as an attractive innovation introduced by a relatively advanced council is picked up and passed in less advanced regions. Putnam et al. (1993) examined twelve diverse topics on which similar laws appeared in many of the regions. Our metric here is as follows: On average, across these twelve domains, how soon after the first appearance of a model law was it picked up by a given region? The region that pioneered a particular law was given a score of 100, and a region that had not adopted it at all was given a score of 0.

(iii) Policy implementation:

- Day Care Centers. One of the earliest and most successful policy initiatives undertaken by the new regional governments was the provision of publicly supported day care centers. The metric here is the number of regionally supported day care centers in operation by December 1983, standardized by the population of children aged zero to four. This measure provides an unusually crisp indicator of a region's ability to implement policy at the grassroots, given assured external funding.

- Family clinics. In the health sector one important experiment, originally authorized by national legislation in 1974, was the family clinic (*consultorio familiare*). One useful measure of a region's ability to implement policy reforms is the number of family clinics, standardized for regional population, in operation by May 1978.

- Industrial policy instruments. One crude measure of the sophistication of each region in the area of industrial policy can be computed by noting which of an array of potential tools of industrial policy the region actually deployed: regional economic development plan; regional land use plan; industrial parks; regional development finance agencies; industrial development and marketing consortia; job-training programs.

- Agricultural spending capacity. A region's ability to carry out policy initiatives in this important economic sector can be measured by the fraction of the funds allocated (by the central government in 1977) to the region that the region actually disbursed as planned during the next three years (1978-1980).

- Local Health Unit Expenditures. One measure of the readiness of each region to fulfill its responsibilities in this area is per capita Local Health Units (*Unità sanitarie locali, USL*) expenditures, as of 1983, five years after the enactment of the national statute.

- Housing and Urban Development. Regions were required to formulate four-year housing programs and to set criteria for the allocation of funds. Putnam et al (1993) gathered data in 1979, 1981, 1985, and 1987 on the ability of the regions to use these funds, as measured by the fraction of the funds authorized by the central authorities that the region actually disbursed, and they created a composite index.

- Bureaucratic Responsiveness. To assess the governments' "street-level" responsiveness, they devised a slightly deceptive, but innocuous and highly informative experiment. In January 1983 Italian colleagues approached the bureaucracies in each region (health department; vocational education department; agriculture department), requesting information about three specific (but fictitious) problems. The initial requests were made by mail, and the replies were evaluated for promptness, clarity, and comprehensiveness. If no timely reply was received, follow-up telephone calls and (when necessary) personal visits were made. In either case, the quality and alacrity of the response was evaluated. This experiment enabled them to construct a composite index of the responsiveness of three important agencies, comparable across all twenty regions.