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# EU Cohesion Policy and Digital Public Services\*

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## Abstract

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This paper investigates the impact of European Cohesion Funds on the digitalization of local governments in Italy, using the quality of municipal websites as a proxy for e-government capacity. Using web scraping techniques and a generalized Difference-in-Differences approach, the study examines whether municipalities that received targeted EU funding for digital networks and services experienced improvements in website technological sophistication. The results show that cohesion funds have contributed to the adoption of modern web standards, particularly HTML5, and to the simplification of website structure, indicating progress in the core aspects of digital infrastructure. These effects are especially pronounced in smaller municipalities and those located in the South and Inner Areas, suggesting that the cohesion policy can support digital convergence in structurally disadvantaged contexts. However, the absence of systematic improvements in broader dimensions of web interactivity points to the selective nature of these advancements.

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**Keywords:** Cohesion policy, Digitalization, Italian municipalities.

**JEL Classification:** H77, L86, O18.

# 1 Introduction

The cohesion policy is one of the European Union’s main instruments for promoting territorial convergence and balanced development between member states. It is designed to support economically disadvantaged regions, improve infrastructure and promote social and economic inclusion (Farole *et al.*, 2011; Fratesi, 2025). Despite its strategic importance and substantial financial resources, the effectiveness of the cohesion policy in reducing regional inequalities remains contested (Dall’Erba and Fang, 2017). Although some studies highlight positive impacts on economic growth and public service provision, others emphasize uneven results, often linked to structural and institutional differences between regions (Mohl and Hagen, 2010; Becker *et al.*, 2018).

One crucial factor influencing the success of cohesion policies is institutional quality at the local level (Milio, 2007; Surubaru, 2017; Incaltarau *et al.*, 2020). Strong local governance, characterized by effective administration, transparency, and the ability to manage resources, significantly impacts the way territories use and benefit from cohesion funds (Mendez and Bachtler, 2024). In contrast, territories with weaker institutional frameworks struggle to fully access and implement these funds, exacerbating territorial disparities (Becker *et al.*, 2013; Cunico *et al.*, 2022). This dynamic is particularly evident in Italy, where significant differences in administrative capacity between the northern and southern regions have influenced the results of regional development programs (Barone and de Blasio, 2023; Cerqua *et al.*, 2025; Di Stefano and Resce, 2025).

This is the reason why part of EU cohesion policies are now specifically dedicated to supporting local governments. Recognizing that institutional weaknesses at the subnational level can undermine the effectiveness of investments, recent programming periods have introduced targeted measures to strengthen administrative capacity, improve multilevel governance, and promote strategic planning at the local scale (Atella *et al.*, 2023). A key but still insufficiently explored question is whether these interventions lead to measurable improvements in public sector performance. Although some recent studies (such as Atella *et al.* (2023) which finds positive effects on local taxation autonomy)

have begun to assess these impacts, empirical evidence remains limited.

This paper contributes to this emerging literature by investigating whether municipalities that received EU funding specifically targeted at digital networks and services experienced improvements in the quality of their official websites. As a primary interface between citizens and local governments, municipal websites play a vital role in the delivery of public services and in promoting institutional transparency. Given the growing relevance of e-government, 'website quality' is employed here as a proxy for broader progress in digitalization and local governance capacity.<sup>1</sup>

To assess the impact of EU funding on website quality, this study employs web scraping techniques to extract and analyze data from municipal websites across different time periods (Mazzoni *et al.*, 2024). Web scraping enables the collection of large volumes of unstructured data which are then processed and structured to evaluate key features of website design and functionality. In particular, the analysis focuses on technological indicators such as the adoption of modern web standards (*e.g.*, HTML5), user interface elements, and content accessibility. Using a generalized Difference-in-Differences (DiD) framework, we compare website characteristics before and after the receipt of cohesion funding, with the aim of identifying whether such investments have produced measurable improvements in local digital infrastructure and governance quality.

Results show that municipalities receiving cohesion funding have made measurable progress in improving certain aspects of their websites, particularly through the adoption of modern web standards such as HTML5 and the simplification of site structure. These findings suggest that cohesion funds have contributed to basic technological upgrading, helping municipalities — especially smaller and more disadvantaged ones — to overcome infrastructural barriers. However, the limited progress in broader digital engagement suggests that cohesion funds alone may not be sufficient to drive meaningful change.

The paper is organized as follows: Section 2 outlines the conceptual and

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<sup>1</sup>We define e-government as the use of information technologies to deliver government information and services and to involve citizens in the democratic process and real-time government decision making.

methodological framework used to assess digitalization at the municipal level; Section 3 describes the methodology, including data collection and analysis techniques; Section 4 presents the results; Section 5 concludes by discussing the implications of the findings and suggesting directions for future research.

## 2 Measuring Digitalisation at the Local Level

Digitalization has been identified as a key policy objective for national, regional, and local authorities. Contemporary economic development policies are characterized by a pronounced emphasis on digital connectivity, digital skills, internet usage, and the adoption of digital technologies within the business and public sectors. As Information and Communication Technology (ICT) becomes increasingly prevalent, the ‘digital divide’ has emerged as a critical issue in assessing Information Technology (IT) competencies and the digital gap between territories.

The concept of the digital divide was first introduced to denote the disparity in the degree of ICT penetration among individuals and households (Vehovar *et al.*, 2006; Kyriakidou *et al.*, 2011; Briglauer *et al.*, 2019). Conventionally, the primary concern with regard to digitalization is related to the issue of internet access. This entailed the construction of networks with the objective of facilitating access to the Internet, whilst concomitantly ensuring a satisfactory level of internet speed. This initial phase of digitalization was designated the ‘first-level digital divide’ (Blank *et al.*, 2018). Following the widespread availability of internet access throughout Europe, the focus shifted to the utilization and benefits of this access. In fact, between 2003 and 2014, the European Commission (EC) approved a total of 136 state aid applications for the deployment of broadband networks in rural areas.<sup>2</sup> Subsequently, the extensive proliferation of the Internet shifted the focus from the rudimentary adoption rate to a more sophisticated dimension of ICT use. The digital divide

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<sup>2</sup>The objective of this initiative was twofold: firstly, to bridge the digital divide, and secondly, to trigger welfare-enhancing externalities that were expected from a well-established broadband infrastructure as ‘general purpose technology’ (Bresnahan and Trajtenberg, 1995).

has evolved into a multifaceted and sophisticated concept, encompassing not only access to technology but also the skills and abilities necessary to use it effectively (Szeles, 2018; Aissaoui, 2022).

The existing literature reveals a greater emphasis on the production of digital technologies than on their adoption (Castellacci *et al.*, 2020; Diodato *et al.*, 2023; Xiao and Boschma, 2023). This can be attributed to the divergent adoption of digital web technologies in the construction of web pages. Such technologies are associated with a high degree of knowledge recombination, which is difficult to replicate and thus, provides higher economic benefits (Fleming and Sorenson, 2001; Rigby, 2015; Mewes and Broekel, 2022; Pintar and Scherngell, 2022; Yang *et al.*, 2024). Furthermore, given the pervasiveness of digital transformation over the last decade, the digital divide concept has attracted increased attention due to its capability to serve as a measure of economic performance (Shakina *et al.*, 2021).

In light of this ongoing development, digital traces left by organizations and individuals have recently become subject to empirical analysis, owing to the proliferation of methods such as web scraping (Li *et al.*, 2018). Nevertheless, the methodology of the current study aligns with prevailing web mining research, which regards the information on homepages as appropriate priorities to be selected (Kinne and Lenz, 2021). According to Holzer and Kim (2003), the primary city homepage is defined as the official website through which the city disseminates information about its administration and online services. The importance of proximity to information resources in terms of facilitating urban development has been demonstrated on multiple occasions, and has been shown to engender stronger information spillover effects, greater knowledge flows, and overall increases in human capital (Anselin *et al.*, 1997; Charlot and Duranton, 2004; Bhatt, 2010; Doms *et al.*, 2010; De Witte and Geys, 2011; Bekkerman and Gilpin, 2013). Thus, following Gaspar and Glaeser (1998), it can be posited that digital content has the potential to become a substitute for a significant proportion of locally accessible information resources, thereby obviating the necessity for geographic proximity to information resources. Our approach is consistent with prevailing literature on web mining, which

considers the information on homepages to be a priority. For this reason, in our analysis we retrieved web information focusing solely on the homepage of Italian municipalities' websites.

Taking these disparities into account, governments have increasingly supported initiatives aimed at standardizing municipal website development, thereby ensuring minimum digital accessibility even among smaller or resource-constrained municipalities. The extant literature highlights the correlation between the development of e-services and the presence of robust technological infrastructures or conducive local environments within municipalities. [Attour and Chaupain-Guillot \(2020\)](#) demonstrate, in the French context, that digital service diffusion typically mirrors pre-existing economic strengths rather than enabling disadvantaged municipalities to catch up. Similarly, [Arduini et al. \(2010\)](#) identify that, in Italy, comprehensive digital services are predominantly observed in larger municipalities with dedicated IT resources, further underscoring structural digital divides. This observation is consistent with findings from [Gonzalez et al. \(2013\)](#) in Spain, where larger city administrations demonstrate higher propensities toward innovation, particularly concerning ICT deployment. Also, [Finney and Yoon \(2011\)](#) find that population density increases the probability that a municipality adopts web technology.

In the Italian context, digital disparities are particularly acute, reflecting broader socioeconomic divides between the Northern and Southern regions ([Daniele, 2021](#)). The Italian local e-government services operate within a multi-level governance context involving national, regional, and municipal bodies. At the national level, Italy's digital strategy is coordinated by the [Agency for Digital Italy \(AgID\)](#),<sup>3</sup> which promotes innovation and digital skills across public administrations. The government recognizes the importance of the digital sector and, as part of its digital transformation efforts, has been actively investing to foster innovation and drive overall digitalization. Italy's National

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<sup>3</sup>AgID has introduced standardized guidelines to enhance the accessibility and usability of public administration websites and digital services in Italy. These guidelines aim to promote digital inclusivity. Additionally, AgID offers tools to assist organizations in achieving compliance, reflecting Italy's commitment to digital accessibility and aligning with broader European directives on accessibility.

Recovery and Resilience Plan (NRRP), supported by the European Union’s largest allocation of pandemic recovery funds, and its specific digital initiatives (*e.g.*, digital citizenship and digital administration) includes billions of euros for investments to accelerate the adoption of emerging technologies and improve the country’s digital capabilities. Italy has earmarked about € 48.6 billion euro (25%) of its total NRRP allocation funding for digital initiatives.<sup>4</sup>

Although Italy has made significant progress in investing in and adopting digital technologies, there are still challenges to be addressed. There is a noticeable disparity in digital infrastructure between Northern and Southern Italy and some rural areas still face connectivity issues, limiting their ability to fully leverage digital technologies. For example, in 2018, only 39% of municipalities in Southern Italy had fully interactive online portals, compared to 48% nationwide (PCM, 2025). It is the purpose of this study to explore the use of web variables in order to develop a more profound comprehension of the role of cohesion funds in facilitating the adoption of novel digital technologies (such as HTML5) and enhancing the quality of local authority websites. Empirical evaluations of targeted funding programs, such as those addressing Italy’s marginal areas through the place-based policy (Barca, 2019) of the National Strategy for Inner Areas (*Strategia Nazionale Aree Interne* – SNAI) underscore the nuanced impact of policy interventions. While such initiatives may not quickly resolve entrenched demographic challenges, evidence indicates that targeted funding can stimulate local economic dynamism (Monturano *et al.*, 2025) or tourist attractions (Di Matteo, 2025). Moreover, current debates on depopulation indicate that digital access is a priority to retain the population in rural areas (Pontones-Rosa *et al.*, 2021). Nonetheless, Santos and Coad (2023) advocate for improved monitoring and evaluation mechanisms, emphasizing the need for timely data collection and rigorous impact analyses to optimize policy effectiveness, such as those offered by web scraping techniques.

Instead of examining the content of the websites, we focused on a list of ‘objective’ available IT features, following the emerging stream of research

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<sup>4</sup>Additional information about NRRP funds are available at [The Italian Chamber of Deputies](#).

linking new IT technologies to related capabilities (Miranda *et al.*, 2009; Shan *et al.*, 2017; Ashouri *et al.*, 2024a; Mazzoni *et al.*, 2024; Greavu-Șerban *et al.*, 2025). The factors under consideration are as follows:

1. the adoption of HTML5 indicative of technological modernity and compliance with contemporary web standards;
2. the number of external links reflecting the connectivity of the website, indicating its network scope and the potential flow of information;
3. the count of HTML tags that represents webpage complexity, potentially affecting accessibility, loading speed, and navigability.

The selection of these indicators is intended to reflect the technological modernity of the site, the network of connections, and the accessibility, speed, and navigability (or complexity) of the webpage. Collectively, the indicators offer a structured and quantifiable method to evaluate the quality and effectiveness of digital public services.

## 2.1 HTML5

Despite the rapid emergence of novel digital web technologies, a unified framework for characterizing their adoption dynamics over time remains unavailable (Haefner and Sternberg, 2020). Moreover, Papagiannidis *et al.* (2015) have demonstrated that such technologies embody increased intrinsic complexity, resulting in them being particularly challenging to comprehend, assimilate, and deploy. In the context of an examination of the role of contemporary web technologies, it is evident that the introduction and adoption of HTML5 is a critical indicator of the innovative nature of municipal websites.<sup>5</sup> The transition to HTML5, finalized by the W3C in 2014, fundamentally altered web development by enabling sophisticated multimedia, enhanced semantic structure, improved forms, and superior accessibility across devices (Tabarés Gutiérrez, 2021). For example, digital records and automated workflows minimize the need

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<sup>5</sup>For a detailed explanation of HTML code, see Appendix A.2; for a discussion of HTML5's cutting-edge properties, see Appendix A.3.

for physical paperwork, reducing the time required for processing applications and approvals (Radojčić and Vučetić, 2023). This new technology is the fifth major revision of the Hypertext Markup Language, developed from 2004 to 2014 and was officially published as a W3C Recommendation in November 2014.<sup>6</sup>

## 2.2 External link

As demonstrated by numerous studies, the importance of knowledge flows as vital mechanisms for enhancing innovation capabilities is widely acknowledged. This, in turn, has been shown to result in the strengthening of competitiveness at both regional and national levels (Martin and Moodysson, 2013; Tödtling and Grillitsch, 2015; Edler and Fagerberg, 2017). In the contemporary digital era, this phenomenon can be investigated through a comprehensive analysis of the presence and quantity of external hyperlinks on digital platforms. It has been established that these elements function as significant indicators of stakeholder engagement and embodiment within the broader digital ecosystem. A greater number of unique external links—defined as hyperlinks pointing to domains external to the host website—are indicative of more fruitful interactions with external actors, which in turn reflect active participation in knowledge flows and open innovation processes.

Recent years have seen an increase in the application of external hyperlinks in research, serving as a quantitative metric for the assessment of relationships and knowledge networks. As demonstrated in multiple studies such as Abbasiharofteh *et al.* (2023), Axenbeck and Breithaupt (2021), and Arifi *et al.* (2023) link counts have been utilized as a metric for evaluating the strength and scope of firms' ties to external partners and innovation networks. In Mazzoni *et al.* (2024), on the subject of measuring stakeholder involvement in the digital ecosystem, a simple yet replicable method is proposed for operationalizing this approach. This method involves the counting of `<href>` elements in HTML code that link to external domains.<sup>7</sup>

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<sup>6</sup>More about the HTML5 implementation can be found within the [W3C Recommendation](#).

<sup>7</sup>This attribute specifies the target Uniform Resource Locator (URL) for elements. By

Accordingly, it is evident that external link analysis, comprehended within this extensive context, functions not solely as a digital metric of connectivity but also as a robust indicator of organizational embeddedness, collaborative orientation, and innovation potential. This finding is consistent with those pertaining to knowledge flows and regional competitiveness.

### **2.3 HTML tags**

The number of HTML tags on a webpage is used as a proxy for its structural complexity and loading performance. Although such richness can improve functionality, excessive complexity on a public service site could reduce response times or confuse users, thereby undermining the benefits of digital access. A lower tag count generally corresponds to faster load times, which enhance usability and may reflect the adoption of modern, performance-oriented technology stacks (Shan *et al.*, 2017; Axenbeck and Breithaupt, 2021). By capturing variations in site, 'lightness' versus 'heaviness', the HTML tag count metric highlights whether municipalities prioritize performance-optimized design (Shan *et al.*, 2017). In summary, HTML tag count offers an accessible indicator of a website's technical complexity and operational efficiency, both of which critically influence user experience and accessibility of online public services.

### **2.4 A Composite Framework for Assessing Municipal Web Presence**

When considered collectively, these three metrics—modern HTML5 usage, external connections, and page complexity—offer a multifaceted perspective on a municipality's web presence. The degree of adoption of HTML5 serves as an indicator of the level of technological innovation in the site's development. The number of external links represents the connections and flows of information between the municipality and other entities, while the HTML tag count is a providing this attribute, authors enable the loading of external resources.

measure of the technical complexity, which has implications for usability. The implementation of these measures on municipal websites throughout Italy will facilitate a quantitative comparison of the digital engagement of different local authorities. This approach is consistent with a growing body of research that employs web-scraped data to develop novel indicators of digital development (Shan *et al.*, 2017; Tabarés Gutiérrez, 2021; Mazzoni *et al.*, 2024). This approach facilitates a more comprehensive understanding of broader digitalization patterns and disparities.

### 3 Data and Methods

The advent of the digital age, coupled with the exponential growth of online activities, has given rise to novel methods for the collection and analysis of data pertinent to innovation (Einav and Levin, 2014; Blazquez and Domenech, 2018). The Internet, and specifically the World Wide Web (WWW), serve as rich sources of real-time data that can be harnessed to gain insights into innovation activities (Kosala and Blockeel, 2000; Keller and Hüsig, 2009; Chen and Kuo, 2017). However, data available on the web are often unstructured and noisy, necessitating the application of sophisticated processing techniques in order to extract meaningful information (Feldman and Sanger, 2007). In this context, the process of web scraping and the subsequent analysis of online data provide a novel means of capturing real-time information that may not be available through traditional data sources (Kinne and Lenz, 2021) and enable the extraction of meaningful information from unstructured web data (Van Oorschot *et al.*, 2018). In addition, analysis of HyperText Markup Language (HTML) code and website functionalities can provide insights into digitization and technological sophistication (Horváth and Szabó, 2019). The analysis of online content applicable to emerging technologies enables the identification of potential innovations and the evaluation of their implications (Scheiner *et al.*, 2015; Amankwah-Amoah, 2017). This approach facilitates a forward-thinking approach to both innovation processes and the formulation of related policies. Several studies have demonstrated the utility of web data in fostering innovation

and performance.

Daas and van der Doef (2020) utilized website content to detect innovative companies, finding that web-derived indicators correlate with traditional innovation metrics. In addition, web-based indicators have been used to monitor technological trends and forecast innovation trajectories (Keller and Hüsigg, 2009; Scheiner *et al.*, 2015; Wamba *et al.*, 2021). Ashouri *et al.* (2024b) developed digitalization indicators using web-scraped data, offering empirical measures that can be applied across industries and regions over time. Moreover, Axenbeck and Breithaupt (2021) investigated which characteristics of the website predict the activity of firm-level innovation while Kinne and Lenz (2021) used web mining and deep learning to identify innovative firms, showing that web-based models can enhance the identification process.

The integration of data obtained through web scraping with conventional financial and administrative data is consistent with the overarching tendency to employ big data and sophisticated analytical methods to capture intricate economic phenomena (Einav and Levin, 2014; Rammer and Es-Sadki, 2023). Furthermore, recent advances in the field of computational linguistics have highlighted the efficacy of HTML code in enhancing the performance of large language models (LLM) (Ashby and Weir, 2020; Li *et al.*, 2021; Gur *et al.*, 2022). The use of HTML code, as outlined in this paper, while preserving the general constraints and prospects of unconventional web-scraped data, addresses the issue of content analysis since it is not particular to any specific language or technology.

### 3.1 Sample

The sample under consideration includes 4,888 Italian municipalities, which corresponds to 61.9% of the total number of municipalities (as of 2025). It is crucial to acknowledge the limitation imposed by the unavailability of data from the Wayback Machine of the [Internet Archive](#),<sup>8</sup> which results in only

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<sup>8</sup>The Wayback Machine, a digital archive hosted by the Internet Archive, is a comprehensive repository of historical web content dating back as far as twenty-six years, offering invaluable insights into the evolving landscape of digital communication.

partial accessibility of municipal websites for data retrieval.<sup>9</sup> We relied on this tool to retrieve homepage information from all Italian municipalities for two years: 2013 and 2021. We selected 2013 because it refers to the year before the implementation of the 2014 – 2020 cohesion fund cycle. The choice of 2021 is twofold: first, it represents the following year after the end of a cycle, hence useful to evaluate the impact of the resources allocated so far; second, we were constrained by the availability of additional variables at municipal level whose time coverage ends in 2021. As a consequence, the sample of this study has been limited to municipal websites for which the web pages from 2013 and 2021 are available for consultation on the Internet Archive.

Table 1 provides an overview of our key outcome variables, namely HTML5 adoption, external link count, and total HTML tag count for our two survey years (2013 and 2021, respectively) and multiple subsamples. In 2013, HTML5 adoption was virtually nonexistent (mean adoption rate around 0.06), given the official release of this standard is on October 2014; by 2021, the overall adoption rate rose to nearly 50 percent, reflecting substantial diffusion following the rollout of cohesion policy funds. Likewise, both the median and dispersion of total tags and external links increased from 2013 to 2021, indicating that not only did more municipalities adopt HTML5, but their websites also changed in content and structure.

Table 1 further disaggregates the sample by geography (inner and non-inner areas;<sup>10</sup> northern and southern regions) and population size ( $> 5,000$  vs.  $\leq 5,000$  inhabitants). In 2013, smaller and more remote municipalities (inner, southern, or  $\leq 5,000$  population) tended to have slightly higher HTML5 adoption and tag counts than their larger or more central counterparts, although overall levels remained low. By 2021, these subgroup patterns persist to some

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<sup>9</sup>In order to determine whether the characteristics of our sample are similar to those of all Italian municipalities, we made a comparison between the distribution of the population of the sample and that of all municipalities in Italy. As shown in Figure A2, a comparison of the two distributions reveals a high degree of similarity.

<sup>10</sup>Within the Italian SNAI strategy, inner areas are municipalities characterized by a high degree of marginalization. They are identified as those located more than 27.7 minutes by car from the nearest hub municipality (*i.e.*, a municipality or cluster of municipalities capable of providing essential services such as schools, hospitals and train stations) (NUVAP, 2022).

extent - municipalities with a population  $> 5,000$  and those in northern regions exhibit marginally higher adoption rates - yet the convergence in mean adoption across all divisions underscores the broad reach of the policy intervention. The reported means, standard deviations, medians and interquartile ranges in each cell illustrate both central tendency and variability, setting the stage for our subsequent regression analyses.

Table 1: *Descriptive Statistics by Year, Subgroup, and Treatment Status*

Year	Subgroup	Variable	Observations	Treated	Mean	SD	Median	Q1	Q3
<i>2013</i>									
	All Observations	External Links	4888	0	7.2218	5.8761	5.0	3.00	10.00
	All Observations	HTML5 Adoption	4888	0	0.0610	0.2393	0.0	0.00	0.00
	All Observations	Total Tags	4888	0	390.1935	299.1501	361.5	191.75	535.00
	Inner Area	External Links	2378	0	7.1976	5.9104	5.0	3.00	10.00
	Inner Area	HTML5 Adoption	2378	0	0.0656	0.2476	0.0	0.00	0.00
	Inner Area	Total Tags	2378	0	374.5034	279.2170	347.5	188.00	519.00
	Non-Inner Area	External Links	2510	0	7.2446	5.8445	5.0	3.00	10.00
	Non-Inner Area	HTML5 Adoption	2510	0	0.0566	0.2311	0.0	0.00	0.00
	Non-Inner Area	Total Tags	2510	0	405.0586	316.2186	377.0	195.00	543.00
	Northern Regions	External Links	3264	0	7.4151	5.8761	5.0	3.00	10.00
	Northern Regions	HTML5 Adoption	3264	0	0.0539	0.2259	0.0	0.00	0.00
	Northern Regions	Total Tags	3264	0	392.4712	301.7526	367.5	186.00	537.00
	Population $> 5,000$	External Links	1497	0	6.8985	5.9725	5.0	3.00	9.00
	Population $> 5,000$	HTML5 Adoption	1497	0	0.0521	0.2223	0.0	0.00	0.00
	Population $> 5,000$	Total Tags	1497	0	441.4369	348.2284	412.0	200.00	612.00
	Population $\leq 5,000$	External Links	3391	0	7.3645	5.8282	6.0	3.00	10.00
	Population $\leq 5,000$	HTML5 Adoption	3391	0	0.0649	0.2463	0.0	0.00	0.00
	Population $\leq 5,000$	Total Tags	3391	0	367.5715	271.7070	341.0	190.00	500.00
	Southern Regions & Islands	External Links	1624	0	6.8331	5.8586	5.0	3.00	8.00
	Southern Regions & Islands	HTML5 Adoption	1624	0	0.0751	0.2637	0.0	0.00	0.00
	Southern Regions & Islands	Total Tags	1624	0	385.6158	293.8886	353.0	216.00	529.00
<i>2021</i>									
	All Observations	External Links	4888	566	12.4583	10.1835	10.0	5.00	17.00
	All Observations	HTML5 Adoption	4888	566	0.4937	0.5000	0.0	0.00	1.00
	All Observations	Total Tags	4888	566	626.1716	446.9461	616.5	379.00	821.25
	Inner Area	External Links	2378	268	12.1018	10.1194	9.0	5.00	17.00
	Inner Area	HTML5 Adoption	2378	268	0.4996	0.5001	0.0	0.00	1.00
	Inner Area	Total Tags	2378	268	594.5017	437.1439	579.0	346.75	792.00
	Non-Inner Area	External Links	2510	298	12.7960	10.2344	10.0	6.00	17.00
	Non-Inner Area	HTML5 Adoption	2510	298	0.4880	0.5000	0.0	0.00	1.00
	Non-Inner Area	Total Tags	2510	298	656.1761	454.0918	648.5	413.00	850.00
	Northern Regions	External Links	3264	286	12.6872	10.0481	10.0	6.00	17.00
	Northern Regions	HTML5 Adoption	3264	286	0.4795	0.4997	0.0	0.00	1.00
	Northern Regions	Total Tags	3264	286	647.4464	444.1162	642.5	410.75	844.00
	Population $> 5,000$	External Links	1462	238	13.9494	12.0573	10.0	5.25	20.00
	Population $> 5,000$	HTML5 Adoption	1462	238	0.5527	0.4974	1.0	0.00	1.00
	Population $> 5,000$	Total Tags	1462	238	699.2729	492.5246	677.0	431.25	944.75
	Population $\leq 5,000$	External Links	3426	328	11.8219	9.1980	9.0	5.00	15.00
	Population $\leq 5,000$	HTML5 Adoption	3426	328	0.4685	0.4991	0.0	0.00	1.00
	Population $\leq 5,000$	Total Tags	3426	328	594.9766	422.2548	590.0	366.25	786.00
	Southern Regions & Islands	External Links	1624	280	11.9982	10.4382	8.0	4.00	17.00
	Southern Regions & Islands	HTML5 Adoption	1624	280	0.5222	0.4997	1.0	0.00	1.00
	Southern Regions & Islands	Total Tags	1624	280	583.4126	449.6820	547.5	337.00	776.50

*Notes:* This table presents descriptive statistics for the number of HTML5 adoption (proportion adopting), external links, and total HTML tags of municipal websites in 2013 and 2021. Subgroups are geographic and population splits. Columns report the number of observations, count of treated municipalities, mean, standard deviation, median, first quartile (Q1), and third quartile (Q3).

## 3.2 Cohesion Funds

The capabilities of municipal websites and e-government services are profoundly shaped by funding mechanisms and administrative capacity. Simply put, developing and maintaining robust digital services requires financial resources for technology infrastructure, software, skilled personnel and training. Not all municipalities have equal access to such resources, leading to disparities in e-government development. In many countries, higher-level governments (national or state) and supranational bodies (such as the EU) play a crucial role in funding local digital initiatives, especially in economically weaker areas. The European Union’s Cohesion Policy treats structural funds as a primary tool to reduce regional disparities and stimulate development ([Fratesi, 2025](#)). Over time, these European Structural and Investment Funds (ESIF) have grown substantially; nearly € 330 billion was earmarked for 2021–2027, roughly one-third of the entire EU budget. A portion of these funds was directed toward improving digital infrastructure and e-government capacity at the local level, particularly in communities that would struggle to finance such investments on their own. Adequate funding is a *sine qua non* for municipalities aiming to develop advanced online platforms; without external support, poorer or smaller municipalities risk falling behind in digital service provision, exacerbating a digital divide between well-resourced cities and those with lean budgets.

The empirical analysis is primarily supported by data retrieved from [Open-Coesione](#), an open government initiative focused on the Italian Cohesion Policy ([PCM, 2025](#)). This initiative is overseen by the Department for Cohesion Policy within the Presidency of the Council of Ministers. This archive collects all the information concerning projects (also partially) financed within the Administrative Capacity line of action of the EU structural funds starting from the 2007 – 2013 programming cycle, which includes also funds coming from co-financing from both the Italian central government and local authorities. We consider for our analysis the 2014 – 2020 cycle. More specifically, we focus only on a specific set of funding: networks and digital services. The overarching theme encompasses network infrastructure and broadband/ultra-broadband connectivity, along with services for citizens and enterprises. Additionally, it

includes measures to assist enterprises to develop novel technologies. It also encompasses interventions for multimedia educational networks and laboratories in schools, e-government projects, e-health services (centralized medical appointment hubs, services provided by the means of national health card, online services for networks of general practitioners) and e-inclusion (active citizenship, e-participation and public access centers on the web). Since 2007 up to the present (data updated up to October 31, 2024), the value of projects monitored and supported by cohesion policies in digital networks and services has exceeded 10 billion euros, with 70,240 projects funded. Of these, over 6 billion concern projects were financed in the 2014-2020 programming period.<sup>11</sup>

In the case of Italy, 1,180 municipality projects have been funded for a total amount of € 267,659,662.<sup>12</sup> Figure A1 illustrates a comparison between the density distributions of Cohesion Fund allocations across all Italian municipalities and our selected analytical sample for 2021. It is important to note that the data are aggregated for municipality, and have undergone log transformation, in order to address the issue of skewness in the funding distributions. The density curves demonstrate a high degree of alignment, particularly at lower and mid-range fund values, thereby confirming that the selected sample closely reflects the overall distribution. However, minor discrepancies at higher funding levels indicate slight differences. Nevertheless, the selected sample robustly represents approximately 87% of the total Cohesion Fund amounts allocated, suggesting minimal bias in subsequent analytical interpretations based on this dataset.

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<sup>11</sup>Further information is available for consultation at [OpenCoesione Networks and digital services](#).

<sup>12</sup>Notice that in our analysis we considered only municipal-specific projects. Although they represent almost all of the funded projects, some of them are distributed across several municipalities or at provincial/regional level. We decided to exclude them because it would not have been possible to deduce the actual amount of expenditure received by each municipality. In our case, projects with multiple beneficiaries represented roughly 3.16% of the entire amount of funding.

### 3.3 Web Based Data

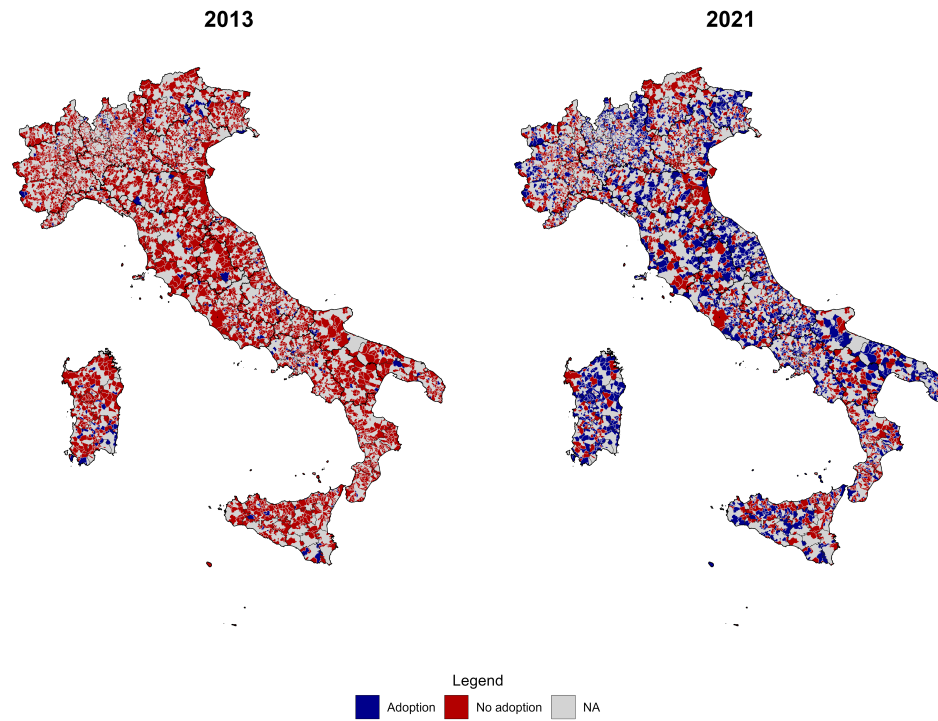
The methodology employed in this study involve the use of web scraping techniques to process the content of websites, thereby transforming the unstructured data into structured variables that are suitable for analysis. Furthermore, the use of HTML code analysis offers supplementary insights into the technological capabilities and online sophistication of local authorities. It is possible to draw inferences regarding the potential for innovation on the part of the municipality in question by examining the coding practices and the complexity of the websites. The methodologies employed in this study facilitate the extraction and structuring of online data, thereby enabling a nuanced examination of online activities over time. Our approach aligns with that of previous studies (Blazquez *et al.*, 2018; Crosato *et al.*, 2021; Bottai *et al.*, 2024), which sought to utilise data obtained from websites to identify patterns in their online activity. In order to extract the relevant online data, a process of information retrieval was initiated. To this end, the URLs (Uniform Resource Locator), reported by each municipality, were accessed with a view to obtaining the desired information. The content of each web page was obtained through the use of web scraping techniques on the Wayback Machine hosted by the Internet Archive, enabling us to specify relevant dates, thereby facilitating the collection of data from multiple years for each web page (Arora *et al.*, 2016).

In the course of data collection, the entire content and HTML code for the homepages of local authorities were extracted. The data set encompasses two distinct periods, namely 2013 and 2021, thereby incorporating the potential alterations that transpired subsequent to the 2014–2020 cohesion program within the online framework. The nature of the data was found to be unstructured, primarily due to the fact that the websites of municipalities are designed with communication as a primary objective, rather than for the purpose of analytical assessment. Consequently, a process of data structuring was undertaken to obtain a count of external links, a count of the HTML tags, and the presence of HTML5 tags in the codes employed by the municipality in constructing their websites. The methodological approach adopted in this study was designed to facilitate a comprehensive examination of the content and coding practices

employed.

Figure 1 depicts the adoption of the HTML5 standard among Italian municipalities, comparing the years 2013 and 2021. The figure clearly demonstrates a marked increase in HTML5 adoption across municipalities over the examined period, indicating significant progress in digital infrastructure and technological advancement at the local administrative level. The spatial representation reveals broader and denser adoption in 2021, particularly highlighting municipalities that transitioned from non-adopters in 2013, since the standard was not officially presented, to adopters by 2021. These visual patterns underscore the diffusion of web technology standards throughout Italy, thereby providing a clear basis for evaluating the effectiveness and reach of digital transformation policies.

Figure 1: *Adoption of HTML5 by Italian municipalities in the years 2013 and 2021*



*Notes:* The figure provides detailed data regarding the municipalities that adopted the HTML5 standard in the years 2013 and 2021 in our sample.

*Sources:* Authors' personal elaboration based on [ISTAT \(2025\)](#) and [Internet Archive](#).

### 3.4 Municipal Data

In order to validate the robustness of our results, we have further tested the baseline model by controlling for multiple sets of covariates which enriched our dataset.

First, economic conditions of inhabitants (*eco*) were proxied by average municipal income. This variable captures municipal heterogeneity in economic factors that potentially influence both demand and supply-side determinants (Gallo and Pagliacci, 2020). Data on *eco* are sourced from municipal-level fiscal declarations provided by the Italian Ministry of Economics and Finance (MEF, 2024).

Second, demographic factors (*demo*) were incorporated into the model, specifically the lagged log population, with the aim of accounting for agglomeration effects. These effects are widely recognized as influential for industrial activity concentration (Carlino, 1980). Data for *demo* originates from Istat (2024b).

Third, institutional characteristics of local governments (*gov*) are controlled for, including mayoral age, gender, educational attainment (degree or higher), the average age of municipal council members, and a dummy variable indicating civic list governance. Institutional factors have been shown to significantly impact local industrial development. Specifically, younger politicians tend to behave strategically by increasing spending and attracting higher government transfers, which can influence local outcomes (Alesina *et al.*, 2019). Gender is included since female politicians generally demonstrate greater government efficiency, concern for social welfare, cooperation, team orientation and lower likelihood of corruption (Chattopadhyay and Duflo, 2004; Hernández-Nicolás *et al.*, 2018; Bucci *et al.*, 2024; Lodi *et al.*, 2025), potentially affecting policy implementation and resource allocation (Funk and Gathmann, 2015). Educational attainment captures formal human capital of local politicians, linked to improved governance quality (Geys, 2017); for instance, Mitra (2025) demonstrate through how more educated Italian mayors allocate greater investment to public infrastructure. Data for *gov* variables are obtained from the Italian Ministry

of the Interior MINT’s (2024) registry of local and regional administrators.<sup>13</sup>

Fourth, geographical covariates (*geo*), specifically altitude and municipal surface area (in square kilometres), are included to control for variations in logistic costs driven by geographic heterogeneity (Hesse and Rodrigue, 2004). Data for *geo* variables are retrieved from Istat (2024c).

Finally, we include three Municipal Administration Quality Indicators (MAQI) proposed by Cerqua *et al.* (2025). These indicators synthesize local administration quality across three pillars: bureaucratic quality and capacity (Pillar I), the quality of local politicians (Pillar II), and municipal fiscal and economic performance (Pillar III).<sup>14</sup>

### 3.5 Methods

The present study employs a strategy of empirical inquiry, grounded in the methodological approach delineated by Atella *et al.* (2023). This methodology is instrumentalized to estimate the causal relationship between European Union funding received by local municipalities for website improvements and the quality of their digital services. In this paper, a difference-in-differences (DiD) framework is adopted for specific analysis (Roth *et al.*, 2023). To address heterogeneity in the amount of funds allocated across municipalities, a generalized version of the DiD approach with continuous treatment intensity is implemented, as described in Card (1992). In this particular setting, the variable of interest—the treatment variable—is the cumulative amount of EU funds received by each subject. This serves as a proxy for the intensity of treatment received by each subject. This approach facilitates the comprehensive

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<sup>13</sup>This registry provides comprehensive biographical, political affiliation, education, and professional data on elected municipal, provincial, metropolitan, and regional officials.

<sup>14</sup>Pillar I, focused on public employees, includes the following variables: average years of education, number of bureaucrats per 1,000 inhabitants, average number of absences, and turnover rate. Pillar II concerned key political figures (*i.e.*, the mayor, deputy mayor, executive committee members, and president of the local council) and includes: average years of education, gender balance index, and the share of white-collar workers. Pillar III related to local government performance and comprises: spending rigidity, spending capacity, collection capacity, and the share of the municipal budget allocated to investments (Cerqua *et al.*, 2025).

exploitation of the granular information concerning policy implementation that is contained within the specified dataset.

We estimate two DiD specifications: (i) a classic 2×2 DiD with a binary treatment indicator and (ii) a generalized DiD with a continuous treatment intensity.

The empirical model specified with binary treatment (Imbens and Wooldridge, 2009; Baker *et al.*, 2025) is as follow:

$$Y_{it} = \theta_i + \lambda_t + \delta (D_i \times \text{Post}_t) + \beta' X_{it} + \varepsilon_{it} \quad (1)$$

where in addition to the definitions above:

- $i$  indexes municipalities and  $t \in \{2013, 2021\}$  indexes years;
- $Y_{it}$  is our outcome of interest (*e.g.*, a binary indicator for HTML5-compliance, or—alternatively—the count of external links or total HTML tags). When  $Y_{it}$  is binary, we estimate (1) via a fixed-effects (FEs) logit, conversely, when  $Y_{it}$  is continuous (counts of links/tags), we estimate (1) via linear FEs;
- $\theta_i$  are municipality FEs;
- $\lambda_t$  are year FEs;
- $X_{it}$  is a vector of time-varying controls (see Section 3.4), with coefficients  $\beta$ ;
- $D_i$  is a binary indicator equal to 1 if municipality  $i$  ever receives cohesion funding in the 2014–2020 window, and 0 otherwise;
- $\text{Post}_t$  is a post-period dummy, equal to 1 for  $t = 2021$  and 0 for  $t = 2013$ ;
- $D_i \times \text{Post}_t$  is the standard 2×2 DiD interaction;  $\delta$  is the causal DiD-estimate of treatment on  $Y_{it}$ ;
- $\varepsilon_{it}$  is the idiosyncratic error term.

The empirical model specified as a generalized DiD with continuous treatment (Bertrand *et al.*, 2004; Hansen, 2007) is:

$$Y_{it} = \theta_i + \lambda_t + \beta' X_{it} + \gamma \ln(\text{Funds}_{it}) + \varepsilon_{it} \quad (2)$$

where:

- $i$  indexes municipalities and  $t \in \{2013, 2021\}$  indexes years;
- $Y_{it}$  is our outcome of interest (*e.g.*, a binary indicator for HTML5-compliance, or—alternatively—the count of external links or total HTML tags). When  $Y_{it}$  is binary, we estimate (2) via a FEs logit, conversely, when  $Y_{it}$  is continuous (counts of links/tags), we estimate (2) via linear FEs;
- $\theta_i$  are municipality FEs;
- $\lambda_t$  are year FEs;
- $X_{it}$  is a vector of time-varying controls (see Section 3.4), with coefficients  $\beta$ ;
- $\text{Funds}_{it}$  is cumulative EU funding for municipality  $i$  over 2014–2020, so that  $\gamma$  measures the (log-linear) effect of funding intensity on  $Y_{it}$ ;
- $\varepsilon_{it}$  is the idiosyncratic error term.

A key challenge in observational studies is the potential endogeneity of treatment assignment, as selection into treatment may be influenced by underlying characteristics of the municipalities. Within the DiD framework, identifying the causal effect of  $\text{Funds}_{it}$  relies on the assumption that the allocation of EU funds is exogenous with respect to the trends in municipal outcomes (Besley and Case, 2000; Heckman, 2000). However, this assumption may not hold if municipalities that are more likely to receive funding systematically differ from those that do not — particularly if these differences are correlated with their fiscal capacity or other unobserved factors affecting outcome trends.

To mitigate this issue, we control for a comprehensive set of covariates that could influence both the probability of receiving EU funding and the evolution of local performance indicators. These include institutional characteristics, as the ability to participate in and secure EU funding might depend on factors such as political incentives, which have also been shown to affect financial management practices at the local level (Caravaggio *et al.*, 2025; Di Stefano and Resce, 2025). In addition to these institutional and political controls, we include geographical and demographic variables, to further account for differences across municipalities that could confound the relationship between funding and website quality. The variables included are those presented in Section 3.4.

## 4 Results

Here we present the results obtained from the estimation of the model in eq. 1 and 2 discussed in Section 3.5.

We begin by presenting the estimates of  $Y_{it}$  shown in Table 2 of the impact of EU Cohesion Policy funds on the three outcomes of interest: HTML5 adoption, external links, and total HTML tags on municipal websites over the years 2013–2021, where: *HTML5 adoption*, represents a dummy variable for the implementation of the new standard in the website code; *external links* reports the number of referral to other entities in the website, useful as a proxy of the number of connections of the municipality; *Total Tag* is a continuous variable for the total number of HTML tags in the page representing the complexity of the webpage. Columns (1)-(2) present results when the treatment is a binary indicator, while Columns (3)-(4) re-estimate the model replacing the dummy with a continuous measure (the total amount of funding received in log).

The coefficient for *HTML5 adoption* is found to be positive and statistically significant, indicating that the cohesion funds have a favourable impact on the degree to which the municipality’s capacity to improve and innovate its website is reinforced. In the baseline specification (column 1), the binary treatment increases the probability of HTML5 adoption by approximately 5.1

percentage points ( $p < 0.05$ ). After adding the full set of controls (column 2), the magnitude and significance remain unchanged, confirming the robustness of the positive effect. The continuous treatment in columns (3)–(4) likewise yields a statistically significant positive coefficient. In contrast, the analysis of *External links* reveals that when the treatment is binary, point estimates in columns (1)–(2) indicate a positive but uncertain effect. The transition to the continuous measure (columns 3–4) also results in a modest but non-significant increase in the number of external links. This absence of precision may be indicative of heterogeneity in the flows of information and connections with other entities across municipalities. Finally, for *Total Tags*, representative of website complexity, the binary treatment reduces the total number of tags by about 56 tags (highly significant at the 1% level) in both the base and full models. The continuous treatment similarly decreases tag counts by roughly 5.3 tags per funding unit ( $p < 0.01$ ). This suggests that EU funding may encourage more efficient, streamlined markup even as municipalities adopt modern standards.

These results indicate a discernible positive correlation between the adoption of HTML5 and the EU funds allocated at the municipal level. This finding remains consistent across all specifications. This underscores the critical role of EU funds in accelerating the digitalization process in municipalities, thereby outpacing the adoption of innovations in municipalities lacking such financial resources.

Table 2: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – Full Sample*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.0506** (0.0225)	0.0505** (0.0227)			0.4914 (0.4668)	0.4867 (0.4699)			-55.8699*** (20.6212)	-58.5546*** (20.7448)		
Treatment (continuous)			0.0045** (0.0021)	0.0045** (0.0021)			0.0474 (0.0431)	0.0476 (0.0433)			-5.2569*** (1.9027)	-5.4535*** (1.9136)
Taxable Income		-0.0000 (0.0000)		-0.0000 (0.0000)		-0.0001 (0.0001)		-0.0001 (0.0001)		-0.0004 (0.0063)		-0.0004 (0.0063)
Population		-0.0000 (0.0000)		-0.0000 (0.0000)		-0.0003* (0.0001)		-0.0003* (0.0001)		-0.0142** (0.0064)		-0.0142** (0.0064)
Mayor Age		-0.0013*** (0.0004)		-0.0013*** (0.0004)		-0.0244*** (0.0093)		-0.0244*** (0.0093)		-0.1329 (0.4085)		-0.1315 (0.4085)
Mayor Female (binary)		0.0120 (0.0181)		0.0120 (0.0181)		0.2001 (0.3761)		0.1997 (0.3761)		4.9103 (16.6044)		4.9718 (16.6040)
Mayor Degree (binary)		0.0127 (0.0135)		0.0127 (0.0135)		0.2113 (0.2790)		0.2117 (0.2790)		34.4709*** (12.3187)		34.4151*** (12.3184)
Civic List (binary)		0.0173 (0.0133)		0.0172 (0.0133)		0.0791 (0.2754)		0.0777 (0.2754)		-35.5533*** (12.1578)		-35.3999*** (12.1581)
Municipal Council Avg Age		0.0014 (0.0013)		0.0014 (0.0013)		0.0362 (0.0273)		0.0362 (0.0273)		1.5392 (1.2050)		1.5396 (1.2049)
Altitude		-0.0010 (0.0011)		-0.0010 (0.0011)		-0.0060 (0.0227)		-0.0060 (0.0227)		-0.7034 (1.0003)		-0.7031 (1.0003)
Surface Area		-0.0280 (0.0444)		-0.0280 (0.0444)		-0.5157 (0.9193)		-0.5165 (0.9193)		-17.1831 (40.5861)		-17.0915 (40.5854)
MAQI Bureaucratic Burden		0.0018 (0.0012)		0.0018 (0.0012)		0.0636** (0.0253)		0.0637** (0.0253)		1.7607 (1.1179)		1.7563 (1.1179)
MAQI Political Environment		0.0002 (0.0007)		0.0002 (0.0007)		0.0016 (0.0149)		0.0016 (0.0149)		-0.2185 (0.6594)		-0.2150 (0.6594)
MAQI Economic Environment		-0.0011 (0.0013)		-0.0011 (0.0013)		-0.0358 (0.0266)		-0.0358 (0.0266)		-1.7802 (1.1752)		-1.7839 (1.1752)
Num. obs.	9776	9776	9776	9776	9776	9776	9776	9776	9776	9776	9776	9776

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

## 4.1 Context

It is well established that Italian municipalities exhibit significant variations in administrative capacity, largely due to persistent territorial disparities (Cerqua *et al.*, 2025; Di Stefano and Resce, 2025). These divides reflect long-standing structural differences, including the North–South dualism (Nifo and Vecchione, 2014; Greco *et al.*, 2018; Antulov-Fantulin *et al.*, 2021), the marginalization of Inner Areas (Gallo and Pagliacci, 2020), and disparities linked to municipal size.

To examine how these factors shape the impact of cohesion policies on municipal web performance, we implement three sample splits that reflect key dimensions of Italy’s digital divide. In this section, we present the results of subgroup analyses based on the following partitions:

1. Population size: the first categorization is distinguished by the delineation between municipalities based on their respective population sizes, comparing those with  $\leq 5,000$  inhabitants and those with  $> 5,000$  inhabitants,

considering population in year 2013;<sup>15</sup>

2. Remoteness: in the second differentiation, municipalities are divided based on the Inner Areas classification;<sup>16</sup>
3. Geographic area: for the third division, municipalities are separated in the North and Centre regions from those in the South and Islands (also known as *Mezzogiorno*), according to the Istat regional classification.<sup>17</sup>

The findings of this analysis indicate that the beneficial influence of the EU Cohesion Fund on the adoption of HTML5 is contingent on specific contextual factors. Small municipalities (population  $\leq 5,000$ ; Table 3) exhibit a strong positive response: the binary treatment increases HTML5 adoption, and the same occurs considering the amount of funding. In such contexts, the implementation of cohesion funds has been demonstrated to boost innovation in digital public services. Also, this is evidenced by a decrease in total tag count that is statistically significant for both binary and continuous treatment. This is indicative of a dual effect that encompasses simultaneous modernization and streamlining of code. In contrast, an increase for the number of external links is observed in the results, although with no statistical significance.

When we split the sample taking into account the proximity or distance to essential public services, municipalities of inner (marginal) areas in Table 4 exhibited a statistically significant increase in the adoption of new technologies such as HTML5 ( $p < 0.01$ ) for both binary and continuous effects. This finding underscores the crucial role of EU funds in facilitating the digital transition of peripheral localities. In addition, the efficacy of the proposed treatment has been substantiated by empirical observation. Specifically, the intervention has been shown to augment the network’s structural efficiency, as evidenced by the significant statistical enhancement in the number of external links. These observations suggest a marked increase in the interconnectedness amongst local

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<sup>15</sup>See Figure A3.

<sup>16</sup>We considered all municipalities classified, in terms of driving distance from hub municipalities, as intermediate (*Intermedio*), peripheral (*Periferico*), and ultra-peripheral (*Ultra periferico*) (NUVAP, 2022).

<sup>17</sup>See Figure A4.

authorities, which have traditionally been perceived as operating in a largely isolated capacity, remote from the reach of service provisions.

Evidence of the North-South divide is finally apparent in Tables 5 and 6 which depict Northern-central and Southern-islands municipalities, respectively. Northern municipalities exhibited minimal treatment effect on HTML5 adoption; however, they did streamline their structure and reduce the complexity of their websites for both binary and continuous treatment, with a high statistical significance. In contrast, Southern and Island municipalities achieved pronounced HTML5 adoption (for both dichotomous and continuous treatment, both  $p < 0.01$ ) between funding and digital upgrades, as indicated by the minimal change in tags. This suggests that funding plays a primary role in driving broader digital upgrades rather than simply pruning code in economically lagging regions. Moreover, a greater prevalence of external hyperlinks is observed in this sample, thereby reinforcing the significance of connections with external entities, particularly in the context of an area that has been identified as lagging behind in the process of digitalization.

Table 3: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – Population ≤ 5,000*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.1025*** (0.0292)	0.1022*** (0.0294)			0.6251 (0.5545)	0.6450 (0.5585)			-88.7156*** (25.4879)	-82.9227*** (25.6517)		
Treatment (continuous)			0.0091*** (0.0027)	0.0091*** (0.0027)			0.0560 (0.0511)	0.0580 (0.0515)			-8.2276*** (2.3487)	-7.6594*** (2.3647)
Taxable Income		0.0000 (0.0000)		0.0000 (0.0000)		0.0000 (0.0001)		0.0000 (0.0001)		0.0035 (0.0063)		0.0035 (0.0063)
Population		-0.0002** (0.0001)		-0.0002** (0.0001)		-0.0023 (0.0015)		-0.0023 (0.0015)		0.0514 (0.0705)		0.0512 (0.0705)
Mayor Age		-0.0012** (0.0005)		-0.0012** (0.0005)		-0.0113 (0.0103)		-0.0113 (0.0103)		-0.0633 (0.4718)		-0.0589 (0.4719)
Mayor Female (binary)		0.0241 (0.0217)		0.0238 (0.0217)		0.3127 (0.4125)		0.3108 (0.4125)		-20.6505 (18.9459)		-20.4047 (18.9460)
Mayor Degree (binary)		0.0024 (0.0167)		0.0026 (0.0167)		0.6038* (0.3160)		0.6049* (0.3160)		32.6631** (14.5138)		32.5393** (14.5132)
Civic List (binary)		0.0223 (0.0166)		0.0222 (0.0166)		-0.1270 (0.3154)		-0.1277 (0.3154)		-40.5144*** (14.4851)		-40.3989*** (14.4857)
Municipal Council Avg Age		0.0007 (0.0015)		0.0007 (0.0015)		0.0346 (0.0279)		0.0346 (0.0279)		1.8044 (1.2836)		1.8040 (1.2836)
Altitude		-0.0007 (0.0020)		-0.0007 (0.0020)		-0.0229 (0.0380)		-0.0230 (0.0380)		-1.5795 (1.7437)		-1.5780 (1.7436)
Surface Area		0.0538 (0.0746)		0.0538 (0.0746)		0.5373 (1.4154)		0.5372 (1.4154)		15.8826 (65.0106)		15.9670 (65.0105)
MAQI Bureaucratic Burden		0.0014 (0.0013)		0.0014 (0.0013)		0.0431* (0.0242)		0.0432* (0.0242)		1.3682 (1.1123)		1.3603 (1.1124)
MAQI Political Environment		-0.0007 (0.0009)		-0.0007 (0.0009)		-0.0085 (0.0162)		-0.0086 (0.0162)		0.2105 (0.7448)		0.2157 (0.7449)
MAQI Economic Environment		-0.0015 (0.0014)		-0.0015 (0.0014)		-0.0440 (0.0271)		-0.0439 (0.0271)		-1.2619 (1.2467)		-1.2714 (1.2467)
Num. obs.	6782	6782	6782	6782	6782	6782	6782	6782	6782	6782	6782	6782

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 4: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – Inner Areas*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.1344*** (0.0327)	0.1311*** (0.0329)			2.0006*** (0.6720)	1.8474*** (0.6753)			-37.2251 (28.4548)	-38.6308 (28.6221)		
Treatment (continuous)			0.0119*** (0.0030)	0.0116*** (0.0030)			0.1775*** (0.0612)	0.1636*** (0.0614)			-3.8632 (2.5888)	-3.9646 (2.6041)
Taxable Income		0.0000 (0.0000)		0.0000 (0.0000)		0.0002 (0.0002)		0.0001 (0.0002)		0.0102 (0.0085)		0.0102 (0.0085)
Population		-0.0001*** (0.0000)		-0.0001*** (0.0000)		-0.0030*** (0.0008)		-0.0030*** (0.0008)		-0.0811** (0.0325)		-0.0816** (0.0325)
Mayor Age		-0.0013** (0.0006)		-0.0013** (0.0006)		-0.0227* (0.0125)		-0.0227* (0.0125)		0.2044 (0.5314)		0.1993 (0.5314)
Mayor Female (binary)		0.0044 (0.0275)		0.0040 (0.0275)		-0.3649 (0.5649)		-0.3701 (0.5650)		-41.7401* (23.9441)		-41.5417* (23.9430)
Mayor Degree (binary)		0.0278 (0.0192)		0.0282 (0.0192)		0.9426** (0.3932)		0.9482** (0.3931)		41.6347** (16.6647)		41.6185** (16.6606)
Civic List (binary)		0.0227 (0.0190)		0.0223 (0.0190)		0.1972 (0.3897)		0.1914 (0.3898)		-30.7134* (16.5187)		-30.5507* (16.5178)
Municipal Council Avg Age		0.0015 (0.0018)		0.0015 (0.0018)		0.0444 (0.0367)		0.0439 (0.0367)		3.3928** (1.5570)		3.3844** (1.5566)
Altitude		-0.0006 (0.0020)		-0.0006 (0.0020)		-0.0237 (0.0415)		-0.0238 (0.0415)		-1.4466 (1.7594)		-1.4509 (1.7592)
Surface Area		0.0414 (0.0731)		0.0415 (0.0731)		-0.0270 (1.4994)		-0.0265 (1.4995)		7.6840 (63.5509)		7.9209 (63.5445)
MAQI Bureaucratic Burden		0.0009 (0.0016)		0.0009 (0.0016)		0.0640** (0.0321)		0.0641** (0.0321)		2.0505 (1.3599)		2.0455 (1.3598)
MAQI Political Environment		-0.0014 (0.0010)		-0.0014 (0.0010)		-0.0075 (0.0207)		-0.0076 (0.0207)		0.5771 (0.8755)		0.5829 (0.8755)
MAQI Economic Environment		-0.0032* (0.0016)		-0.0032* (0.0016)		-0.0624* (0.0337)		-0.0621* (0.0337)		-1.3902 (1.4264)		-1.3954 (1.4262)
Num. obs.	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table 5: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – North-Centre Regions*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	-0.0129 (0.0311)	-0.0152 (0.0313)			-0.3522 (0.6354)	-0.3282 (0.6401)			-107.6016*** (28.3278)	-101.5460*** (28.5141)		
Treatment (continuous)			-0.0006 (0.0029)	-0.0008 (0.0029)			-0.0343 (0.0590)	-0.0321 (0.0594)			-9.8745*** (2.6305)	-9.2768*** (2.6483)
Taxable Income		-0.0000 (0.0000)		-0.0000 (0.0000)		-0.0002 (0.0002)		-0.0002 (0.0002)		-0.0041 (0.0068)		-0.0040 (0.0068)
Population		0.0000 (0.0000)		0.0000 (0.0000)		0.0000 (0.0002)		0.0000 (0.0002)		0.0119 (0.0105)		0.0118 (0.0105)
Mayor Age		-0.0003 (0.0006)		-0.0003 (0.0006)		-0.0155 (0.0126)		-0.0155 (0.0126)		-0.0654 (0.5596)		-0.0610 (0.5596)
Mayor Female (binary)		0.0094 (0.0209)		0.0094 (0.0209)		0.1132 (0.4273)		0.1134 (0.4273)		4.0116 (19.0334)		4.1100 (19.0345)
Mayor Degree (binary)		0.0002 (0.0173)		0.0003 (0.0173)		0.1432 (0.3546)		0.1428 (0.3546)		37.4378** (15.7968)		37.4659** (15.7979)
Civic List (binary)		0.0366** (0.0165)		0.0366** (0.0165)		0.3130 (0.3370)		0.3140 (0.3370)		-32.5230** (15.0126)		-32.2530** (15.0140)
Municipal Council Avg Age		0.0024 (0.0016)		0.0024 (0.0016)		0.0246 (0.0331)		0.0247 (0.0331)		1.2319 (1.4727)		1.2273 (1.4728)
Altitude		0.0014 (0.0061)		0.0014 (0.0061)		0.0261 (0.1244)		0.0261 (0.1244)		2.4137 (5.5435)		2.4165 (5.5439)
Surface Area		-0.0226 (0.0466)		-0.0227 (0.0466)		0.0407 (0.9542)		0.0410 (0.9542)		-12.0980 (42.5083)		-12.0964 (42.5111)
MAQI Bureaucratic Burden		0.0010 (0.0016)		0.0010 (0.0016)		0.0538* (0.0318)		0.0538* (0.0318)		1.4943 (1.4180)		1.4965 (1.4181)
MAQI Political Environment		0.0013 (0.0009)		0.0013 (0.0009)		0.0085 (0.0188)		0.0086 (0.0188)		-0.7823 (0.8362)		-0.7901 (0.8362)
MAQI Economic Environment		-0.0008 (0.0019)		-0.0008 (0.0019)		-0.0445 (0.0380)		-0.0445 (0.0380)		-0.2019 (1.6929)		-0.1978 (1.6931)
Num. obs.	6528	6528	6528	6528	6528	6528	6528	6528	6528	6528	6528	6528

Notes: \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

Table 6: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – South-Islands Regions*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.1160*** (0.0332)	0.1178*** (0.0337)			1.5193** (0.7066)	1.5200** (0.7188)			22.2674 (30.5074)	8.1924 (31.0269)		
Treatment (continuous)			0.0096*** (0.0030)	0.0098*** (0.0031)			0.1442** (0.0648)	0.1464** (0.0658)			1.6296 (2.7963)	0.4386 (2.8389)
Taxable Income		0.0000* (0.0000)		0.0000* (0.0000)		0.0002 (0.0004)		0.0002 (0.0004)		0.0051 (0.0183)		0.0049 (0.0183)
Population		-0.0000** (0.0000)		-0.0000** (0.0000)		-0.0004** (0.0002)		-0.0004** (0.0002)		-0.0312*** (0.0082)		-0.0313*** (0.0082)
Mayor Age		-0.0024*** (0.0007)		-0.0024*** (0.0007)		-0.0351** (0.0145)		-0.0352** (0.0145)		-0.2626 (0.6273)		-0.2563 (0.6272)
Mayor Female (binary)		0.0182 (0.0366)		0.0181 (0.0366)		0.4917 (0.7808)		0.4899 (0.7807)		6.2012 (33.7062)		6.1865 (33.7066)
Mayor Degree (binary)		0.0438** (0.0221)		0.0444** (0.0221)		0.3347 (0.4722)		0.3355 (0.4720)		23.6241 (20.3836)		23.7573 (20.3801)
Civic List (binary)		-0.0216 (0.0229)		-0.0220 (0.0229)		-0.2715 (0.4894)		-0.2739 (0.4893)		-26.7820 (21.1262)		-26.8414 (21.1251)
Municipal Council Avg Age		-0.0004 (0.0023)		-0.0005 (0.0023)		0.0568 (0.0493)		0.0570 (0.0493)		1.9423 (2.1275)		1.9258 (2.1272)
Altitude		-0.0010 (0.0011)		-0.0010 (0.0011)		-0.0055 (0.0237)		-0.0054 (0.0237)		-0.7390 (1.0240)		-0.7411 (1.0240)
Surface Area		-0.0576 (0.1431)		-0.0599 (0.1432)		-5.6788* (3.0557)		-5.6927* (3.0551)		-70.8192 (131.9064)		-71.1697 (131.9009)
MAQI Bureaucratic Burden		0.0032 (0.0020)		0.0032 (0.0020)		0.0765* (0.0424)		0.0769* (0.0424)		1.5000 (1.8307)		1.5001 (1.8307)
MAQI Political Environment		-0.0016 (0.0012)		-0.0017 (0.0012)		-0.0072 (0.0249)		-0.0075 (0.0249)		0.9984 (1.0762)		0.9953 (1.0761)
MAQI Economic Environment		-0.0015 (0.0018)		-0.0016 (0.0018)		-0.0200 (0.0393)		-0.0194 (0.0393)		-1.8655 (1.6954)		-1.8776 (1.6958)
Num. obs.	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

## 5 Conclusions

This paper examines the impact of EU Cohesion Policy funds on the digitalization of local governments in Italy, using the quality of municipal websites as a proxy for e-government capacity. Using web scraping techniques and a generalized Difference-in-Differences approach, we evaluated whether municipalities receiving targeted funding for digital networks and services exhibited measurable improvements in technological sophistication.

Our results indicate that cohesion funds have had a positive and statistically significant effect on the adoption of HTML5 — reflecting greater alignment with modern web standards — and on reducing HTML tag complexity, which is associated with improved website loading performance. These findings suggest that EU investments have contributed to basic technological upgrading for recipient municipalities. However, we find no consistent evidence of improvements in external link integration, implying that the effects may be limited to infrastructure rather than broader digital openness or interactivity.

Subgroup analyses reveal that the effects are more pronounced in smaller municipalities and in those located in the South and Inner Areas, pointing to the potential of cohesion policy to partially alleviate structural digital divides. Nevertheless, the persistence of significant disparities highlights the need for complementary interventions aimed at strengthening institutional capacity and fostering more advanced forms of digital engagement, particularly in lagging territories.

These findings contribute to the emerging literature on the governance effects of cohesion policy and demonstrate the utility of web-based indicators in evaluating local-level public sector digitalization. Future research should investigate whether these technological upgrades translate into more effective public service delivery and increased citizen engagement.

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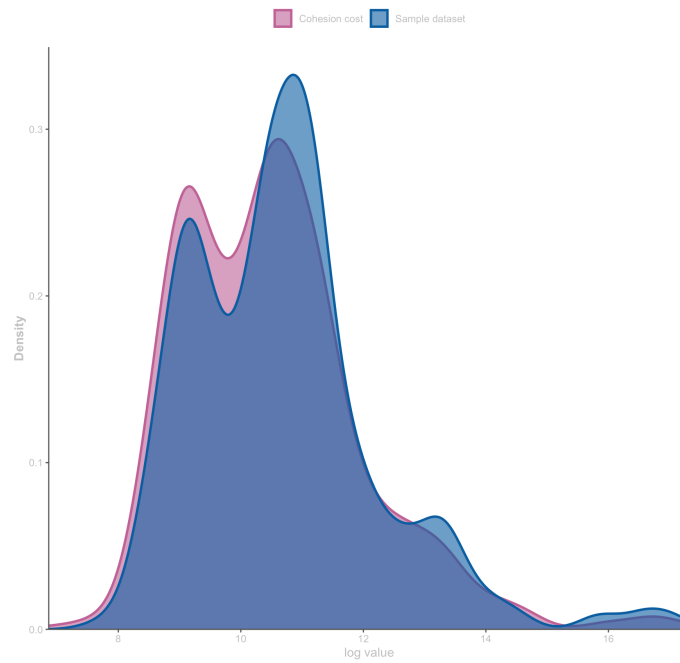
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# Appendix

## A.1 Additional figures and tables

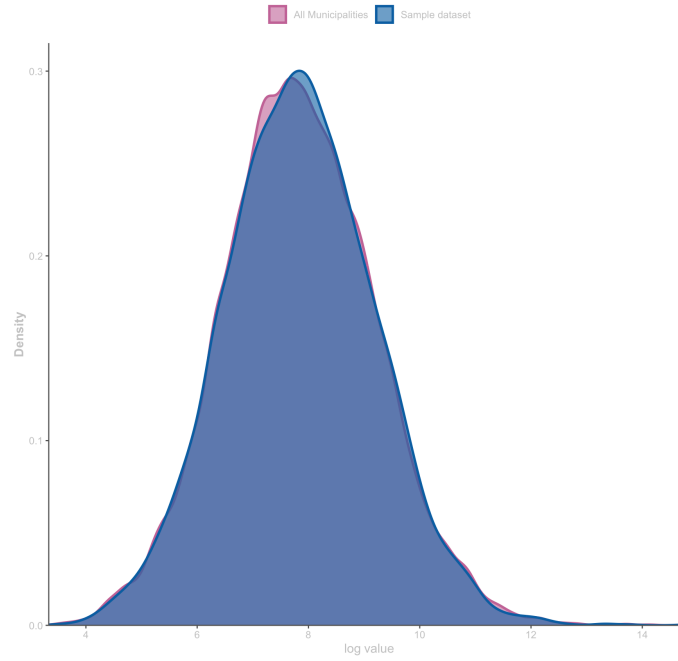
Figure A1: *Cohesion Funds 2014–2020 density received by Italian municipalities (networks and digital services)*



*Notes:* The figure compare the Cohesion Fund values received by Italian municipalities with the sample used for analysis. Values have been log-transformed. Our sample is representative of 87% of the total amount that was funded.

*Sources:* Authors' personal elaboration based on [PCM \(2025\)](#).

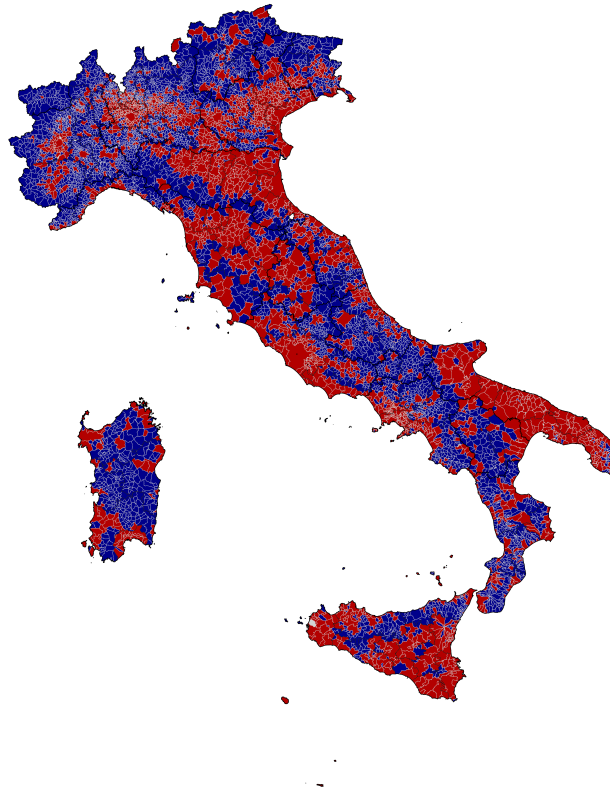
Figure A2: *Population density of Italian municipalities (2013)*



*Notes:* Population values for Italian municipalities and sample used for analysis; values are log-transformed.

*Sources:* Authors' personal elaboration based on [Istat \(2024b\)](#).

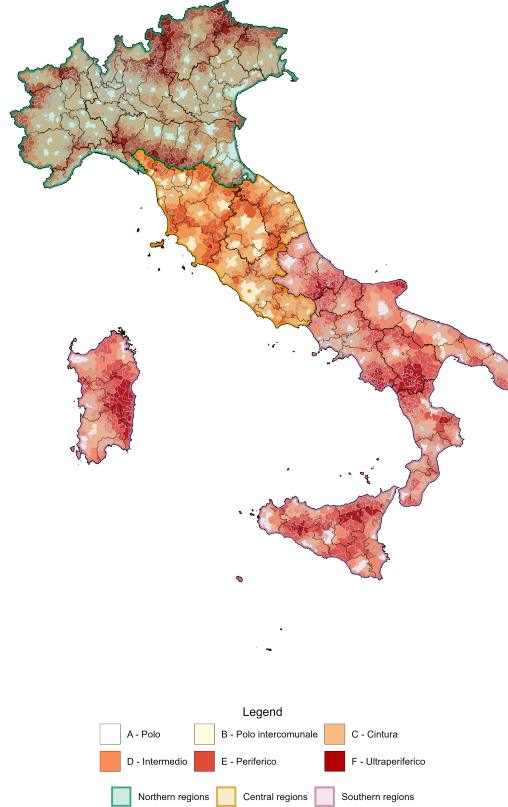
Figure A3: *Municipalities classified by population (2013)*



*Notes:* *A - Polo* stands for municipal hub, *B - Polo intercomunale* stands for inter-municipal hub, *C - Cintura* stands for belt municipality, *D - Intermedio* stands for intermediate municipality, *E - Periferico* stands for peripheral municipality, and *E - Ultraperiferico* stands for ultra-peripheral municipality. Inner areas are those within the categories C, D, and E.

*Sources:* Authors' personal elaboration based on [ISTAT \(2025\)](#) and [Istat \(2024a\)](#).

Figure A4: *Municipalities classified by the SNAI and macro-regional areas*



*Notes:* A - *Polo* stands for municipal hub, B - *Polo intercomunale* stands for inter-municipal hub, C - *Cintura* stands for belt municipality, D - *Intermedio* stands for intermediate municipality, E - *Periferico* stands for peripheral municipality, and F - *Ultraperiferico* stands for ultra-peripheral municipality. Inner areas are those within the categories C, D, and E.

*Sources:* Authors' personal elaboration based on ISTAT (2025) and NUVAP (2022).

Table A1: *Descriptive Statistics for year 2013 by subgroups*

Subgroup	Variable	Obs.	Mean	SD	Median	Q1	Q3
All Observations	Altitude	4810	351.31	290.28	290.00	114.00	517.75
All Observations	Civic List (binary)	4810	0.69	0.46	1.00	0.00	1.00
All Observations	MAQI Bureaucratic Burden	4810	101.57	3.24	101.71	100.26	103.13
All Observations	MAQI Economic Environment	4810	99.28	5.35	100.52	96.89	102.74
All Observations	MAQI Political Environment	4810	103.03	8.43	102.85	97.06	108.58
All Observations	Mayor Age	4810	49.91	13.54	51.00	43.00	59.00
All Observations	Mayor Degree (binary)	4810	0.45	0.50	0.00	0.00	1.00
All Observations	Mayor Female (binary)	4810	0.13	0.34	0.00	0.00	0.00
All Observations	Council Avg Age	4810	45.46	4.73	45.38	42.17	48.63
All Observations	Employees Avg Age	4810	49.88	11.16	51.70	49.20	54.90

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Table A1 (cont.)

Subgroup	Variable	Obs.	Mean	SD	Median	Q1	Q3
All Observations	Population	4810	7548.55	46518.55	2566.00	1059.75	6310.00
All Observations	Surface Area	4810	37.96	52.43	22.20	11.45	43.65
All Observations	Taxable Income	4810	17067.99	3622.96	17183.19	14232.09	19584.09
Inner Area	Altitude	2332	483.61	311.88	448.00	257.00	669.25
Inner Area	Civic List (binary)	2332	0.67	0.47	1.00	0.00	1.00
Inner Area	MAQI Bureaucratic Burden	2332	101.93	3.65	102.04	100.38	103.72
Inner Area	MAQI Economic Environment	2332	98.54	5.88	99.55	95.36	102.46
Inner Area	MAQI Political Environment	2332	102.21	8.47	102.09	96.31	107.79
Inner Area	Mayor Age	2332	49.41	14.13	51.00	42.00	59.00
Inner Area	Mayor Degree (binary)	2332	0.44	0.50	0.00	0.00	1.00
Inner Area	Mayor Female (binary)	2332	0.11	0.31	0.00	0.00	0.00
Inner Area	Council Avg Age	2332	45.26	4.86	45.22	41.85	48.50
Inner Area	Employees Avg Age	2332	49.94	12.47	52.50	49.20	55.80
Inner Area	Population	2332	3776.11	6420.66	1687.50	756.50	3834.50
Inner Area	Surface Area	2332	46.08	51.44	29.26	15.28	56.54
Inner Area	Taxable Income	2332	15419.74	3171.66	15397.04	12803.94	17736.10
Non-Inner Area	Altitude	2478	226.80	200.17	185.00	69.00	321.00
Non-Inner Area	Civic List (binary)	2478	0.71	0.45	1.00	0.00	1.00
Non-Inner Area	MAQI Bureaucratic Burden	2478	101.23	2.76	101.44	100.19	102.62
Non-Inner Area	MAQI Economic Environment	2478	99.98	4.69	100.97	98.14	102.86
Non-Inner Area	MAQI Political Environment	2478	103.80	8.33	103.50	97.92	109.69
Non-Inner Area	Mayor Age	2478	50.38	12.96	51.00	43.00	59.00
Non-Inner Area	Mayor Degree (binary)	2478	0.45	0.50	0.00	0.00	1.00
Non-Inner Area	Mayor Female (binary)	2478	0.16	0.36	0.00	0.00	0.00
Non-Inner Area	Council Avg Age	2478	45.65	4.61	45.58	42.50	48.75
Non-Inner Area	Employees Avg Age	2478	49.82	9.77	51.10	49.10	53.60
Non-Inner Area	Population	2478	11098.72	64315.42	3810.50	1645.25	8914.50
Non-Inner Area	Surface Area	2478	30.31	52.21	17.12	9.01	32.31
Non-Inner Area	Taxable Income	2478	18619.12	3324.46	18878.36	16532.31	20692.13
Northern Regions	Altitude	3192	331.05	293.96	265.00	106.00	460.00
Northern Regions	Civic List (binary)	3192	0.73	0.44	1.00	0.00	1.00
Northern Regions	MAQI Bureaucratic Burden	3192	101.38	3.20	101.63	100.18	102.96
Northern Regions	MAQI Economic Environment	3192	100.77	4.11	101.34	99.04	103.18
Northern Regions	MAQI Political Environment	3192	102.42	8.21	102.44	96.86	107.90
Northern Regions	Mayor Age	3192	50.94	11.77	51.00	43.00	60.00
Northern Regions	Mayor Degree (binary)	3192	0.40	0.49	0.00	0.00	1.00
Northern Regions	Mayor Female (binary)	3192	0.16	0.37	0.00	0.00	0.00
Northern Regions	Council Avg Age	3192	45.88	4.83	45.80	42.50	49.06
Northern Regions	Employees Avg Age	3192	47.76	11.80	50.40	48.10	52.50
Northern Regions	Population	3192	7092.24	51909.95	2473.50	985.25	6021.25
Northern Regions	Surface Area	3192	32.87	49.04	18.43	10.06	37.21
Northern Regions	Taxable Income	3192	18832.09	2832.17	18743.78	17021.04	20444.85
Population >5,000	Altitude	1474	188.18	186.85	136.00	40.00	280.00
Population >5,000	Civic List (binary)	1474	0.56	0.50	1.00	0.00	1.00
Population >5,000	External Links	1474	6.83	5.92	5.00	3.00	9.00
Population >5,000	HTML5 Adoption	1474	0.05	0.21	0.00	0.00	0.00
Population >5,000	MAQI Bureaucratic Burden	1474	101.45	1.78	101.49	100.52	102.53
Population >5,000	MAQI Economic Environment	1474	99.05	4.87	100.31	96.99	102.27

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Table A1 (cont.)

Subgroup	Variable	Obs.	Mean	SD	Median	Q1	Q3
Population >5,000	MAQI Political Environment	1474	106.89	7.71	106.37	101.44	112.47
Population >5,000	Mayor Age	1474	49.50	13.07	51.00	43.00	58.00
Population >5,000	Mayor Degree (binary)	1474	0.56	0.50	1.00	0.00	1.00
Population >5,000	Mayor Female (binary)	1474	0.12	0.32	0.00	0.00	0.00
Population >5,000	Council Avg Age	1474	45.85	4.07	45.93	43.00	48.63
Population >5,000	Employees Avg Age	1474	51.36	8.37	51.90	50.10	54.70
Population >5,000	Population	1474	20475.03	82583.31	10156.50	6928.25	17412.75
Population >5,000	Surface Area	1474	57.31	78.15	32.27	15.87	65.34
Population >5,000	Taxable Income	1474	18225.61	3518.71	18633.84	15581.86	20746.84
Population >5,000	Total Tags	1474	439.56	346.71	411.00	199.25	608.50
Population ≤ 5,000	Altitude	3336	423.39	298.54	372.50	203.00	604.00
Population ≤ 5,000	Civic List (binary)	3336	0.75	0.43	1.00	1.00	1.00
Population ≤ 5,000	MAQI Bureaucratic Burden	3336	101.62	3.70	101.86	100.06	103.52
Population ≤ 5,000	MAQI Economic Environment	3336	99.38	5.55	100.58	96.87	102.95
Population ≤ 5,000	MAQI Political Environment	3336	101.32	8.17	100.97	95.67	106.50
Population ≤ 5,000	Mayor Age	3336	50.09	13.75	51.00	43.00	60.00
Population ≤ 5,000	Mayor Degree (binary)	3336	0.40	0.49	0.00	0.00	1.00
Population ≤ 5,000	Mayor Female (binary)	3336	0.14	0.35	0.00	0.00	0.00
Population ≤ 5,000	Council Avg Age	3336	45.28	4.99	45.12	41.75	48.63
Population ≤ 5,000	Employees Avg Age	3336	49.22	12.13	51.50	48.30	55.00
Population ≤ 5,000	Population	3336	1837.03	1292.45	1531.50	757.00	2744.25
Population ≤ 5,000	Surface Area	3336	29.41	32.05	18.64	10.38	35.93
Population ≤ 5,000	Taxable Income	3336	16556.49	3550.29	16726.25	13663.42	18985.31
Southern Regions & Islands	Altitude	1618	391.28	278.68	375.50	137.25	590.00
Southern Regions & Islands	Civic List (binary)	1618	0.62	0.49	1.00	0.00	1.00
Southern Regions & Islands	MAQI Bureaucratic Burden	1618	101.94	3.28	101.88	100.42	103.52
Southern Regions & Islands	MAQI Economic Environment	1618	96.33	6.23	97.20	92.47	100.94
Southern Regions & Islands	MAQI Political Environment	1618	104.23	8.73	103.87	98.19	110.23
Southern Regions & Islands	Mayor Age	1618	47.87	16.31	51.00	42.00	58.00
Southern Regions & Islands	Mayor Degree (binary)	1618	0.54	0.50	1.00	0.00	1.00
Southern Regions & Islands	Mayor Female (binary)	1618	0.07	0.26	0.00	0.00	0.00
Southern Regions & Islands	Council Avg Age	1618	44.63	4.43	44.67	41.56	47.83
Southern Regions & Islands	Employees Avg Age	1618	54.06	8.31	55.40	52.90	57.50
Southern Regions & Islands	Population	1618	8448.76	33419.58	2741.50	1224.25	6910.50
Southern Regions & Islands	Surface Area	1618	47.99	57.24	30.36	16.05	56.76
Southern Regions & Islands	Taxable Income	1618	13587.76	2223.66	13289.06	12044.56	14763.22

Table A2: *Descriptive Statistics for year 2021 by subgroups*

Subgroup	Variable	Obs.	Mean	SD	Median	Q1	Q3
All Observations	Altitude	4810	351.49	290.28	290.00	114.00	517.75
All Observations	Civic List (binary)	4810	0.76	0.43	1.00	1.00	1.00
All Observations	MAQI Bureaucratic Burden	4810	98.96	5.57	100.08	97.02	102.19
All Observations	MAQI Economic Environment	4810	103.53	4.01	103.95	101.59	106.04
All Observations	MAQI Political Environment	4810	107.71	9.59	107.15	102.10	114.47
All Observations	Mayor Age	4810	52.27	13.42	53.00	45.00	62.00
All Observations	Mayor Degree (binary)	4810	0.45	0.50	0.00	0.00	1.00
All Observations	Mayor Female (binary)	4810	0.15	0.36	0.00	0.00	0.00
All Observations	Municipal Council Avg Age	4810	47.49	4.80	47.44	44.30	50.60
All Observations	Municipal Employees Avg Age	4810	49.88	11.16	51.70	49.20	54.90
All Observations	Population	4810	7378.82	45792.57	2442.50	987.25	6176.50
All Observations	Surface Area	4810	37.96	52.42	22.20	11.45	43.65
All Observations	Taxable Income	4810	19045.65	3888.82	19177.68	16038.22	21702.03
Inner Area	Altitude	2332	483.80	311.85	448.00	259.00	669.25
Inner Area	Civic List (binary)	2332	0.76	0.42	1.00	1.00	1.00
Inner Area	MAQI Bureaucratic Burden	2332	99.17	6.21	100.41	96.84	102.93
Inner Area	MAQI Economic Environment	2332	103.05	4.60	103.51	100.66	106.09
Inner Area	MAQI Political Environment	2332	106.23	9.83	105.09	100.44	113.11
Inner Area	Mayor Age	2332	51.96	14.17	53.00	44.00	61.00
Inner Area	Mayor Degree (binary)	2332	0.43	0.49	0.00	0.00	1.00
Inner Area	Mayor Female (binary)	2332	0.13	0.34	0.00	0.00	0.00
Inner Area	Municipal Council Avg Age	2332	47.06	4.99	46.90	43.67	50.29
Inner Area	Municipal Employees Avg Age	2332	49.94	12.47	52.50	49.20	55.80
Inner Area	Population	2332	3621.70	6295.59	1559.50	700.00	3681.00
Inner Area	Surface Area	2332	46.08	51.44	29.24	15.28	56.54
Inner Area	Taxable Income	2332	17314.32	3471.24	17153.55	14597.63	19749.18
Non-Inner Area	Altitude	2478	226.97	200.19	185.50	69.00	321.00
Non-Inner Area	Civic List (binary)	2478	0.76	0.43	1.00	1.00	1.00
Non-Inner Area	MAQI Bureaucratic Burden	2478	98.76	4.89	99.84	97.10	101.66
Non-Inner Area	MAQI Economic Environment	2478	103.97	3.31	104.30	102.34	106.01
Non-Inner Area	MAQI Political Environment	2478	109.11	9.14	108.93	102.97	115.45
Non-Inner Area	Mayor Age	2478	52.56	12.66	53.00	45.00	62.00
Non-Inner Area	Mayor Degree (binary)	2478	0.47	0.50	0.00	0.00	1.00
Non-Inner Area	Mayor Female (binary)	2478	0.16	0.37	0.00	0.00	0.00
Non-Inner Area	Municipal Council Avg Age	2478	47.90	4.58	47.94	44.80	50.92
Non-Inner Area	Municipal Employees Avg Age	2478	49.82	9.77	51.10	49.10	53.60
Non-Inner Area	Population	2478	10914.58	63309.34	3664.00	1557.00	8782.75
Non-Inner Area	Surface Area	2478	30.32	52.20	17.12	9.01	32.31
Non-Inner Area	Taxable Income	2478	20674.98	3541.68	20914.51	18486.56	22817.16
Northern Regions	Altitude	3192	331.09	293.97	265.00	106.00	460.00
Northern Regions	Civic List (binary)	3192	0.75	0.43	1.00	1.00	1.00
Northern Regions	MAQI Bureaucratic Burden	3192	99.08	5.41	100.21	97.36	102.16
Northern Regions	MAQI Economic Environment	3192	104.28	3.38	104.55	102.62	106.41
Northern Regions	MAQI Political Environment	3192	106.96	9.28	106.30	101.51	113.63
Northern Regions	Mayor Age	3192	53.07	12.81	54.00	45.00	62.00
Northern Regions	Mayor Degree (binary)	3192	0.40	0.49	0.00	0.00	1.00
Northern Regions	Mayor Female (binary)	3192	0.18	0.38	0.00	0.00	0.00

*Continued on next page*

Table A2 (cont.)

Subgroup	Variable	Obs.	Mean	SD	Median	Q1	Q3
Northern Regions	Municipal Council Avg Age	3192	48.26	4.83	48.30	45.00	51.42
Northern Regions	Municipal Employees Avg Age	3192	47.76	11.80	50.40	48.10	52.50
Northern Regions	Population	3192	6998.75	51350.54	2391.50	927.75	5897.75
Northern Regions	Surface Area	3192	32.87	49.05	18.43	10.06	37.21
Northern Regions	Taxable Income	3192	20931.41	3085.54	20816.33	18992.10	22649.64
Population > 5,000	Altitude	1438	184.00	182.97	133.00	38.00	275.00
Population > 5,000	Civic List (binary)	1438	0.69	0.46	1.00	0.00	1.00
Population > 5,000	MAQI Bureaucratic Burden	1438	99.28	3.29	99.93	98.09	101.27
Population > 5,000	MAQI Economic Environment	1438	103.38	3.13	103.68	101.92	105.28
Population > 5,000	MAQI Political Environment	1438	113.58	7.34	113.31	108.07	119.08
Population > 5,000	Mayor Age	1438	51.23	12.98	52.00	44.00	60.00
Population > 5,000	Mayor Degree (binary)	1438	0.58	0.49	1.00	0.00	1.00
Population > 5,000	Mayor Female (binary)	1438	0.16	0.37	0.00	0.00	0.00
Population > 5,000	Municipal Council Avg Age	1438	47.70	3.95	47.81	45.08	50.25
Population > 5,000	Municipal Employees Avg Age	1438	51.25	8.43	51.90	50.10	54.60
Population > 5,000	Population	1438	20504.83	82266.32	10160.50	6873.50	17485.00
Population > 5,000	Surface Area	1438	57.15	78.72	31.83	15.37	64.90
Population > 5,000	Taxable Income	1438	20349.68	3694.25	20875.17	17458.97	22899.61
Population > 5,000	Total Tags	1438	696.44	490.27	675.50	431.25	941.50
Population ≤ 5,000	Altitude	3372	422.92	298.10	372.50	202.00	604.00
Population ≤ 5,000	Civic List (binary)	3372	0.79	0.41	1.00	1.00	1.00
Population ≤ 5,000	MAQI Bureaucratic Burden	3372	98.82	6.29	100.22	96.35	102.80
Population ≤ 5,000	MAQI Economic Environment	3372	103.59	4.33	104.13	101.39	106.47
Population ≤ 5,000	MAQI Political Environment	3372	105.21	9.34	104.89	99.86	112.10
Population ≤ 5,000	Mayor Age	3372	52.71	13.58	53.00	45.00	62.00
Population ≤ 5,000	Mayor Degree (binary)	3372	0.40	0.49	0.00	0.00	1.00
Population ≤ 5,000	Mayor Female (binary)	3372	0.14	0.35	0.00	0.00	0.00
Population ≤ 5,000	Municipal Council Avg Age	3372	47.40	5.12	47.30	43.83	50.80
Population ≤ 5,000	Municipal Employees Avg Age	3372	49.29	12.09	51.60	48.40	55.00
Population ≤ 5,000	Population	3372	1781.19	1290.53	1451.50	714.00	2642.25
Population ≤ 5,000	Surface Area	3372	29.77	32.48	18.83	10.45	36.43
Population ≤ 5,000	Taxable Income	3372	18489.55	3836.88	18685.12	15466.83	21045.83
Southern Regions & Islands	Altitude	1618	391.74	278.58	378.50	138.00	594.75
Southern Regions & Islands	Civic List (binary)	1618	0.78	0.42	1.00	1.00	1.00
Southern Regions & Islands	MAQI Bureaucratic Burden	1618	98.71	5.86	99.80	96.44	102.33
Southern Regions & Islands	MAQI Economic Environment	1618	102.04	4.69	102.36	99.53	104.88
Southern Regions & Islands	MAQI Political Environment	1618	109.21	9.99	108.58	102.85	117.01
Southern Regions & Islands	Mayor Age	1618	50.70	14.41	52.00	44.00	60.00
Southern Regions & Islands	Mayor Degree (binary)	1618	0.55	0.50	1.00	0.00	1.00
Southern Regions & Islands	Mayor Female (binary)	1618	0.09	0.29	0.00	0.00	0.00
Southern Regions & Islands	Municipal Council Avg Age	1618	45.97	4.37	45.92	42.92	48.80
Southern Regions & Islands	Municipal Employees Avg Age	1618	54.06	8.31	55.40	52.90	57.50
Southern Regions & Islands	Population	1618	8128.63	32123.67	2532.50	1096.00	6651.75
Southern Regions & Islands	Surface Area	1618	47.99	57.23	30.38	16.05	56.76
Southern Regions & Islands	Taxable Income	1618	15325.42	2306.43	15042.40	13764.30	16643.63

Table A3: *Treatment Effects (binary & continuous) on HTML5 Adoption (Binary), External Links, and Total Tags — South and Islands Above Median Funds*

	HTML5 Adoption (Binary)				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.0969*** (0.0358)	0.1006*** (0.0365)			1.4161* (0.7619)	1.4238* (0.7791)			22.6057 (32.8862)	6.3549 (33.6212)		
Treatment (continuous)			0.0184** (0.0075)	0.0176** (0.0075)			0.1723 (0.1598)	0.1686 (0.1596)			1.9572 (6.8998)	1.5586 (6.8924)
Taxable Income		0.0000* (0.0000)		0.0000* (0.0000)		0.0002 (0.0004)		0.0002 (0.0004)		0.0050 (0.0183)		0.0051 (0.0183)
Population		-0.0000** (0.0000)		-0.0000* (0.0000)		-0.0004** (0.0002)		-0.0004** (0.0002)		-0.0312*** (0.0082)		-0.0310*** (0.0083)
Mayor Age		-0.0024*** (0.0007)		-0.0024*** (0.0007)		-0.0352** (0.0146)		-0.0353** (0.0146)		-0.2605 (0.6285)		-0.2651 (0.6284)
Mayor Female (binary)		0.0183 (0.0366)		0.0179 (0.0366)		0.4929 (0.7811)		0.4887 (0.7809)		6.2031 (33.7067)		6.1790 (33.7161)
Mayor Degree (binary)		0.0457** (0.0221)		0.0433* (0.0221)		0.3576 (0.4720)		0.3304 (0.4724)		23.7769 (20.3671)		23.4794 (20.3964)
Civic List (binary)		-0.0223 (0.0230)		-0.0213 (0.0229)		-0.2797 (0.4895)		-0.2676 (0.4895)		-26.8384 (21.1242)		-26.7120 (21.1339)
Municipal Council Avg Age		-0.0005 (0.0023)		-0.0005 (0.0023)		0.0558 (0.0493)		0.0568 (0.0493)		1.9313 (2.1275)		1.9505 (2.1275)
Altitude		-0.0010 (0.0011)		-0.0010 (0.0011)		-0.0057 (0.0237)		-0.0054 (0.0237)		-0.7408 (1.0240)		-0.7371 (1.0243)
Surface Area		-0.0586 (0.1433)		-0.0553 (0.1432)		-5.6801* (3.0570)		-5.6097* (3.0569)		-70.9443 (131.9160)		-70.2946 (131.9867)
MAQI Bureaucratic Burden		0.0032 (0.0020)		0.0031 (0.0020)		0.0764* (0.0424)		0.0761* (0.0424)		1.4993 (1.8307)		1.4978 (1.8312)
MAQI Political Environment		-0.0016 (0.0012)		-0.0017 (0.0012)		-0.0070 (0.0249)		-0.0072 (0.0249)		0.9986 (1.0764)		0.9979 (1.0767)
MAQI Economic Environment		-0.0016 (0.0018)		-0.0016 (0.0018)		-0.0196 (0.0393)		-0.0195 (0.0393)		-1.8692 (1.6976)		-1.8600 (1.6984)
Num. obs.	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248	3248

Note: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table A4: *Treatment Effects (binary & continuous) on HTML5 Adoption (Binary), External Links, and Total Tags — Inner Areas Above Median Funds*

	HTML5 Adoption (Binary)				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	0.1068*** (0.0404)	0.1019** (0.0409)			1.9137** (0.8302)	1.7250** (0.8382)			-2.7116 (35.1377)	-0.5497 (35.5155)		
Treatment (continuous)			0.0182*** (0.0055)	0.0181*** (0.0055)			0.2185* (0.1140)	0.2096* (0.1139)			-8.6745* (4.8279)	-9.2432* (4.8248)
Taxable Income		0.0000 (0.0000)		0.0000 (0.0000)		0.0002 (0.0002)		0.0002 (0.0002)		0.0106 (0.0085)		0.0111 (0.0085)
Population		-0.0001*** (0.0000)		-0.0001*** (0.0000)		-0.0030*** (0.0008)		-0.0030*** (0.0008)		-0.0773** (0.0325)		-0.0783** (0.0325)
Mayor Age		-0.0013** (0.0006)		-0.0013** (0.0006)		-0.0225* (0.0126)		-0.0228* (0.0125)		-0.5114 (0.5319)		-0.5021 (0.5316)
Mayor Female (binary)		0.0065 (0.0276)		0.0038 (0.0275)		-0.3337 (0.5653)		-0.3646 (0.5652)		-42.2016* (23.9518)		-40.8053* (23.9488)
Mayor Degree (binary)		0.0283 (0.0192)		0.0282 (0.0192)		0.9441** (0.3936)		0.9406** (0.3933)		40.8839** (16.6772)		40.8916** (16.6675)
Civic List (binary)		0.0221 (0.0190)		0.0231 (0.0190)		0.1851 (0.3901)		0.1950 (0.3899)		-30.8568* (16.5295)		-31.4498* (16.5233)
Municipal Council Avg Age		0.0015 (0.0018)		0.0014 (0.0018)		0.0444 (0.0368)		0.0444 (0.0368)		3.5081** (1.5595)		3.5236** (1.5583)
Altitude		-0.0007 (0.0020)		-0.0006 (0.0020)		-0.0243 (0.0415)		-0.0237 (0.0415)		-1.4121 (1.7600)		-1.4374 (1.7591)
Surface Area		0.0458 (0.0732)		0.0406 (0.0731)		0.0323 (1.5002)		-0.0290 (1.4996)		6.1067 (63.5659)		8.7364 (63.5445)
MAQI Bureaucratic Burden		0.0010 (0.0016)		0.0008 (0.0016)		0.0652** (0.0321)		0.0638** (0.0321)		2.0608 (1.3609)		2.1203 (1.3603)
MAQI Political Environment		-0.0013 (0.0010)		-0.0014 (0.0010)		-0.0064 (0.0207)		-0.0075 (0.0207)		0.5623 (0.8758)		0.6125 (0.8757)
MAQI Economic Environment		-0.0031* (0.0016)		-0.0032** (0.0016)		-0.0609* (0.0337)		-0.0624* (0.0337)		-1.4112 (1.4269)		-1.3346 (1.4266)
Num. obs.	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756	4756

Note: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table A5: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – Population > 5,000*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	-0.0587 (0.0358)	-0.0644* (0.0362)			-0.5512 (0.8626)	-0.5836 (0.8721)			-22.2943 (36.6132)	-31.2168 (37.0065)		
Treatment (continuous)			-0.0053 (0.0033)	-0.0057* (0.0033)			-0.0428 (0.0797)	-0.0444 (0.0805)			-2.2233 (3.3829)	-2.9184 (3.4152)
Taxable Income		-0.0000** (0.0000)	-0.0000** (0.0000)		-0.0015*** (0.0005)		-0.0015*** (0.0005)		-0.0431* (0.0220)			-0.0430* (0.0220)
Population		-0.0000 (0.0000)	-0.0000 (0.0000)		-0.0001 (0.0002)		-0.0001 (0.0002)		-0.0112 (0.0074)			-0.0111 (0.0074)
Mayor Age		-0.0014* (0.0008)	-0.0014* (0.0008)		-0.0378* (0.0195)		-0.0379* (0.0195)		-0.2719 (0.8259)			-0.2733 (0.8258)
Mayor Female (binary)		-0.0204 (0.0334)	-0.0206 (0.0334)		-0.0836 (0.8037)		-0.0834 (0.8038)		68.2693** (34.1051)			68.1698** (34.1069)
Mayor Degree (binary)		0.0281 (0.0231)	0.0281 (0.0231)		-0.3967 (0.5569)		-0.3968 (0.5569)		40.8017* (23.6305)			40.8059* (23.6303)
Civic List (binary)		-0.0197 (0.0226)	-0.0193 (0.0226)		-0.2500 (0.5438)		-0.2450 (0.5436)		-36.4885 (23.0751)			-36.3391 (23.0684)
Municipal Council Avg Age		0.0049* (0.0029)	0.0049* (0.0029)		0.0804 (0.0704)		0.0805 (0.0704)		1.6533 (2.9859)			1.6568 (2.9858)
Altitude		-0.0014 (0.0013)	-0.0014 (0.0013)		-0.0015 (0.0315)		-0.0015 (0.0315)		-0.2971 (1.3379)			-0.2970 (1.3379)
Surface Area		-0.0910 (0.0557)	-0.0908 (0.0557)		-1.4498 (1.3399)		-1.4461 (1.3399)		-46.5824 (56.8585)			-46.5197 (56.8568)
MAQI Bureaucratic Burden		0.0022 (0.0041)	0.0022 (0.0041)		0.1637* (0.0987)		0.1633* (0.0987)		3.7643 (4.1901)			3.7699 (4.1902)
MAQI Political Environment		0.0013 (0.0014)	0.0013 (0.0014)		-0.0149 (0.0334)		-0.0151 (0.0334)		-1.6870 (1.4192)			-1.6859 (1.4192)
MAQI Economic Environment		-0.0004 (0.0029)	-0.0004 (0.0029)		-0.0312 (0.0703)		-0.0307 (0.0703)		-3.7599 (2.9851)			-3.7560 (2.9848)
Num. obs.	2994	2994	2994	2994	2994	2994	2994	2994	2994	2994	2994	2994

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

Table A6: *Treatment Effects (binary & continuous) on HTML5 Adoption, External Links, and Total Tags – Non-Inner Areas*

	HTML5 Adoption				External Links				Total Tags			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Treatment (binary)	-0.0237 (0.0310)	-0.0258 (0.0313)			-0.8696 (0.6475)	-0.8602 (0.6545)			-73.5936** (29.6696)	-75.2484** (29.9728)		
Treatment (continuous)			-0.0024 (0.0029)	-0.0025 (0.0029)			-0.0758 (0.0605)	-0.0739 (0.0611)			-6.6342** (2.7728)	-6.7216** (2.7995)
Taxable Income		-0.0000 (0.0000)		-0.0000 (0.0000)		-0.0003* (0.0002)		-0.0003* (0.0002)		-0.0104 (0.0094)		-0.0105 (0.0094)
Population		-0.0000 (0.0000)		-0.0000 (0.0000)		-0.0002 (0.0001)		-0.0002 (0.0001)		-0.0115* (0.0069)		-0.0113* (0.0069)
Mayor Age		-0.0012* (0.0007)		-0.0012* (0.0007)		-0.0278** (0.0136)		-0.0279** (0.0136)		0.2044 (0.6240)		0.1993 (0.6241)
Mayor Female (binary)		0.0153 (0.0241)		0.0152 (0.0241)		0.6085 (0.5040)		0.6086 (0.5040)		40.5586* (23.0794)		40.5259* (23.0825)
Mayor Degree (binary)		-0.0001 (0.0189)		-0.0001 (0.0189)		-0.4547 (0.3955)		-0.4536 (0.3955)		29.1574 (18.1100)		29.2249 (18.1117)
Civic List (binary)		0.0084 (0.0186)		0.0085 (0.0186)		-0.0926 (0.3885)		-0.0917 (0.3885)		-41.3882** (17.7904)		-41.2934** (17.7928)
Municipal Council Avg Age		0.0018 (0.0019)		0.0018 (0.0019)		0.0303 (0.0406)		0.0302 (0.0406)		-0.6528 (1.8607)		-0.6594 (1.8609)
Altitude		-0.0013 (0.0013)		-0.0013 (0.0013)		0.0004 (0.0272)		0.0004 (0.0272)		-0.3358 (1.2440)		-0.3338 (1.2442)
Surface Area		-0.0729 (0.0558)		-0.0729 (0.0558)		-1.0148 (1.1655)		-1.0118 (1.1656)		-38.8016 (53.3719)		-38.6000 (53.3770)
MAQI Bureaucratic Burden		0.0029 (0.0019)		0.0029 (0.0019)		0.0587 (0.0407)		0.0587 (0.0407)		1.4612 (1.8631)		1.4584 (1.8633)
MAQI Political Environment		0.0016 (0.0010)		0.0016 (0.0010)		0.0021 (0.0217)		0.0020 (0.0217)		-1.2095 (0.9937)		-1.2131 (0.9939)
MAQI Economic Environment		0.0020 (0.0021)		0.0020 (0.0021)		0.0089 (0.0431)		0.0090 (0.0431)		-2.2944 (1.9718)		-2.2866 (1.9720)
Num. obs.	5020	5020	5020	5020	5020	5020	5020	5020	5020	5020	5020	5020

Notes: \* p<0.10; \*\* p<0.05; \*\*\* p<0.01.

## A.2 HTML code

The *HyperText Markup Language* (HTML) is a standardized markup language designed to convey the semantic structure and content of a document to a web browser. Alongside *Cascading Style Sheets* (CSS) and *JavaScript* (JS), HTML is one of the foundational technologies of the World Wide Web.

A minimal semantic structure for a generic web page, with placeholder text, might look like this:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```

    <title>Lorem Ipsum Dolor</title>
</head>
<body>
  <header>
    <h1>Lorem Ipsum Dolor Sit Amet</h1>
    <p>Consectetur Adipiscing Elit</p>
    <nav>
      <ul>
        <li><a href="#section1">Section I</a></li>
        <li><a href="#section2">Section II</a></li>
        <li><a href="#section3">Section III</a></li>
        <li><a href="#section4">Section IV</a></li>
      </ul>
    </nav>
  </header>

  <main>
    <section id="section1">
      <h2>Section I</h2>
      <p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. </p>
    </section>

    <section id="section2">
      <h2>Section II</h2>
      <p>Ut pharetra sit amet aliquam id diam maecenas ultricies mi eget. </p>
      <ul>
        <li>Lorem ipsum dolor sit amet</li>
        <li>Consectetur adipiscing elit</li>
        <li>Integer molestie lorem at massa</li>
      </ul>
    </section>

```

```

<section id="section3">
  <h2>Section III</h2>
  <p>Faucibus ornare suspendisse sed nisi lacus sed viverra tellus. </p>
</section>

<section id="section4">
  <h2>Section IV</h2>
  <p>Quisque sagittis purus sit amet volutpat consequat. </p>
</section>
</main>

<footer>
  <section id="references">
    <h2>References</h2>
    <ol>
      <li>Lorem ipsum dolor sit amet, consectetur adipiscing elit.</li>
      <li>Vivamus lacinia odio vitae vestibulum vestibulum.</li>
    </ol>
  </section>
</footer>
</body>
</html>

```

Explanation of key tags:

- `<!DOCTYPE html>` declares the document type as HTML;
- The `<html>` element's `lang` attribute specifies the document language;
- `<head>` contains metadata: character set, viewport settings, and the document title (`<title>`);
- `<header>` groups introductory content: main heading (`<h1>`), subtitle (`<p>`), and navigation (`<nav>`);

- `<nav>` with an unordered list (`<ul>`) provides links (`<a>`) to each major section;
- `<main>` wraps the primary content sections, each marked with `<section>` and an `id` for linking;
- Headings `<h2>` define section titles in a hierarchical manner;
- Paragraphs (`<p>`) and lists (`<ul>`, `<ol>`) structure text and enumerations;
- `<footer>` contains closing material, here an ordered list of placeholder “references.”

This structure emphasizes semantic clarity, accessibility, and easy navigation, using placeholder (“Lorem ipsum”) text to illustrate where real content would appear.

### A.3 HTML5 Innovations

Major technical features introduced in HTML5 include:

- **built-in multimedia elements:** new tags like `<video>` and `<audio>` allow native embedding of video and audio streams without third-party plug-ins. This simplifies delivery of multimedia content (*e.g.*, announcements, streaming events) directly on web pages;
- **graphics and dynamic content:** The `<canvas>` element provides a bitmap drawing surface (for charts, maps, interactive graphics), and support for SVG (Scalable Vector Graphics) is fully integrated. These enable rich web applications (*e.g.*, real-time data visualizations) to run in the browser;
- **semantic structure:** HTML5 introduced several new semantic tags (*e.g.*, `<header>`, `<footer>`, `<section>`, `<article>`, `<nav>`, `<aside>`) that explicitly describe the role of page sections. These elements improve the logical structure of documents, making content more understandable to users;

- **enhanced forms and inputs:** new input types (such as `email`, `date`, `url`, `number`, `range`) are part of HTML5. These allow browsers to provide built-in validation and user-friendly controls (*e.g.*, date-pickers, numeric steppers), which streamline form-based interactions (*e.g.*, application forms, feedback widgets);
- **accessibility enhancements:** the HTML5 standard and related ARIA roles were designed with the purpose of enhancing accessibility. By providing semantic markup and explicit roles for dynamic content, HTML5 helps ensure that websites work well with screen readers and other assistive technologies. In particular, native support for multimedia and semantics has improved the accessibility of web content.