Is Competition Only One Click Away?
The Digital Markets Act Impact on Google Maps*

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Abstract

This paper examines the impact of the European Union's Digital Markets Act (DMA) on user search behavior and traffic to online mapping services, focusing on recent design changes to Google's search results page. In January 2024, Google modified how location-based queries are displayed for users in the EU by removing clickable maps and direct links to Google Maps. We leverage this change and implement a difference-in-differences (DiD) approach comparing EU and non-EU countries to evaluate how increased friction in accessing Google Maps affects search volumes and traffic patterns. We document a significant increase of over 21% in search queries for `maps` and `google maps`, largely redirecting users back to Google Maps. While searches for `apple maps` increased modestly, no significant changes are observed for other competitors such as `bing maps`. Organic desktop traffic to `www.google.com/maps` rose by approximately 40%, with no corresponding change in direct traffic or overall desktop visits. A placebo test using mobile traffic shows no effect, confirming the DMA as the causal driver. Engagement metrics suggest a modest decline in user experience. Overall, our findings indicate that while the DMA altered search user behavior, it did not substantially increase traffic to Google's competitors or reduce usage of Google's mapping services.

Keywords: Self-preferencing, Digital Platforms, Online Search, Digital Markets Act

JEL codes: L41, L86, K21

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1 Introduction

In the past years, there has been increasing scrutiny and criticism of the significant market power wielded by major online companies collectively known as GAFAM: Google, Apple, Facebook, Amazon, and Microsoft.[1] These tech giants have been accused of using their dominant positions to design and operate online sites and marketplaces in ways that favor their own products (Crémer, de Montjoye and Schweitzer, 2019). One notable example is the European Union's fine against Google for abusing its market dominance by promoting its own comparison shopping service, Google Shopping, in search results (Cardoso and Ren, 2017). Similarly, Amazon was sued by the Federal Trade Commission in 2023 for biasing its "search results to favor Amazon's own products over those Amazon knows are of better quality" (FTC, 2023a; Etro, 2023).[2]

Online companies often counter these concerns by claiming that "competition is one click away" (Helft, 2009): platform design choices do not significantly prevent users from seeking the best service or product. According to this argument, if users choose GAFAM's services, it is due to superior quality, not because alternatives are hidden. However, this claim overlooks important frictions such as switching costs (Farrell and Klemperer, 2007), behavioral biases, and consumer inattention (Einav, Klopack and Mahoney, 2023; Miller, Sahni and Strulov-Shlain, 2023): all factors that significantly influence the adoption and continued use of online services (Allcott, Castillo, Gentzkow, Musolff and Salz, 2025).

This paper examines the impact of search result presentation on search volumes and online traffic in response to recent changes mandated by the Digital Markets Act (DMA) in the European Union (EU). The DMA aims to increase contestability in digital markets by ensuring fairer competition and providing consumers with more choice and better services. To comply with the DMA, Google changed the design of its search page for users located in the EU beginning in January 2024. Specifically, when a user searches for a location-based query (e.g., for a place, a shop, or a restaurant), the prominently displayed map is no longer clickable, and the signet linking to Google Maps has been removed (see Figure 1 for an example). Users can now only click on "directions", which provides transport advice but does not zoom in on the map or recommend nearby businesses. This design change addresses concerns that Google was leveraging its search engine to direct users to its own mapping service, thereby stifling competition and limiting consumer choice. Yet, it has drawn criticism from European users accustomed to clicking directly on the map to locate their destination on Google Maps.[3] Now, users must first access Google Maps, often by typing `maps` or `google`

[1] For a general discussion on the antitrust concerns about digital platforms, see Tucker (2019); Scott Morton, Bouvier, Ezrachi, Jullien, Katz, Kimmelman, Melamed and Morgenstern (2019); Fletcher, Crawford, Crémer, Dinielli, Heidhues, Luca, Salz, Schnitzer, Morton, Seim et al. (2023).

[2] Similar claims have been raised within the ad tech industry, where the Federal Trade Commission accused Google of favoring bidders who use its technology in its ad-space auction platform (FTC, 2023b).

[3] See, for example, a user discussion on Reddit regarding the inability to click on maps in search results:

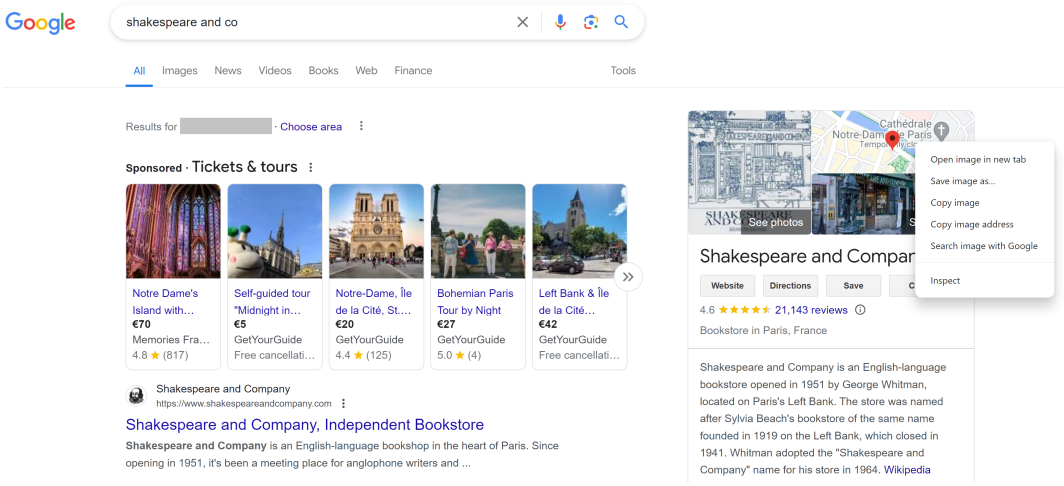


Figure 1. Snapshot of Google results for the query `Shakespeare and co` (July 3, 2024) from the EU: the map is not clickable and the Google Maps signet is absent.

`maps` into Google Search. After selecting a mapping service, they must then search for their place of interest again. This change effectively removes Google's one-click advantage over competitors in the online mapping services market.

We take advantage of the changes to Google's search results pages induced by the DMA to examine how search page design affects users' search behavior and, consequently, online traffic to relevant services. Specifically, we address the following questions: Has the DMA increased the likelihood that users discover and begin to adopt alternative mapping services? Is competition really just one click away? Leveraging the timing of the policy and its exclusive applicability to desktop users in the EU, we employ a difference-in-differences (DiD) approach. We compare Google search volume and online traffic from EU countries to a set of non-EU countries, focusing on one year after January 2024 relative to the previous year.

First, we document that Google search volumes for the queries `maps` and `google maps` increased by more than 21% in EU countries after the DMA, providing strong evidence of a statistically significant rise in additional search activity directed at accessing Google Maps services. This result is highly robust to the choice of control groups and model specifications.

The increase in searches for `maps` observed in our data could, in principle, facilitate user discovery of alternative mapping services. The DMA introduced an additional step for users to access Google Maps, requiring them to issue a search rather than accessing the service directly from the search results page. As a result, the overall effort or friction involved in reaching Google Maps has increased. While this added search effort imposes a small cost on users, it may also create greater opportunity for competing services to

https://www.reddit.com/r/GoogleMaps/comments/1bc7jy7/going.to.google.maps.directly.from.google.search/.

attract users through Google's organic search results. However, a substantial share of the increased search volume for `maps` appears to redirect users back to Google Maps.[4] While there is a statistically significant increase in searches for `apple maps`, a service predominantly used by Apple device users, no significant changes are observed for `bing maps` or other alternative mapping services. Moreover, even the observed increase for `apple maps` is orders of magnitude smaller than the search volumes for `maps` and `google maps`. Similarly, geo-localized queries related to restaurants or shopping show a slight, non-significant decline, suggesting that any reduction in usage of Google Search is limited.

To complement our findings based on search volume, we further explore the DMA's consequences by examining changes in actual traffic volumes to `www.google.com/maps`. For this analysis, we apply the same DiD approach used in the search volume analysis. We document a statistically significant increase of approximately 40% in organic search traffic to `www.google.com/maps` from desktop users. There is no corresponding increase in direct desktop traffic, indicating that users did not significantly adopt direct URL entry or bookmarks as alternative access methods. Importantly, we do not observe any significant effect on the total number of desktop visits to `www.google.com/maps`, suggesting that overall desktop traffic has remained stable. This aligns with the fact that only a minority of users access Google Maps through organic search; thus, the shift in access mode does not translate into a substantial change in total usage.

To further rule out the possibility that external factors, unrelated to the DMA, might be influencing traffic to Google Maps during the same period, we perform a placebo test using mobile traffic data, which should not be directly affected by the DMA's desktop-centric implementation. In line with this argument, we find no statistically significant change in mobile traffic, reinforcing the interpretation that our findings are attributable to the DMA rather than to concurrent external shocks.

Moreover, examining user engagement metrics reveals subtle yet significant changes. Specifically, there is a 5% reduction in the average duration of visits and a 16% increase in bounce rates, suggesting a possible deterioration of the user experience on Google Maps. These metrics indicate that, although overall traffic volumes were not impacted, user interactions on Google's mapping platform may have changed.

Finally, we analyze overall traffic volumes to `www.bing.com/maps` and `www.google.com` using the same DiD approach. We observe a limited impact of the DMA on these services. Traffic to `www.bing.com/maps` experienced a significant decrease, suggesting that the DMA has not led to a meaningful shift toward one of Google Maps' main competitors. Similarly, we find minimal evidence of changes in user engagement with Google's primary domain, `www.google.com`, indicating that the DMA-induced modifications have

[4] Appendix Figure A1 presents snapshots of Google Search results for the term `maps` for France, Germany, Italy, and Spain. In all cases, Google Maps consistently appears among the top two search results.

not significantly affected overall usage of Google's general search services.

Our study offers new empirical insights into how large online firms bias search results or use bundling strategies to integrate additional products (Prasad, Venkatesh and Mahajan, 2010; Derdenger and Kumar, 2013). Early research in this area has been primarily theoretical. Authors have explored platforms' strategies to bias search results (Hagiu and Jullien, 2011; Inderst and Ottaviani, 2012; De Corniere and Taylor, 2019), recommendations (Bourreau and Gaudin, 2022), and to favor integrated products (Carlton, Gans and Waldman, 2010; Anderson and Bedre-Defolie, 2021; Hagiu, Teh and Wright, 2022; Zennyo, 2022). The empirical literature on self-preferencing has largely focused on Amazon's marketplace (Gutierrez, 2021; Lam, 2021; Lee and Musolff, 2021; Raval, 2022; Farronato, Fradkin and MacKay, 2023; Reimers and Waldfogel, 2023), whereas our research examines Google's search engine and its impact on search behavior and online traffic. Previous studies have highlighted how Google's algorithm and Google News affect organic search visits to news outlets (Athey, Mobius and Pal, 2021; Calzada, Duch-Brown and Gil, 2023). For instance, Chiou (2017) demonstrated that integrating Google Flights into search results reduced clicks to competing travel agencies. Similarly, through an experimental design, Kim and Luca (2019) document that users prefer when Google's organic search results display reviews from multiple platforms rather than exclusively Google reviews. Relatedly, Allcott et al. (2025) empirically investigate the sources of Google's search market power, finding that while switching costs play a limited role, both quality beliefs and persistent inattention significantly contribute to its dominance.

We contribute by analyzing the effects of Google's search results changes under the Digital Market Act, which, while aiming to increase user choice (for instance, by altering default options for services like Google Maps), did not significantly alter traffic to Google Maps.[5] In line with Allcott et al. (2025), our findings indicate that the DMA's changes regarding default options alone are insufficient to significantly impact user behavior in the context of Google Maps. This suggests that a truly contestable market may require interventions that not only address choice architecture but also actively promote user awareness and engagement with alternative options.

We also contribute to the literature on online consumer search (Bronnenberg, Kim and Mela, 2016; Amano, Rhodes and Seiler, 2022; Ursu, Zhang and Honka, 2023; Honka, Seiler and Ursu, 2024). Previous studies have highlighted the significant impact of content aggregation, rankings, and links on search behavior and purchase decisions (Chiou and Tucker, 2017; Ursu, 2018; Roos, Mela and Shachar, 2020; Harris, Novarese and Wilson, 2022; Zhang, Ursu, Honka and Yao, 2023). The prominence of search results also affects organic traffic from search engines (Baye, De los Santos and Wildenbeest, 2016). Our research extends

[5] See Decarolis and Li (2023) for a broader analysis of the DMA's impact on online search and Google's market power.

these insights by examining how Google's compliance with the DMA, specifically removing its one-click advantage, impacts user behavior.

Finally, we contribute to the analysis of policies regulating digital marketplaces and their effects. Previous research has examined the General Data Protection Regulation (GDPR) and its impact on privacy and advertising (Goldfarb, 2018; Johnson, 2022; Johnson, Shriver and Goldberg, 2023; Goldberg, Johnson and Shriver, 2024; Miller and Skiera, 2024). Related to our study, Decarolis, Li and Paternollo (2023) found that regulatory actions in the EU, Russia, and Turkey, specifically aimed at removing contractual restrictions imposed by Google on the pre-installation of competing search engines on Android devices, effectively reduced Google's market share. Our study is among the first to examine the DMA's impact. Closest to our work, Waldfogel (2024) showed that after the EU designated Amazon as a "gatekeeper" platform in September 2023, Amazon's product rank advantage decreased. In contrast, we focus on Google, observing how users responded to Google's design change to comply with the DMA. Our results support the case for additional regulatory measures aimed at removing self-preferential features from Google Search, such as the "directions" button that steers users toward Google's own navigation services. Our findings suggest that while the removal of clickable map elements reduces default-based bias, many users may still overlook alternatives and return to Google Maps through organic search. To foster meaningful adoption of competing services, further regulatory steps may be needed to enhance visibility and salience of alternative options.

The remainder of this paper is structured as follows. Section 2 details our empirical context, encompassing the regulatory background of the Digital Markets Act (DMA) in Subsection 2.1, the data sources utilized in our analysis in Subsection 2.2, and our identification strategy designed to isolate the effects induced by the DMA in Subsection 2.3. Section 3 then presents our core findings regarding search volumes. This section focuses on changes in the volume of queries for `maps` and `google maps` (Subsection 3.1), queries related to competing mapping services (Subsection 3.2), and other pertinent queries that yield geo-referenced results (Subsection 3.3). Following this, Section 4 examines traffic data to provide further insights. We begin by analyzing shifts in the sources of desktop traffic to `www.google.com/maps` (Subsection 4.1.1). Subsequently, we explore overall changes in both desktop and mobile traffic (Subsection 4.1.2). Finally, we delve into the intensive margin of Google Maps usage by analyzing session durations and bounce rates (Subsection 4.2). Within Section 4.3, we also present data on desktop and mobile traffic for `www.google.com` and `www.bing.com/maps` to provide a comparative perspective. Section 5 then discusses the implications of our findings for policy. Lastly, Section 6 summarizes our key results and proposes potential directions for future research in this area.

2 Context, Data, and Empirical Strategy

2.1 Regulatory Context: the DMA and its Implementation

The European Union's Digital Markets Act (DMA) is a major regulatory initiative aimed at ensuring fair and open digital markets across the EU. The legislation, which "entered into force" on November 1, 2022, targets large online platforms designated as "gatekeepers" to curb anti-competitive practices such as self-preferencing (Cabral, Haucap, Parker, Petropoulos, Valletti and van Alstyne, 2021). On September 6, 2023, the European Commission designated six large companies (Alphabet, Amazon, Apple, ByteDance, Meta, and Microsoft) as gatekeepers. These companies were given six months, until March 2024, to comply with the new obligations and prohibitions set forth in the DMA.[6]

The DMA calls for significant changes in the way these platforms operate. In particular, the six gatekeepers are asked to partially redesign the way information is presented to users in order to "ensure contestability (i.e., the reduction of entry barriers) and to ensure fairness (i.e., a balance between the rights and obligations of the gatekeepers and their business users) of EU digital markets" (De Streel, Bourreau, Feasey, Fletcher, Kraemer and Monti, 2024). Alphabet has been designated as a gatekeeper for a group of online intermediation services, including Google Maps.[7] This service has traditionally been seamlessly integrated into Google's search results. Such integration has raised concerns about the contestability of the market for mapping services, as it could constitute a "dark pattern" used by the company to steer users to its own services. To comply with the DMA, Google could have displayed other geolocation applications alongside Google Maps.[8] Another alternative would have been to allow users to select their preferred mapping service through a choice screen, similar to how Google implemented a selection prompt for search engines in Google Chrome.[9] However, for desktop searches, Google decided to completely remove any link, clickable map, or signet that would allow users to directly access Google Maps with a single click (see Figure 1 for an example). This change does not affect mobile searches. As a result, users in the EU must now manually navigate to Google Maps or other mapping services when searching for a location-based query.[10,11]

[6] In the following figures, we refer to the period between September 2023 and March 2024 as the "DMA Compliance Period".

[7] Apple and Meta were not designated as gatekeepers for search or mapping services and they did not have to adjust their related services (Apple Maps and Bing Maps) in accordance with the DMA. See: https://ec.europa.eu/commission/presscorner/detail/en.

[8] For a broader discussion of Google's "choice architecture" options to comply with the DMA, see: https://www.latribune.fr/technos-medias/internet/entree-en-vigueur-du-digital-market-act-les-gafam-font-ils-preuve-de-mauvaise-foi-au-detriment-des-utilisateurs-992204.html.

[9] See: https://www.ghacks.net/2023/12/09/google-chrome-to-display-choose-your-search-engine-prompt/.

[10] For more information, see: https://www.lemonde.fr/en/pixels/article/2024/03/06/digital-markets-act-how-the-way-you-use-google-maps-and-messenger-is-changing.html, https://www.francetvinfo.fr and Google's official statement at https://blog.google/around-the-globe/google-europe/new-competition-rules-come-with-trade-offs/.

[11] The "directions" button is still present and directs users to Google Maps, but only for transport advice. Users cannot directly zoom in on the area of interest or search for recommendations around that location. A series of browser extensions have been

We date the introduction of the "choice architecture" change in Google Search to January 2024, based on user reports from online forums. Google's official statement regarding DMA compliance does not explicitly mention the removal of clickable Google Maps elements.[12] However, discussions on Reddit and the Google Search community forum indicate that this change was progressively implemented throughout January and February 2024.[13] The noticeable increase in user reports after the first week of January 2024 supports identifying this period as the onset of the broader rollout of the policy change.

This change to Google's search interface is consistent with the principles of the DMA and eliminates Google Maps' previous one-click advantage over other services. However, the DMA also requires gatekeepers to monitor the impact of their "choice architecture" on an ongoing basis. Gatekeepers must submit a compliance report within six months of designation and update it annually, with the steps taken to ensure compliance.

2.2 Data for Search Queries and Online Traffic

For this study, we analyze search query volume data over time, compiling weekly country-level panel data from two primary sources: Google Trends and Glimpse, spanning January 2023 to December 2024. Additionally, we collect monthly web traffic data from Semrush, covering January 2023 to December 2024.

Our dataset includes 25 European Union countries affected by the DMA, excluding Malta and Cyprus due to data limitations. To construct a suitable control group, we incorporate 13 European non-EU countries and all OECD and BRICS countries where Google and Google Maps services are available, resulting in 27 control countries. This expanded control set allows for robust comparisons across different regulatory and market environments.[14]

Google Trends provides insights into search behavior by analyzing the relative frequency of specific queries over time. The data is normalized to a scale from 0 to 100, where 100 represents the peak pop-

created to restore the previous design for EU users. However, judging by the number of reviews and users, these extensions do not seem to be widely installed by EU users. For an example, see: https://chromewebstore.google.com/detail/google-search-maps-button/edllcgchknhokighleffpipdedmpgiln?hl=en.

[12] See: https://blog.google/around-the-globe/google-europe/an-update-on-our-preparations-for-the-dma/.

[13] The Reddit discussion about the absence of clickable maps began in early January 2024 (https://www.reddit.com/r/GoogleMaps/comments/19ahfx2). For instance, on January 19, 2024, one user noted: "It used to be that under every Google search you had a button to search it in Maps (but it does not anymore). Anyone know how to fix this? It is really annoying." Other users responded by stating, "it started a few weeks ago, between end 2023 and beginning 2024," and "I had this issue for months now. I always fixed it by clearing the cache, but it does not work anymore." Similarly, posts on Google's official support forum confirm that users started noticing the removal of clickable maps as early as January and February 2024 (https://support.google.com/websearch/thread/258720758). These discussions strongly suggest that the update was gradually introduced across different regions before March 2024.

[14] The control countries are: Albania, Armenia, Australia, Azerbaijan, Belarus, Bosnia, Brazil, Canada, Chile, Colombia, Costa Rica, Georgia, Iceland, India, Israel, Japan, Mexico, New Zealand, Norway, South Africa, South Korea, Serbia, Switzerland, Turkey, the United Kingdom, the United States, and Ukraine.

ularity of the query during the selected time frame, and 0 signifies insufficient data.[15] To supplement Google Trends data, we utilize search volume estimates from Glimpse (https://meetglimpse.com/). Glimpse achieves this by applying a proprietary scaling factor to the normalized data from Google Trends, effectively converting relative interest scores into estimated query volumes.[16]

To ensure consistency across countries, we use a uniform set of queries, regardless of regional variations in mapping service terminology.

Our dataset includes six key search queries relative to online mapping services per country and per week: the general term `maps`, along with specific queries for Google Maps and a set of major competing mapping services: `apple maps`, `bing maps`, `google maps`, `mappy`, and `openstreetmap`. These competitors were selected based on their relevance in European and global markets, their visibility in online search environments, and their potential substitutability for Google Maps. Apple Maps and Bing Maps are prominent services provided by large tech firms with significant user bases. Mappy is a well-known European (particularly French) mapping service, and OpenStreetMap is a widely used open-source platform that powers many third-party navigation applications. Together, these services represent the most recognizable and accessible alternatives to Google Maps across EU countries.[17]

While the term `maps` is generic, Appendix Figure A1 shows that users searching for it on Google are highly likely to encounter results related to Google Maps. The figure presents snapshots of Google Search results for the term `maps`, with no personalization based on search history, for France, Germany, Italy, and Spain. In all cases, Google Maps always appears in the top two search results. We supplement these queries with search terms that prompt Google Search to display business listings near the user's location, specifically: `restaurant`, `shopping`, and `supermarket`. This enables us to evaluate whether queries typically performed within Google Maps are instead being conducted via Google Search.

To further assess the impact of the DMA, we use a complementary dataset of estimated website traffic from Semrush (https://www.semrush.com/). Semrush employs a proprietary algorithm that integrates data from multiple sources to estimate monthly website traffic volumes. In particular, the algorithm combines keyword rankings, search volumes, and estimated click-through rates (CTR) to approximate organic

[15] For additional details on the normalization methodology employed by Google Trends, see https://support.google.com/trends/answer/4365533. Google Trends data does not incorporate any explicit time trends or smoothing. See also Brodeur, Clark, Fleche and Powdthavee (2021) and France, Shi and Kazandjian (2021) for econometric discussions and considerations.

[16] The exact methodology Glimpse employs to determine this scaling factor is not publicly documented, which may introduce some uncertainty regarding the precision of these estimates. However, all results presented in the subsequent Sections remain robust when relying solely on Google Trends data without applying Glimpse's scaling factor. Furthermore, even when using Glimpse estimates, our empirical approach includes country fixed effects, ensuring that any fixed differences in scaling across countries do not affect our main findings.

[17] Apple Maps is owned by Apple Inc.; Bing Maps by Microsoft Corporation; Google Maps by Alphabet Inc.; Mappy is a French mapping service owned by RATP; OpenStreetMap is an open-source platform maintained by the OpenStreetMap Foundation.

search traffic.[18] Additionally, Semrush incorporates data from paid search campaigns, social media activity, and referral traffic to provide a comprehensive overview of a website's online visibility.[19] These estimations represent monthly average volumes and do not include explicit time trends or smoothing.[20]

In contrast to previous EU privacy-related policies such as the General Data Protection Regulation (GDPR), which had broad implications across numerous online entities, the DMA specifically targets a limited number of large digital platforms. Accordingly, we do not expect the DMA's implementation to significantly affect overall website traffic estimates by Semrush, as only a few actors are directly subject to the DMA.

We use this data to analyze visits and other traffic metrics for Google Maps, as well as two other key domains: `www.google.com` and `www.bing.com/maps`. This allows us to examine potential spillover effects to other Google-related domains, or to potential substitutes for Google Maps.[21]

In our analysis, we aggregate traffic from each country by combining visits to the generic domains `www.google.com/maps` and `www.google.com` with visits to the corresponding country-specific domains (e.g., `www.google.fr/maps` and `www.google.fr` for France).[22]

Our dataset provides monthly estimates of online visits, distinguishing between desktop and mobile traffic. For desktop visits, we further categorize traffic by source, including direct, organic search, referral, and other sources. Additionally, for desktop traffic, we collect information on the number of monthly visitors, the average number of pages visited per session, the average visit duration, and the average bounce rate, defined as the percentage of unengaged sessions (i.e, those that do not last longer than 10 seconds).

In Table 1, we present the average weekly search volumes for these queries in EU and non-EU countries before and after the DMA. Prior to the DMA, `google maps` and `maps` accounted for 91% of average weekly searches in Europe and 99% in non-EU countries. These high figures suggest that searching for `maps` or `google maps` was the predominant method for users to access mapping services via search engines. The main difference between EU and non-EU countries before the DMA is the prevalence of queries for `mappy`, a French mapping app that is especially popular in France.

[18] For further details on how Semrush calculates organic traffic estimates, see https://www.flyingvgroup.com/seotools/semrush-estimated-traffic/.

[19] See https://www.freshpies.co.uk/knowledge-base/how-does-semrush-calculate-traffic/.

[20] Semrush traffic estimation methodology is discussed in detail here: https://www.semrush.com/kb/162-monthly-numbers.

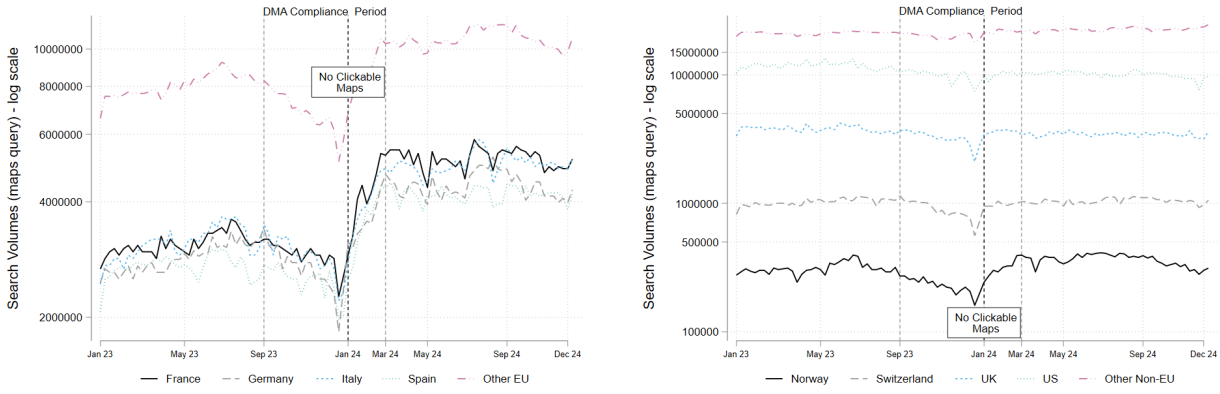
[21] Bing Maps was selected for its extensive global search volumes compared to other competitors. Mappy's search volumes are significant primarily in France. Apple Maps, despite having substantial search volumes, lacks a dedicated web-based mapping platform that would allow for comparable traffic analysis. Although a beta web version of Apple Maps became available in July 2024, its release postdates the DMA implementation. Moreover, Mac and iPhone users are directed to the pre-installed Apple Maps app for mapping services. OpenStreetMap is primarily used via API or integrated into other services and apps and it does not provide real-time traffic data.

[22] In the remainder of the paper, we refer to `www.google.com/maps` or `www.google.com` traffic, which should be understood as the sum of both country-specific and generic domains. The list of country-specific domains for both webpages can be found here: .

Table 1. Google Search Volumes and Shares before and after January 2024 for EU and non-EU countries

	EU		Non-EU	
Before DMA (Jan 23 - Dec 23)	Search Volumes	Share (%)	Search Volumes	Share (%)
`apple maps`	1943	.16	9223	.32
`bing maps`	10780	.9	6804	.23
`google maps`	311485	26.24	923512	32.25
`mappy`	92609	7.8	742	.02
`maps`	768390	64.74	1921755	67.11
`openstreetmap`	1609	.13	1148	.04
	EU		Non-EU	
After DMA (Jan 24 - Dec 24)	Search Volume	Share (%)	Search Volume	Share (%)
`apple maps`	2832	.17	10526	.37
`bing maps`	12526	.76	6025	.21
`google maps`	398166	24.3	819681	29.39
`mappy`	82458	5.03	699	.02
`maps`	1140828	69.62	1950741	69.94
`openstreetmap`	1703	.1	1256	.04

Notes: The sample includes weeks from January 2023 to December 2024 for 25 EU countries and 19 non-EU countries. Cyprus and Malta were excluded from the EU group, as they lack data on search volumes for all queries. Similarly, we excluded non-EU countries without complete data on search volumes. The non-EU countries included in the analysis are Australia, Brazil, Canada, Chile, Colombia, Costa Rica, India, Israel, Japan, Mexico, New Zealand, Norway, South Africa, South Korea, Serbia, Switzerland, Turkey, the United Kingdom, and the United States. Search volumes are averaged at the weekly level across the countries comprising the EU and non-EU groups.



(a) EU countries **(b)** non-EU countries

Figure 2. Google Search Volumes over Time for `maps` Query

Notes: The graph plots the Google search volumes using a log scale for the `maps` query for EU and non-EU countries. The sample includes weeks between January 2023 and December 2024.

Table 2. Online Visits for `www.google.com/maps` before and after January 2024 for EU and non-EU countries

	EU		Non-EU	
Before DMA (Jan 23 - Dec 23)	Visits (× 1000)	Share (%)	Visits (× 1000)	Share (%)
All Devices	6790	100	11997	100
Desktop	4657	68.58	7705	64.22
Mobile	2133	31.41	4292	35.77
Direct Desktop Traffic	3264	70.08	5630	73.06
Referral Desktop Traffic	367	7.88	929	12.06
Organic Desktop Search	963	20.68	1067	13.85
Other Desktop Sources	62	1.33	77	1
	EU		Non-EU	
After DMA (Jan 24 - Dec 24)	Visits (× 1000)	Share (%)	Visits (× 1000)	Share (%)
All Devices	10324	100	18435	100
Desktop	8167	79.11	13532	73.4
Mobile	2156	20.88	4903	26.59
Direct Desktop Traffic	5230	64.04	9767	72.17
Referral Desktop Traffic	664	8.13	1698	12.55
Organic Desktop Search	2131	26.09	1816	13.42
Other Desktop Sources	141	1.72	249	1.84

Notes: The sample includes months from January 2023 to December 2024 for 25 EU countries and 19 non-EU countries. Cyprus and Malta were excluded from the EU group, as they lack data on search volumes for all queries. Similarly, we excluded non-EU countries without complete data on search volumes. Among the non-EU countries included in the analysis are Australia, Brazil, Canada, Chile, Colombia, Costa Rica, India, Israel, Japan, Mexico, New Zealand, Norway, South Africa, South Korea, Serbia, Switzerland, Turkey, the United Kingdom, and the United States. Traffic variables are averaged at the monthly level across the countries comprising the EU and non-EU groups. The shares of desktop and mobile traffic are calculated as a proportion of the total traffic from all devices. The shares of other desktop-related traffic are calculated as a proportion of total desktop traffic.

Following the DMA, the shares of `google maps` and `maps` remained stable in both EU and non-EU regions. However, search volumes in EU countries rose significantly (+27.56%), whereas non-EU search volumes slightly declined (-0.03%).

To further illustrate this shift, we plot the search volumes over time for the query `maps` in EU and non-EU countries in Figure 2.[23] In EU countries, we observe a sharp increase in search volumes beginning in January 2024, coinciding with the DMA-driven changes to Google Search. Before this, trends in both EU and non-EU countries followed a similar trajectory, marked by a gradual decline in search volumes dur-

[23]Time series for search query `google maps` are provided in Figure A2 of the Appendix and exhibits similar patterns.

ing the latter half of 2023, with a more pronounced reduction in the final weeks of December. However, post-January 2024, non-EU countries returned to the levels observed before the winter months of 2023, reinforcing their role as a control group for the EU. Since non-EU countries are unaffected by the DMA and VPN usage for such searches is likely minimal, the risk of contamination in the control group remains low.

In Table 2, we present a similar analysis focusing on the average monthly visits to `www.google.com/maps` in EU and non-EU countries before and after the DMA. The table includes total visits from all devices, disaggregated into desktop and mobile traffic. For desktop traffic, the data is structured by source: direct (users entering the URL), referrals (clicking links on other webpages), organic search (users arriving via unpaid search engine results), and other sources.

Post-DMA, we observe a substantial increase in visits to `www.google.com/maps` in both EU and non-EU countries (+52% in the EU and +54% in non-EU countries), primarily driven by desktop traffic. A key difference emerges in the share of desktop visits originating from organic search: in EU countries, this proportion increases, whereas in non-EU countries, it remains stable. This trend supports the hypothesis that the DMA-induced Google Search design change prompted more EU desktop users to search for `maps` and `google maps`, thereby increasing the share of organic search-driven visits.

To illustrate these trends, we plot the monthly time series of organic search desktop visits and all desktop visits for EU and non-EU countries in Appendix Figures A3a and A4a, as well as Figures A3b and A4b, respectively. The figures confirm a sharp increase in organic search and desktop visits in the EU beginning in January 2024, coinciding with DMA-related modifications. While a similar pattern emerges in non-EU countries, the magnitude of the change is considerably smaller.

In Appendix Table A1, we examine changes in visits to `www.google.com` and `www.bing.com/maps` over time for both EU and non-EU countries. We find that visits to both websites show no significant changes. Specifically, the overall visit volume and the share of desktop or mobile traffic for both domains remain relatively stable over time in both regions. This suggests that users have not substantially increased their searches for `bing maps`, nor have they significantly altered their visits to `www.google.com` after the DMA.

Based on this descriptive evidence, in the next Section, we present our empirical strategy to measure the impact of the DMA by comparing search volumes and visits in EU and non-EU countries over time.

2.3 Identification Strategy

Our objective is to measure the change in the propensity to search for queries and the likelihood of visiting mapping domains as a result of the DMA. To achieve this, we treat the DMA as an exogenous shock affecting only users based in EU countries. Non-EU countries serve as a control group to account for ini-

tial differences in query rates. We employ a two-way fixed effects model within a difference-in-differences framework. Specifically, we estimate the following specification:

$$\ln\left(Y_{it}\right) = \alpha_i + \omega_t + \gamma_{\text{DMA}} EU_i \times post_t^{DMA} + \varepsilon_{it}, \tag{1}$$

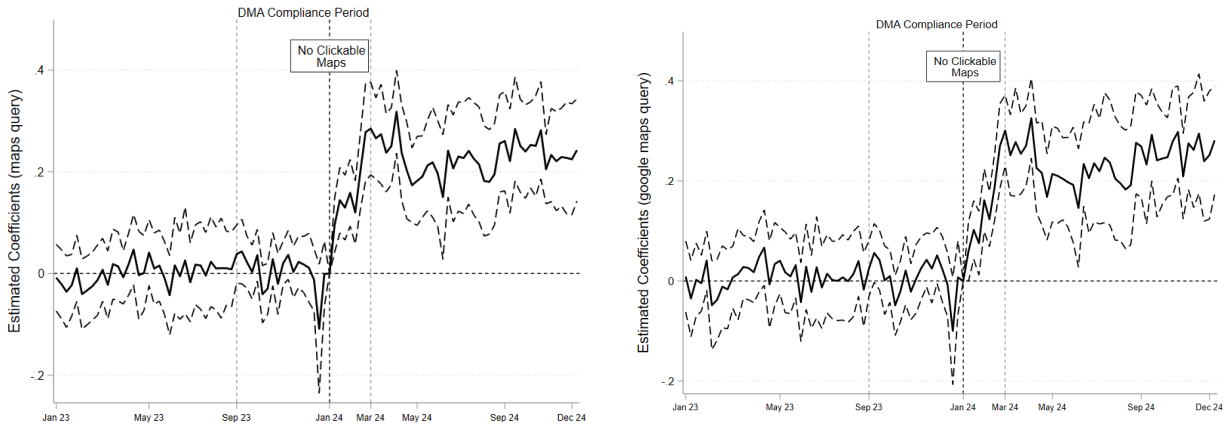
where Y_{it} denotes Google search volumes for the query or online visits to the domain of interest for country i at time t. α_i and ω_t represent country and time fixed effects, respectively, with time fixed effects defined at the week level for search volumes and at the month level for online visits. The variables EU_i and $post_t^{DMA}$ are dummy variables equal to 1 if country i is a member of the EU, and if time t falls after January 2024, respectively. The coefficient γ_{DMA} is our parameter of interest, capturing the average treatment effect. It is identified as the difference in the average values of the dependent variable between EU and non-EU countries after the DMA changes are implemented, while accounting for initial cross-country differences. We assume that the change in the ability to click on the map to access Google Maps from Google Search took effect at the beginning of January 2024. Finally, ε_{it} is an unobserved error term assumed to have a zero conditional mean.

Both the estimated search volumes and visit variables occasionally report values of zero for certain weeks or months. However, these zeros do not represent true absences of searches or visits; rather, they reflect values that are too small to be detected or estimated. When Google Trends and subsequently Glimpse report zero searches for a given query in a specific country and week, we assume a search volume equivalent to a Google Trends value of one for that country and query.[24]

To validate the DiD design, we present event study plots examining the parallel trends assumption during the pre-treatment period. These event studies not only help assess whether EU and non-EU countries followed similar trends before the DMA but also provide insights into which control countries best approximate the counterfactual scenario of EU countries in the absence of the DMA. We begin by studying the evolution of search volumes over time, focusing on the queries `maps` and `google maps`.

Figure 3 displays coefficients tracking the differences between EU and non-EU countries over time for these two queries, with January 1st, 2024, as the reference point. These event studies use European non-EU countries as the control group. In Appendix Figures A5 and A6, we replicate the same event studies using all non-EU countries in our sample, and only control countries in the Northern Hemisphere, respectively. When including all non-EU countries, pre-trends appear to be affected by differing seasonal patterns between EU and non-EU regions. This seasonality is largely driven by countries in the Southern Hemisphere,

[24] For online visits, zero values are rare. To ensure that all observations remain usable in the log transformation, we simply replace these cases with one. This minimal adjustment allows us to retain all data points without introducing significant bias.



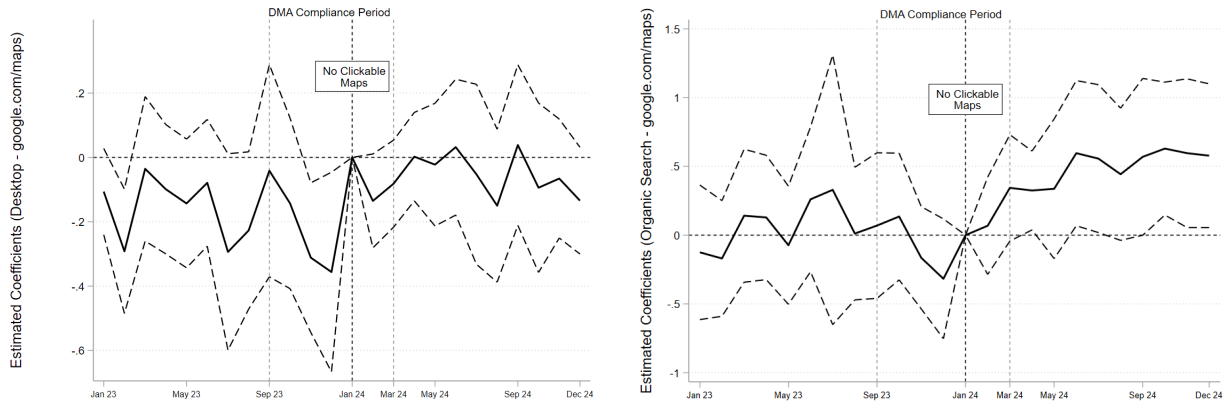
(a) `maps` **(b)** `google maps`

Figure 3. Event study: log of Google Search Volumes for `maps` and `google maps`

Notes: The log of Google search volumes for `maps` and `google maps` queries are regressed on country and time fixed effects and interactions between a dummy variable indicating if a country is in the European Union and a full set of dummy variables for each snapshot. The graphs plot the estimated coefficients of these interaction terms. The coefficient for January 2024 is normalized to zero. The treated group includes 25 EU countries. The control group comprises European non-EU countries. The sample includes weekly data from January 2023 to December 2024. Figures 3a and 3b show the analysis for search volumes related to `maps` and `google maps`, respectively. Standard errors are clustered by country and reported in the form of 95% confidence intervals.

where seasons are reversed relative to the Northern Hemisphere. Given that mapping services may be used more frequently during the spring and summer months, when travel and outdoor activities peak, the seasonal misalignment between hemispheres likely explains these fluctuations. In contrast, when restricting the control group to countries in the Northern Hemisphere, seasonal fluctuations are noticeably reduced. The cleanest pre-trends, with no visible seasonality, emerge when focusing on European non-EU countries, our preferred specification.

As an alternative to manually selecting control groups based on geographical and seasonal considerations, we also implement a synthetic difference-in-differences (SDiD) approach (Arkhangelsky, Athey, Hirshberg, Imbens and Wager, 2021). This method optimally assigns weights to non-EU countries to construct a synthetic control group that best resembles the pre-DMA trends of EU countries. Unlike the standard DiD approach, which relies on a predefined set of control countries, SDiD leverages data-driven weighting to minimize differences in pre-trends, potentially improving the validity of our counterfactual estimates. In Appendix Figure A7, we present the event study associated with the SDiD approach, which closely resembles our main DiD results. Regardless of the control group used, the post-DMA surge in search volumes is striking. The increase begins during the final months of the implementation period, reaching a new, higher level by March 2024. Notably, the gap in search volumes between EU and non-EU countries remains elevated for the rest of 2024, highlighting the persistent impact of the DMA on search behavior.



(a) Desktop **(b)** Organic Search

Figure 4. Event study: log of Desktop Visits and Desktop Visits from Organic Search

Notes: The log of all online visits for `www.google.com/maps` from desktop devices and those originating from organic search results on desktop are regressed on country and time fixed effects and interactions between a dummy variable indicating if a country is in the European Union and a full set of dummy variables for each snapshot. The graphs plot the estimated coefficients of these interaction terms. The coefficient for January 2024 is normalized to zero. The treated group includes 25 EU countries, excluding Cyprus and Malta due to data availability. The control group comprises European non-EU countries. The sample includes weekly data from January 2023 to December 2024. Figures 4a and 4b show the analysis for all online visits for `www.google.com/maps` from desktop devices and those originating from organic search, respectively. Standard errors are clustered by country and reported in the form of 95% confidence intervals.

Unlike the GDPR (Johnson, 2022), the DMA is expected to have limited spillover effects beyond the countries it directly affects. It targets a small number of gatekeepers, such as Alphabet for online map services, and regulates only users accessing online services from treated countries. Thus far, Alphabet has not implemented similar adjustments in non-EU nations. While EU users can revert to the previous version of Google Search through browser extensions or VPNs, adoption of these methods appears minimal, as indicated by low installation rates for such extensions. Even if a surge in the use of browser extensions or VPNs were to occur in 2024, the significant increase in searches for `maps` and `google maps` from the EU suggests that we may still be underestimating the short-term negative impact on EU users. These users now face either the inconvenience of additional browser extensions or the financial costs associated with VPN services.

In addition to analyzing search patterns, we study changes in online visits to `www.google.com/maps` following the implementation of the DMA. Specifically, we focus on all desktop visits and on those desktop visits originating from organic search results.[25] For both categories, we estimate the same model as presented in Equation 1. To assess the parallel trends assumption, we again conduct event studies comparing EU and non-EU countries in the pre-DMA period.

Figure 4 presents the event study estimates using a difference-in-differences design, where European

[25] In Section 3, we analyze and report results for desktop and mobile visits, as well as all sources of desktop visits (direct, referral, organic search, and other sources).

non-EU countries serve as the control group. In Appendix Figures A8, and A9, we replicate these event studies using alternative control groups: all non-EU countries in our sample, and only non-EU countries in the Northern Hemisphere. Appendix Figure A10 presents the SDiD event study estimates.

As observed in the search volume analysis, where pre-trends were consistent across specifications, we also find that pre-trends for both total desktop visits and desktop visits originating from organic search remain generally stable. In the final months of 2023, we detect a slight negative trend, but this discrepancy disappears when using the synthetic DiD approach. Overall, the absence of pre-trends supports the validity of our identification strategy. Across all specifications, we find no evidence of a decline in desktop visits to `www.google.com/maps` following the DMA. On the contrary, there is a small but consistent increase. This increase in desktop visits appears to be driven by traffic from organic search, aligning with the observed rise in search volumes for Google Maps in the EU. This pattern reinforces the idea that users are actively seeking out the service.

3 The DMA's Impact on Search Volumes

3.1 Impact on `maps` and `google maps` Queries

We now present the main empirical results. Table 3 reports three specifications of the DiD estimates from Equation 1 for the queries `maps` (Columns (1)–(3)) and `google maps` (Columns (4)–(6)). Standard errors are clustered at the country level. The sample covers weekly data from January 2023 to December 2024.

All specifications include country fixed effects, which control for time-invariant factors influencing search behavior at the national level, and time (week) fixed effects, which account for time-varying confounders affecting all countries similarly. The treated group consists of 25 EU countries.

For each query, the three specifications differ in the composition of the control group. The specification in Columns (1) and (4) includes all countries in the control group. The specification in Columns (2) and (5) restricts the control group to countries in the Northern Hemisphere. The specification in Columns (3) and (6) further limits the control group to non-EU European countries.

The estimates of the average treatment effect $\hat{\gamma}_{\text{DMA}}$ in Equation 1 are positive and statistically significant at the 1% level across all specifications. The DMA is associated with an increase in search volume of at least 21% for both queries in EU countries compared to non-EU countries. These estimates are economically significant, indicating that a substantial number of users in the EU have searched for general mapping services, and specifically for Google Maps, due to the inability to access them directly through Google Search.

Moreover, the robustness of our results across different control groups suggests that the observed ef-

Table 3. Difference-in-Differences: log of Google Search Volumes for `maps` and `google maps` Queries

	(maps)			(google maps)		
	(1)	(2)	(3)	(4)	(5)	(6)
$EU \times post^{DMA}$	0.244***	0.233***	0.214***	0.244***	0.233***	0.212***
	(0.027)	(0.030)	(0.036)	(0.028)	(0.031)	(0.036)
Country FEs	✓	✓	✓	✓	✓	✓
Week FEs	✓	✓	✓	✓	✓	✓
Control Contries	All	North Hem.	Only Euro	All	North Hem.	Only Euro
R^2	0.997	0.997	0.997	0.995	0.995	0.995
N	5304	4794	3876	5304	4794	3876
Mean Dep. Var.	12.795	12.731	12.511	12.150	12.116	11.923

Notes: The sample includes weekly data from January 2023 to December 2024. The first three columns correspond to the query `maps`, and the second three correspond to the query `google maps`. For each query, we present specifications that include country and week fixed effects. The specifications differ in the composition of the control group: the first specification includes all countries in the control group. The second specification limits the control group to countries in the Northern Hemisphere. The third specification restricts the control group to European, non-EU countries. In all specifications, the treated group comprises 25 EU countries. Standard errors clustered by country are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

fects are not driven by the specific choice of reference countries. The significance and magnitude of the estimates remain stable when using various control sets, reinforcing the validity of our findings.

We also note that the R^2 values in these regressions are extremely high (all above 0.99). This shows that a large share of the variation in these search volumes is captured by the combination of country and month fixed effects, along with the inclusion of the interaction term of the DiD accounting for the regulatory shock affecting EU countries.[26]

3.1.1 Robustness Checks

Synthetic Difference-in-Differences Given that our analysis compares outcomes across a limited number of countries over time, alternative identification strategies—such as synthetic difference-in-differences and synthetic control—could help assess whether our two-way fixed effects model is overly restrictive or influencing our point estimates. To test this, we estimate both the synthetic difference-in-differences model and the synthetic control model (Abadie and Gardeazabal, 2003) for the queries `maps` and `google maps`.

Appendix Table B1 reports the results, while Appendix Figures B1 and B2 display the weights assigned to each country and each week before the DMA in the synthetic difference-in-differences. Across all specifications, the treated group consists of 25 EU countries, while the control group includes all 27 non-EU

[26] This is partially driven by the way search volume estimates are computed by Glimpse, which multiplies a term for each country and each week with the Google Trends normalized value. Mechanically, this process introduces a sizable amount of variation from country and month differences. To illustrate this, when we use only Google Trends data in Appendix Table B3, the R^2 values remain high (0.85) but are noticeably lower than those in Table 3.

countries. The point estimates from all three econometric methods are highly consistent, with confidence intervals overlapping at the 1% level, further reinforcing the robustness of our findings.

Placebo Test using YouTube Search Could the observed increase in search volume reflect a broader surge in interest in mapping services across Europe in early 2024? We are not aware of any major event, other than the DMA, that could explain such a strong and unprecedented shift in search behavior among EU users. To investigate this possibility, we estimate Equation 1 using search volumes on Google's video-sharing platform, YouTube, as the dependent variable for the queries `maps` and `google maps`.

Since YouTube is not a tool for finding Google Maps or alternative mapping providers, we do not expect the DMA to affect search volumes there. The results, presented in Appendix Table B2, show no statistically significant effect. Furthermore, as illustrated by the event study plot in Appendix Figure B3, there is no systematic difference between EU and non-EU countries before 2024. These findings support the conclusion that no external factors, aside from the DMA, are driving changes in Google search behavior related to mapping services among EU users.

Verifying the Role of Google Trends Data Our primary results rely on search volume data obtained from Google Trends and estimated through Glimpse. Our empirical design includes country fixed effects in all specifications. This means that any country- and query-specific adjustments made by Glimpse to measure volumes should not influence our estimated treatment effects. Nonetheless, to ensure that our findings are not an artifact of the estimation process used by Glimpse, we re-estimate our main specification using only raw Google Trends data. Google Trends reports search intensity as an index, where search volume for a keyword at time t in country i is normalized by the maximum observed search volume for that keyword over the data horizon, i.e., $I_{it} = Y_{it}/\max(Y_{it})$. Appendix Table B3 presents the results of this alternative specification. As expected, the estimates are identical to those in Table 3, confirming that our findings are not driven by how Glimpse estimates search volumes, but rather reflect changes in search behavior.

Alternative Identification Using EU Countries as Their Own Counterfactual Our identification strategy relies on comparisons between EU countries (the treated group) and non-EU countries (the control group). If unobserved differences between these groups influence search behavior independently of the DMA, this could bias our estimates. To address this concern, we implement an alternative identification strategy that compares EU countries in 2024, the year of DMA implementation, to the same EU countries before 2024, using their past search behavior as a control. This approach follows a similar logic to Liaukonytė, Tuchman and Zhu (2023). Appendix Table B4 presents the results of three specifications that include only EU coun-

tries, incorporating country fixed effects (Columns (1) and (4)), linear time trends (Columns (2) and (5)), and country-specific time trends (Columns (3) and (6)) for the queries `maps` and `google maps`. The estimation begins in June 2022, ensuring a full year of pre-treatment data. This alternative approach, which does not rely on an external set of control countries, produces qualitatively similar effects to those in Table 3, reinforcing the robustness of our findings.

3.2 Impact on Queries of Competing Mapping Services

Using our previous identification strategy, we found that EU users reacted to the DMA-induced changes in Google Search by increasing their searches for `maps` and `google maps`. Since Google Maps links appear as top results when searching for `maps`, we can reasonably assume that most of these additional searches led EU users to Google Maps services. However, some users may also have been considering alternative mapping services.

To investigate this possibility, we estimate Equation 1 using search query data for competing mapping services: `apple maps`, `bing maps`, `mappy`, and `openstreetmap`. These queries are far less common than `maps` and `google maps`, and for some smaller countries, search volume data is unavailable. To maximize sample size and increase statistical power, we report results using all available control groups. Table 4 shows that the only competing service experiencing a statistically significant increase in searches was Apple Maps, with an estimated increase of nearly 28%. However, while this percentage change appears large, it corresponds to only 0.175% of `google maps`' search volume, making it unclear how economically meaningful this increase is. Other mapping services did not exhibit statistically significant changes in search volume following the DMA's implementation in Europe. While we cannot exclude the possibility that the null results are driven by a lack of statistical power, it is worth noting that the estimated increases for `bing maps` and `openstreetmap` are much smaller than that of Apple Maps, at around 3–4% and not statistically significant. Moreover, these changes concern queries with relatively low baseline search volumes. The coefficient for `mappy` is even negative (and also not statistically significant). Thus, while statistical power limitations could contribute to the null results, the observed changes remain overall quite modest, particularly given the relatively small number of searches for these competing services. Consistent with this analysis, Appendix Figure B4 presents the event study coefficients comparing EU and non-EU countries over time for `apple maps` and `bing maps`. The pre-trends appear parallel between EU and non-EU countries for both competitors, and a positive trend emerges for `apple maps` following the DMA.

To ensure the robustness of our results, Appendix Tables B5 and B6 present the same analysis as Table 4, but with two alternative ways of handling cases where weekly Google search volume (and the corresponding

Table 4. Difference-in-Differences: log of Google Search Volumes for Queries about Alternative Mapping Services

	(apple maps)	(bing maps)	(mappy)	(openstreetmap)
$EU \times post^{DMA}$	0.279***	0.027	-0.153	0.038
	(0.089)	(0.099)	(0.106)	(0.056)
Country FEs	✓	✓	✓	✓
Week FEs	✓	✓	✓	✓
Control Contries	All	All	All	All
R^2	0.791	0.820	0.925	0.828
N	4998	4590	3366	4896
Mean Dep. Var.	6.278	5.455	5.102	5.172

Notes: The sample includes weekly data from January 2023 to December 2024. The four columns use the same specification with country and week fixed effects for four queries associated with alternative mapping services: `apple maps`, `bing maps`, `mappy`, and `openstreetmap`. We restrict the control group to all non-EU countries that have information about Google search volumes for all four queries. The treated group comprises 25 EU countries. When the Google search volume in a week (and the associated Google Trends data) is zero, we replace the zero value with the search volume equivalent to a Google Trends value of 1. Standard errors clustered by country are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Google Trends data) is zero. In Appendix Table B5, we replace zeros with the search volume equivalent to a Google Trends value of 0.5. In Appendix Table B6, we retain zero values without replacement. The results remain broadly consistent: `mappy` and `openstreetmap` remain unaffected by the DMA. When zero values are not replaced, the effect remains positive for `apple maps` but loses statistical significance, while for `bing maps`, the effect becomes positive and is statistically significant only at the 10% level.

Additionally, we conduct a synthetic difference-in-differences analysis for all competitors, reported in Appendix Table B7 and Appendix Figure B5. The results align with those in the main text: Apple Maps is the only competing service experiencing a significant increase in search volume.

Notably, Apple Maps was historically available only to Mac users. When these users searched for Apple Maps on Google, they could click on a website link that redirected them to the Mac application. For all non-Mac users, searching for`apple maps` on a desktop did not direct them to any website providing access to Apple's mapping services. However, in July 2024, Apple launched a beta version of Apple Maps accessible via the web, making it available to all users.[27] Despite this expansion, the beta version remains relatively unknown among non-Mac users. In December 2024, worldwide online visits to `www.beta.maps.apple.com` were 231,000, significantly lower than the 702 million visits to `www.google.com/maps` and the 13.2 million visits to `www.bing.com/maps` during the same period. This suggests that while some users may indeed switch to alternative mapping services when a competitive option such as Apple Maps is available,

[27] See: https://www.apple.com/newsroom/2024/07/apple-maps-on-the-web-launches-in-beta/.

widespread adoption remains limited. To explore this idea further, we focus on the case of France, the only country where one competing service, Mappy, had a higher search volume than Google Maps before the DMA. In Appendix Figure B6, we present the time series of search volumes in France for `maps`, `google maps`, and `mappy` in 2023 and 2024. The data suggest that French users were actively using an alternative service that had gained some traction. However, as the figure illustrates, the DMA did not lead to an increase in searches for `mappy`; instead, search volumes for Mappy slightly declined after the DMA and were eventually surpassed by searches for Google Maps. This indicates that while the presence of a readily available alternative can play a role, it is not necessarily sufficient to drive a switch in user behavior.

Beyond analyzing each competitor separately, we also examine whether the share of search volume for competing mapping services changed. To construct this share, we aggregate the search volumes for all queries related to competing services (`apple maps`, `bing maps`, `mappy`, and `openstreetmap`) and divide this sum by the total search volume, which includes queries for both competing services and Google's mapping services (`google maps` and `maps`). This calculation provides, for each country and each week, the share of search volume attributable to competing mapping services.

Appendix Table B8 presents a standard difference-in-differences analysis, showing that regardless of the set of control countries used, the share of searches for competing mapping services declined by approximately 15%. Appendix Figure B7 presents the event study analysis and demonstrates that this decline occurred precisely during the introduction of non-clickable maps and the corresponding surge in search volumes for `maps` and `google maps`. This suggests that while searches for `apple maps` increased, the magnitude of this increase was small relative to the large surge in searches for Google's mapping services.

3.3 Impact on Other Search Queries

We conclude our analysis of the DMA's impact on Google search volumes by examining its effect on other types of searches that could have been influenced by the policy change. As shown in Figure 1, following the DMA, when EU users perform searches that generate geo-referenced results, the embedded maps are no longer clickable. We have provided some empirical evidence suggesting that, as a result, users increased their searches for `maps` and `google maps`, while searches for alternative mapping services did not exhibit a significant rise.

Here, we investigate whether the removal of clickable maps led users to reduce their reliance on Google for geo-localized searches more broadly. For example, as illustrated in Figure 1, a search for a location-specific term such as "Shakespeare and Company" now returns a non-clickable map. If users increasingly turn to Google Maps , they might reduce their use of Google Search for geo-localized information.

To analyze this potential shift, we focus on queries that are commonly searched worldwide. This is necessary to ensure comparability, as search interest in landmarks such as the Eiffel Tower or the Colosseum varies significantly across countries. We thus apply the same DiD approach in Equation 1, comparing EU and non-EU countries, but now using three generic search queries: `restaurant`, `shopping`, and `supermarket`. These queries consistently trigger Google Search results displaying business listings near the user's location, making them well-suited to capturing shifts in geo-localized search behavior.

Appendix Table B9 presents the results using the full set of control countries to maximize sample size and statistical power. We do not find significant effects for any of the three queries, although all estimated coefficients are negative. Additionally, the magnitude of the estimated effects is relatively modest, ranging from a 1% to a 4% reduction in search volume. These findings suggest that while we do not observe a strong decline in geo-localized searches on Google, the increase in searches for `maps` and `google maps` could be part of a broader shift in user behavior. However, due to the dispersed nature of geo-localized searches, detecting a significant aggregate effect remains challenging.

In the next Section, we take a more direct approach to examine how users adapted to the removal of clickable maps. By analyzing online visits to `www.google.com/maps`, we aim to assess whether the DMA-induced change influenced how users access mapping services and whether it altered their navigation behavior on Google.

4 The DMA's Impact on Online Traffic

To complement our previous findings based on search volumes, we extend the analysis to traffic volumes for `www.google.com/maps`, `www.bing.com/maps`, and `www.google.com`. This enables us to assess whether, and to what extent, the actual usage of mapping and related services has changed following the introduction of the DMA. We continue to apply the DiD design specified in Equation 1 and validate the robustness of our estimates by considering alternative control groups and employing SDiD and synthetic control methods.

We begin by analyzing the impact of the DMA on the extensive margin of Google Maps traffic in Subsection 4.1, where we examine changes in the number of visits to Google Maps, regardless of how much users engage with the service during each visit. We then investigate the intensive margin in Subsection 4.2, focusing on how users' engagement with Google Maps has evolved, as measured by changes in session duration or bounce rates. Last, in Subsection 4.3, we assess whether the removal of clickable maps has influenced consumer access to competing mapping platforms or to other services offered by Google.

4.1 Impact on the Extensive Margin of Google Maps Traffic

We now examine the DMA's effect on the extensive margin of Google Maps' traffic. We first investigate changes in the sources of traffic, linking them to the previously observed shifts in search queries (Section 3). We then analyze variations in the total desktop and mobile traffic volumes to measure the overall effect of the DMA on the visits to `www.google.com/maps`.

4.1.1 Direct Traffic and Organic Search for Desktop Visits

As discussed in Section 3, the DMA-induced removal of clickable maps resulted in an increase in the number of users accessing `www.google.com/maps` by searching for the online mapping service through Google Search. This is expected to increase the volume and share of desktop traffic originating from search engines (i.e, Google Search). Using clickstream data from the data analytics platform Semrush, we now assess how the DMA altered the pathways through which users arrived at Google Maps.[28]

Table 5 reports three specifications of the DiD estimates from Equation 1 for desktop visits originating from direct access (Columns (1)–(3)) and from organic search (Columns (4)–(6)), the two most relevant channels for accessing Google Maps, as shown in Table 2. Standard errors are clustered at the country level. The sample covers monthly data from January 2023 to December 2024. All specifications include country fixed effects, which control for time-invariant factors influencing online traffic at the national level, and time (month) fixed effects. As before, the treated group consists of 25 EU countries. For each channel of desktop visits, the three specifications differ in the composition of the control group. The specification in Columns (1) and (4) includes all countries in the control group. The specification in Columns (2) and (5) restricts the control group to countries in the Northern Hemisphere. The specification in Columns (3) and (6) further limits the control group to non-EU European countries.

The estimates presented in Table 5 indicate a statistically and economically significant increase of more than 33% in desktop visits originating from organic search after the DMA implementation. However, we do not find similar evidence of a statistically significant increase in the number of desktop visits accessing `www.google.com/maps` via direct access. Figure 4b and Appendix Figure C1 confirm that the parallel trends assumption holds for both traffic channels.

As shown in Table 2, prior to the DMA, only 21% of EU desktop traffic originated from organic search, increasing to 26% after its implementation. This suggests that, despite the significant estimated increase

[28] As discussed in Section 2.2, Semrush categorizes traffic into visits from direct access (entering the `www.google.com/maps` in the address bar); organic search (clicking a Google Search result); referrals (e.g., the "directions" button on Google Search); and other sources (e.g., social media). We focus on desktop traffic, as Google's DMA-related changes affected only the desktop version of Google Search.

Table 5. Difference-in-Differences: log of Desktop Visits for `www.google.com/maps` - Direct and Organic Search

	(Direct)			(Organic Search)		
	(1)	(2)	(3)	(4)	(5)	(6)
$EU \times post^{DMA}$	0.019	0.060	0.063	0.329***	0.409***	0.401***
	(0.069)	(0.076)	(0.106)	(0.102)	(0.107)	(0.126)
Country FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	✓	✓	✓	✓	✓
Control Contries	All	North Hem.	Only Euro	All	North Hem.	Only Euro
R^2	0.978	0.978	0.971	0.963	0.964	0.960
N	1248	1128	912	1248	1128	912
Mean Dep. Var.	14.565	14.502	14.270	12.603	12.481	12.283

Notes: The sample includes monthly data from January 2023 to December 2024 about the online visits to the domain `www.google.com/maps` from desktop devices. The first three columns correspond to the desktop visits from direct links, and the second three correspond to desktop visits from organic search. For each type of visit, we present specifications that include country and month fixed effects. The specifications differ in the composition of the control group: The first specification includes all countries in the control group. The second specification limits the control group to countries in the Northern Hemisphere. The third specification restricts the control group to European, non-EU countries. In all specifications, the treated group comprises 25 EU countries. Standard errors clustered by country are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Difference-in-Differences: log of Visits for `www.google.com/maps` - Desktop and Mobile

	(Visits Desktop)			(Visits Mobile)		
	(1)	(2)	(3)	(4)	(5)	(6)
$EU \times post^{DMA}$	0.077	0.121	0.122	0.031	0.043	0.094
	(0.066)	(0.072)	(0.099)	(0.082)	(0.091)	(0.144)
Country FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	✓	✓	✓	✓	✓
Control Contries	All	North Hem.	Only Euro	All	North Hem.	Only Euro
R^2	0.980	0.980	0.975	0.883	0.881	0.839
N	1248	1128	912	1248	1128	912
Mean Dep. Var.	14.867	14.795	14.569	13.940	13.859	13.566

Notes: The sample includes monthly data from January 2023 to December 2024 about the online visits to the domain `www.google.com/maps`. The first three columns correspond to the visits from desktop, and the second three correspond to the visits from mobile. For each type of visit, we present specifications that include country and month fixed effects. The specifications differ in the composition of the control group: The first specification includes all countries in the control group. The second specification limits the control group to countries in the Northern Hemisphere. The third specification restricts the control group to European, non-EU countries. In all specifications, the treated group comprises 25 EU countries. Standard errors clustered by country are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

in organic search traffic, the overall impact on total desktop visits may be limited. More than 64% of traffic came from direct access, and we find no evidence of an increase in the number of visits accessing Google Maps through this channel. Appendix Table C3 and Appendix Figures C6a and C6b present the effect of the DMA on desktop visits originating from referral links and other sources. We find a small positive effect on referral traffic, which is weakly statistically significant.

In summary, our findings suggest that the increase in organic search traffic is directly driven by a rise in user searches for queries related to `maps` or `google maps`. The removal of clickable maps would have been expected to reduce referral traffic, as users clicking on a map after a search result previously contributed to referral link traffic. However, we do not observe a significant decline in referral traffic. This is likely because many users, instead of clicking on the now-removed maps, may have used the "directions" button, which remains available. We believe this counterbalancing effect has resulted in a net neutral impact on referral traffic. Moreover, since referral traffic accounts for only about 8% of total desktop traffic, the removal of clickable maps was unlikely to cause a substantial shift in the overall volume of desktop visits to Google Maps.

4.1.2 Total Desktop and Mobile Visits

The increase in organic search desktop visit was partially expected given the surge in searches for `maps` and `google maps`. Yet, the overall impact of the DMA on desktop traffic volumes for `www.google.com/maps` is less straightforward. On the one hand, the removal of the map signet and clickable maps may have discouraged some users from accessing Google Maps. On the other hand, some users may have adapted by setting Google Maps as their homepage instead of relying on Google Search for access. This could have made Google Maps the default option for all geo-based searches, potentially increasing traffic to the platform. Determining which effect dominates is crucial for assessing the extent to which the DMA's efforts to enhance digital market contestability are impacting Google's bottom line.

To this end, Table 6 presents three specifications of the DiD estimates from Equation 1 for the overall volume of desktop visits (Columns (1)–(3)) and, as a placebo test, for mobile visits (Columns (4)–(6)). The specifications mirror those presented in Tables 3 and 5. As before, standard errors are clustered at the country level, and all specifications include country fixed effects and month fixed effects. For both desktop and mobile visits, the three specifications differ in the composition of the control group.

For overall desktop visits, we observe a positive but statistically non-significant coefficient, suggesting that the DMA likely did not reduce traffic to Google Maps. This result is corroborated by the absence of pre-trends in the event study plots shown in Figure 4a and in Appendix Figures A8a and A9a for different sets

of non-EU control countries.

To further assess the validity of our identification design and ensure that there are no other significant changes occurring in EU versus other non-EU countries right during the DMA implementation, we conduct a placebo test using mobile visits to `www.google.com/maps` as the dependent variable. Given the absence of any notable changes in mobile browser access to Google Maps during the period of interest, no effect should be detectable. The estimates are reported in Columns (4) to (6) of Table 6. As expected, none of the point estimates are statistically significant, regardless of the geographic zone chosen to construct the control group. Considering the associated event study plot using non-EU European countries in Appendix Figure C7, we do not consider these expected null results to be driven by a failure in the underlying identifying assumptions.

Interestingly, the coefficients for both desktop and mobile visits are positive but statistically insignificant. However, the coefficients for desktop visits are nearly twice the size of those for mobile visits. This is reassuring for our analysis, as it confirms that mobile visits are not significantly affected (as expected). Furthermore, we can confidently rule out a large negative effect on desktop visits to Google Maps. Based on the results of the specification in Column (3) of Table 6, the probability that the coefficient for desktop traffic is positive, meaning that desktop visits to Google Maps did not decrease due to the DMA, is 89% and we can exclude a negative decline of more than 5% for desktop visits with a probability equal to 95.9%.

4.1.3 Robustness Checks

Synthetic Difference-in-Differences Similar to the analysis performed for search volumes, we use synthetic difference-in-differences and synthetic control methods to assess the robustness of our results. Appendix Table C1 presents the estimates for desktop visits originating from direct access and organic search using both methods. For organic desktop search, the estimated effect of the DMA ranges from 33% (SDiD) to 47% (synthetic control) and remains qualitatively similar to the standard DiD estimates reported in Table 5. The null effect for direct desktop traffic is also confirmed, as neither synthetic difference-in-differences nor synthetic control yields statistically significant results. Appendix Figures C2, C3 and A10b, C4 display the synthetic weights assigned to each country and each month, and the event study plots for organic desktop search and desktop direct traffic, respectively. All figures provide strong evidence that a well-matched control group can be constructed based on the pre-treatment period, supporting the credibility of the associated average treatment effect estimates.

Similarly, Appendix Table C4 shows the estimates for all desktop visits and all mobile visits originating using synthetic difference-in-differences and synthetic control methods. In all cases, we do not observe

any statistically significant estimates with all methods reporting similar (positive) coefficients. Appendix Figures C8, C9 and A10a, C10 display the synthetic weights and the event study plots for all desktop and mobile visits, respectively. Again, all figures show that we can construct a well-matched control group on the pre-treatment period.

Direct and Organic Search Shares of Desktop Visits Instead of examining the volumes of desktop visits from direct and organic search, we can show how the DMA affected the composition of desktop traffic reaching Google Maps through these channels. This approach allows us to focus specifically on changes in traffic shares while abstracting from fluctuations in overall volumes. To implement this, we use the proportions of desktop traffic originating from direct access and organic search as dependent variables in Equation 1.[29] The estimates are presented in Appendix Table C2, along with the associated event study plots in Appendix Figure C5, where European non-EU countries serve as the control group. The share of traffic from organic search increases by approximately 4 points, while the share from direct access decreases by a similar amount. This suggests that the removal of clickable maps primarily led to a shift in user behavior, with more individuals relying on organic search to access Google Maps.

Triple Differences: Using Mobile Visits as Control An alternative approach to measuring the potential effect of the DMA on overall desktop traffic to Google Maps is to use mobile traffic as a control for shocks that affect both desktop and mobile traffic in the EU post-DMA. By controlling for changes in post-treatment mobile traffic, a triple differences approach isolates the treatment effect as the change in desktop traffic, relative to both mobile, before and after the DMA's implementation, for EU and non-EU countries. In practice, we estimate the following equation:

$$\ln\left(Y_{itd}\right) = \alpha_i + \omega_t + \delta_d + \gamma_0 EU_i \times post_t^{DMA} + \gamma_1 desktop_d \times post_t^{DMA} + \gamma_{\text{DMA}} EU_i \times desktop_d \times post_t^{DMA} + \varepsilon_{itd}, \quad (2)$$

Again, the variables EU_i and $post_t^{DMA}$ are dummy variables equal to 1 if country i is a member of the EU, and if time t falls after January 2024, respectively. Moreover, the variable $desktop_d$ is a dummy equal to 1 if the measured traffic originates from desktop devices, and 0 if it originates from mobile devices. The coefficients have the following interpretations: γ_0 captures the difference over time between treated and control countries, γ_1 captures the difference by device type, and γ_{DMA} estimates the treatment effect of the DMA by comparing changes in desktop traffic relative to both mobile traffic and the control group. The error term, ε_{itd}, is assumed to have a zero conditional mean.

[29] Since this variable ranges between zero and one, the corresponding point estimates are interpretable as a probability.

The results are presented in Appendix Table C5 using three different control groups (all non-EU countries, non-EU countries in the Northern Hemisphere, and European non-EU countries). In all cases, all coefficients $\hat{\gamma}_{DMA}$ are not statistically different from zero. The point estimates remain positive, but are smaller in magnitude than those in Table 6, while the standard errors are of similar size, suggesting that the null results are not driven by a lack of statistical power. Appendix Figure C11 presents the corresponding event study, which shows no evidence of either pre-trends or post-trends.

Overall, this triple differences analysis further supports the conclusion that the removal of clickable maps and the map signet had minimal impact on Google Maps' desktop traffic. If anything, the effect appears to be non-negative.

4.2 Impact on the Intensive Margin of Google Maps Traffic

Having established that the DMA did not significantly alter the extensive margin of `www.google.com/maps` traffic, as measured by desktop traffic volumes, we now turn to the intensive margin to assess whether the DMA influenced how Google Maps is used.

We measure usage through four key metrics: the number of unique visitors, the average number of pages visited per session, the average duration of each visit, and the bounce rate (i.e., the share of users who leave the site within 10 seconds). These metrics provide insights into how the removal of clickable maps may have affected user behavior and, more broadly, the Google Maps ecosystem. We analyze each metric using the DiD strategy presented in Equation 1, varying the set of countries in the control group to check the robustness of our results.

4.2.1 Unique Visitors and Visited Pages

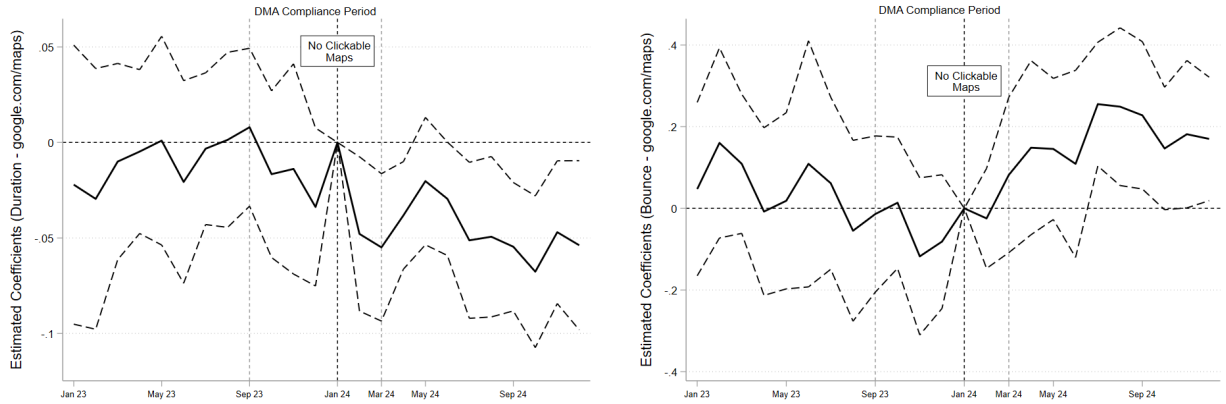
Appendix Table C6 reports the estimates from Equation 1 for the number of unique visitors and the average number of pages visited per visit. The corresponding event study plots, using European non-EU countries as a control group, are presented in Appendix Figure C12.

For both variables, we do not observe any significant effect. This result remains robust to alternative definitions of the control group, and the pre-trends support the validity of our approach. We conclude that the DMA has not led to a significant decline in Google Maps usage, as nearly no users have abandoned the platform, and engagement, measured by the number of visited pages, has remained stable. This provides further evidence that the DMA did not fundamentally alter traffic patterns on Google Maps.

Table 7. Difference-in-Differences: log of Desktop Visits' Duration and Bounce Rates for `www.google.com/maps`

	(Duration)			(Bounce Rate)		
	(1)	(2)	(3)	(4)	(5)	(6)
$EU \times post^{DMA}$	-0.051***	-0.050***	-0.031*	0.169***	0.158***	0.121**
	(0.012)	(0.013)	(0.016)	(0.045)	(0.046)	(0.052)
Country FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	✓	✓	✓	✓	✓
Control Contries	All	North Hem.	Only Euro	All	North Hem.	Only Euro
R^2	0.905	0.911	0.830	0.855	0.850	0.823
N	1248	1128	912	1248	1128	912
Mean Dep. Var.	6.939	6.940	6.951	2.043	2.006	1.955

Notes: The sample includes monthly data from January 2023 to December 2024 about the visits' duration and bounce rates for the domain `www.google.com/maps` from desktop devices. The first three columns correspond to the the visits' duration, and the second three correspond to desktop bounce rates. For each variable, we present specifications that include country and month fixed effects. The specifications differ in the composition of the control group: The first specification includes all countries in the control group. The second specification limits the control group to countries in the Northern Hemisphere. The third specification restricts the control group to European, non-EU countries. In all specifications, the treated group comprises 25 EU countries. Standard errors clustered by country are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.



(a) Duration **(b)** Bounce Rate

Figure 5. Event study: log of Desktop Visits' Duration and Bounce Rates

Notes: The log of the visits' duration and bounce rates for the domain `www.google.com/maps` from desktop devices are regressed on country fixed effects and interactions between a dummy variable indicating if a country is in the European Union and a full set of dummy variables for each snapshot. The graphs plot the estimated coefficients of these interaction terms. The coefficient for January 2024 is normalized to zero. The treated group includes 25 EU countries, excluding Cyprus and Malta due to data availability. The control group comprises European non-EU countries. The sample includes weekly data from January 2023 to December 2024. Figures 5a and 5b show the desktop visits' duration and bounce rates for `www.google.com/maps`, respectively. Standard errors are clustered by country and reported in the form of 95% confidence intervals.

4.2.2 Visit Duration and Bounce Rate

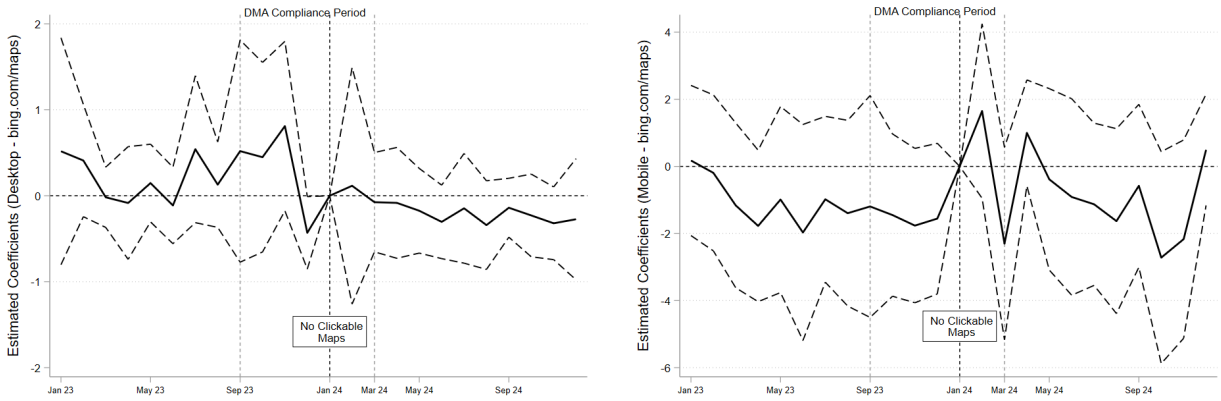
Thus far, we have shown that `www.google.com/maps` traffic does not appear to be significantly affected by the DMA. However, when analyzing the average time spent per visit and the share of visits lasting less than ten seconds (bounce rate), we find evidence consistent with a deterioration in consumer experience. Table 7 presents the estimates from Equation 1 for these two outcomes, using our usual three control groups.

We document a statistically significant decline in the average visit duration of approximately 5% and a 16% increase in the bounce rate. The associated event study plots in Figure 5 (using European non-EU countries as the control group) and Appendix Figures C13 and C14 (using, respectively, the Northern Hemisphere and all non-EU countries as control groups) clearly show that these effects emerge immediately after January 2024, coinciding with the removal of clickable maps. Moreover, all plots provide no indication of a departure from the parallel trends assumption. Using SDiD or synthetic control methods does not alter our results for either variable, as shown in Appendix Table C7. The point estimates remain qualitatively similar to those in Table 7, though they exhibit slightly greater magnitudes and higher levels of statistical significance for the effect on the bounce rates. Similarly, Appendix Figure C15 presents the event study plots for both variables using the SDiD design, once again showing that the changes' timing aligns with the removal of clickable maps in the EU.

A possible explanation for this deterioration in consumer experience is that a segment of the user base accesses Google Maps via the "directions" button, which remains available when searching for location-based results in the EU (see Figure 1). However, users are now directed to a version of Google Maps that automatically provides an itinerary from their current location to the selected destination. This information may not be relevant for all users, leading some to leave the platform shortly after. Furthermore, the additional time spent clicking on directions could otherwise have been used to explore information directly on Google. If this interpretation is correct, the DMA has negatively impacted the consumer experience on both Google Maps and Google more broadly.

4.3 Impact on Google Maps Alternative and Related Services

In the previous subsections, we established that users have, at most, reduced their time spent per visit on `www.google.com/maps`. We now examine whether the DMA has facilitated access to alternative online mapping services. We focus on the traffic of Google Maps' alternative, `www.bing.com/maps`. We then analyze how traffic for Google Search has evolved following the implementation of the DMA, given that the two services vertically integrated during the DMA's implementation.



(a) Desktop **(b)** Mobile

Figure 6. Event study: log of Desktop and Mobile Visits for `www.bing.com/maps`

Notes: The log of the desktop and mobile visits for the domain `www.bing.com/maps` are regressed on country and time fixed effects and interactions between a dummy variable indicating if a country is in the European Union and a full set of dummy variables for each snapshot. The graphs plot the estimated coefficients of these interaction terms. The coefficient for January 2024 is normalized to zero. The treated group includes 25 EU countries, excluding Cyprus and Malta due to data availability. The control group comprises European non-EU countries. The sample includes weekly data from January 2023 to December 2024. Figures 6a and 6b show the desktop and mobile visits for `www.bing.com/maps`, respectively. Standard errors are clustered by country and reported in the form of 95% confidence intervals.

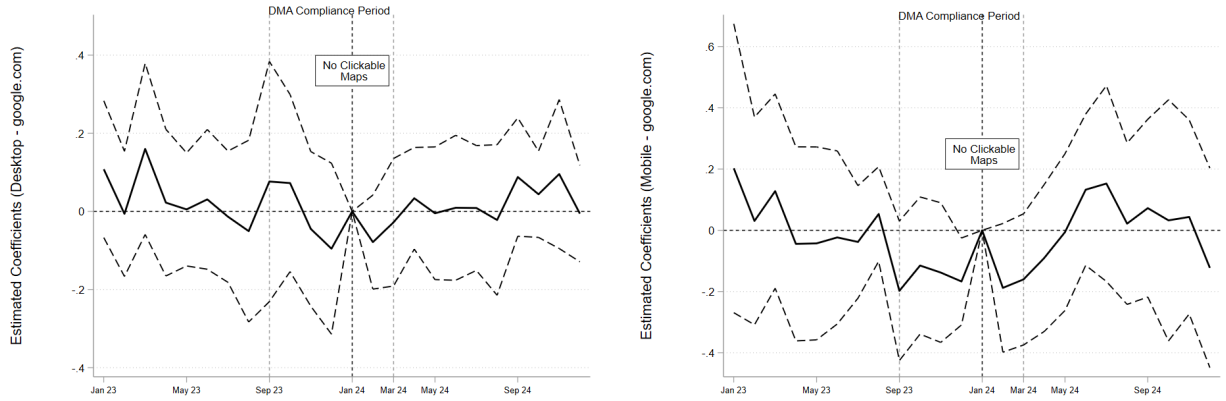
4.3.1 Online Traffic for `www.bing.com/maps`

As discussed in Section 3, Bing Maps is one of the most significant competitors to Google Maps. In particular, Bing Maps is the only competitor with substantial search volumes in both EU and non-EU countries before the DMA, and it features a dedicated mapping website accessible to all users.

In response to the removal of clickable maps due to the DMA and the rise of organic search for online mapping services, some users may have turned to Bing Maps as a substitute for Google Maps. To investigate this possibility, we use total desktop and mobile traffic as dependent variables within our DiD framework based on Equation 1. The estimates are presented in Appendix Table C8 for different control groups, while Figure 6 presents the associated event study using European non-EU countries as a control group. We find no evidence that either mobile or desktop traffic volumes increased as a result of the DMA. In fact, there are indications that Bing Maps' desktop traffic may have decreased.

As a robustness check, Appendix Table C9 reports estimates based on SDiD and synthetic control methods, while Appendix Figure C16 displays the associated event study for the SDiD approach. The estimates are qualitatively similar to those in Appendix Table C8, and the event study plot closely mirrors the one in Figure 6.

Also in this case, we can use mobile visits to control for shocks affecting traffic in the EU post-DMA on both desktop and mobile devices. We estimate a triple differences design based on Equation 2 and report



(a) Desktop **(b)** Mobile

Figure 7. Event study: log of Desktop and Mobile Visits for `www.google.com`

Notes: The log of the desktop and mobile visits for the domain `www.google.com` are regressed on country and time fixed effects and interactions between a dummy variable indicating if a country is in the European Union and a full set of dummy variables for each snapshot. The graphs plot the estimated coefficients of these interaction terms. The coefficient for January 2024 is normalized to zero. The treated group includes 25 EU countries, excluding Cyprus and Malta due to data availability. The control group comprises European non-EU countries. The sample includes weekly data from January 2023 to December 2024. Figures 7a and 7b show the desktop and mobile visits for `www.google.com`, respectively. Standard errors are clustered by country and reported in the form of 95% confidence intervals.

the associated estimates in Appendix Table C10. Also with this approach, we find a negative non-statistically significant treatment effect, suggesting that, with high probability, there has been no increase in desktop traffic to Bing Maps subsequent to the DMA. This finding is further supported by the triple differences event study plot presented in Appendix Figure C17, which shows no identifiable pre- or post-trends.

All of these results are consistent with the null effect observed for desktop traffic on Google Maps, as well as the absence of Bing Maps in search results for `maps` within Google Search (see Appendix Figure A1). We conclude that, in the short run, the DMA has not led to a significant redirection of traffic from Google Maps to Bing Maps.

4.3.2 Online Traffic for `www.google.com`

We conclude this Section by analyzing the impact of the DMA on traffic volumes to `www.google.com`, given Google's vertical integration of aspects of Google Maps directly into Google Search. For example, when searching for a restaurant near a landmark, Google Search now shows restaurant recommendations (e.g., price range, ratings, number of reviews, type of restaurant, address). Additionally, two new badges, "Places" and "Places Sites", have been introduced. These badges display a list of businesses with direct links to Google Maps and a list of their reviews, respectively (see Appendix Figure C18). This integration complicates the detection of self-preferencing, as it becomes challenging to differentiate between Google Search

and Google Maps. Furthermore, the DMA may have affected Google Search's traffic by altering its appeal, such as through changes in search results that reduce the prominence of Google Shopping, Google Hotels, and Google Flights, while also potentially exposing consumers to alternative search engines.

As in previous analyses, we apply the DiD methodology presented in Equation 1, using desktop and mobile traffic as outcome variables for `www.google.com`.

Appendix Table C11 presents the DiD estimates for three control group specifications, and Figure 7 shows the corresponding event study plots using European non-EU countries as the control group. For both desktop and mobile traffic, and across different model specifications, we observe a precise null result with no pre-existing trends. This suggests that the DMA has not had a significant effect on the traffic volume to `www.google.com`.

Appendix Table C12 provides estimates based on SDiD and synthetic control methods, with Appendix Figure C19 presenting the corresponding event study for the SDiD approach. The estimates and event study results are qualitatively similar to those in Appendix Table C11, as well as to those shown in Figure 6.

To further control for shocks that may have affected traffic in the EU post-DMA on both desktop and mobile devices, we use mobile visits as a control variable. We apply a triple difference methodology based on Equation 2, with the associated estimates reported in Appendix Table C13. The results show a non-statistically significant treatment effect, suggesting that, with high probability, there has been no increase in desktop traffic to `www.google.com` following the DMA. This conclusion is further supported by the triple difference event study plot in Appendix Figure C20, which shows no clear pre- or post-trends.

This finding can be interpreted as evidence that the DMA has not harmed Google in the form of reduced traffic. It can also be said that the DMA has failed, in the short run, to direct traffic towards competitors. With regards to the online mapping market, these results suggest that the removal of clickable maps has not led to a detectable increase in traffic for `www.google.com` at the expense of `www.google.com/maps`.

5 Policy and Managerial Implications

The DMA aimed to enhance contestability in digital markets by reducing self-preferencing behaviors of gatekeeper platforms. However, our findings suggest that, at least so far, the removal of clickable maps in Google Search has not led to a substantial increase in market contestability for mapping services. The persistence of Google Maps as the dominant service indicates that alternative providers have yet to benefit meaningfully from these changes, and users continue to engage primarily with Google's ecosystem.

Google's modifications align with the formal requirements of the DMA, but they have not effectively

provided users with new opportunities to discover and adopt alternative mapping services. Different design approaches could have been considered to stimulate competition. For instance, Google has previously introduced choice screens for Chrome users, allowing them to select their preferred search engine upon installation.[30] A similar mechanism applied to mapping services, explicitly presenting users with various mapping options, might have been more effective in raising awareness of alternative providers and facilitating competition. Another notable development is the introduction of "Google Places", which now integrates certain local search results that were previously displayed on Google Maps directly into Google Search (see Appendix Figure C18). This shift raises concerns about whether the intended unbundling of services has been fully achieved. Rather than reducing Google's control over location-based search, this redesign may have simply redistributed the prominence of its own services within a different interface.

A separate but related issue is the availability and quality of alternatives. For market contestability to be effective, competing mapping services must provide comparable geo-localized information. As of now, very few alternatives match Google Maps in terms of data coverage and usability. However, one notable development is the expansion of Apple Maps to desktop users beyond the Mac ecosystem.[31] Although its market share remains small, this move represents a step toward increased competition. That said, it remains unclear whether this expansion was directly influenced by the DMA or simply part of Apple's broader strategy.

5.1 Managerial Implications

The potential reduction in time spent on Google Maps due to the removal of clickable maps in Google Search may lead to fewer opportunities for users to discover businesses through the platform. With users no longer able to click directly on maps to access Google Maps reviews and explore local competitors, businesses that have historically relied on their Google Maps reputation may need to adjust their strategies. One possible response is to strengthen their presence on alternative platforms that provide reviews to competing mapping services, such as Tripadvisor and TheFork, or expand their visibility on Yelp (Goldfarb and Tucker, 2011b; Luca, Nagaraj and Subramani, 2022). Another approach is to enhance visibility on other mapping services, such as Bing Maps or Apple Maps, to reduce dependency on Google's ecosystem. Businesses may also need to optimize their presence in Google Search by increasing investments in search engine optimization (SEO) to ensure that their locations appear prominently in search results, particularly for location-based queries. For instance, instead of relying on Google Maps listings, they may need to focus on ranking

[30] For more information about this change, see https://www.google.com/chrome/choicescreen/.
[31] See again: https://www.apple.com/newsroom/2024/07/apple-maps-on-the-web-launches-in-beta/.

higher in searches for queries like "bookstore near me" or "restaurant in Paris". Additionally, as the discovery process shifts, businesses might find it beneficial to strengthen their offline reputation through direct marketing efforts or by improving customer experience (Goldfarb and Tucker, 2011a).

While Google Maps continues to dominate the online mapping market, if the DMA's goal of increasing contestability is eventually realized, businesses that rely on Google's ecosystem should anticipate a more fragmented competitive landscape. In such a scenario, early adaptation to alternative mapping and discovery platforms could provide a strategic advantage. Rather than waiting for market conditions to shift entirely, businesses may benefit from proactively diversifying their online presence and experimenting with new channels to reach potential customers.

6 Conclusion

This paper investigates the impact of changes to Google's search results page, mandated by the Digital Markets Act (DMA) in the EU, on user search behavior and online traffic, particularly concerning mapping services. Leveraging a difference-in-differences approach comparing EU and non-EU countries before and after the January 2024 implementation, we analyze how removing the direct clickability of map results and the Google Maps signet influenced user choices and market dynamics.

Our findings reveal a significant behavioral response to the DMA-induced design change. We document a robust and statistically significant increase of over 21% in Google search volumes for queries like `maps` and `google maps` within the EU. This indicates that users, unable to access Google Maps directly via the map snippet, resorted to explicit searches to reach the service. However, this increased search activity did not translate into a significant shift towards competing services. While searches for `apple maps` saw a minor, statistically significant rise, volumes remained orders of magnitude smaller than those for Google Maps, and no significant increase was observed for `bing maps` or other alternatives. Furthermore, traffic analysis using Semrush data shows a corresponding, statistically significant increase of approximately 40% in organic search traffic to `www.google.com/maps` from desktop users, with no significant change in direct traffic. Crucially, overall desktop traffic to Google Maps remained stable, suggesting the shift primarily involved users taking an extra search step to reach their preferred service, rather than switching away. Supporting this, we observed a significant decrease in traffic to `www.bing.com/maps`, and no impact on overall usage of `www.google.com`.

These results suggest that while the DMA's intervention successfully altered the immediate user pathway, removing Google's "one-click advantage" has been insufficient to significantly enhance the contesta-

bility of the online mapping market or substantially divert traffic away from Google Maps. The notion that "competition is one click away" appears challenged, as frictions like user habit, brand dominance, and potential inattention seem to lead users back to the incumbent service even when presented with an additional search step (Allcott et al., 2025). We also note subtle changes in user engagement on Google Maps post-DMA, including a 5% reduction in average visit duration and a 16% increase in bounce rates, potentially indicating a slight deterioration in user experience due to the altered access method.

Our study provides early empirical evidence on the real-world effects of the DMA on a major digital platform, contributing to the literature on self-preferencing, online search behavior, and digital regulation. The findings underscore the potential limitations of interventions focused solely on choice architecture modifications when confronting deeply entrenched market positions. While removing preferential placements like clickable maps addresses one aspect of self-preferencing, regulators might consider scrutinizing other integrated features, such as the persistent "directions" button linking to Google's navigation, and exploring mechanisms to enhance the visibility and salience of alternative services within search results.

Future research could explore the longer-term evolution of these trends, including potential lagged effects on competitor adoption or market entry. Investigating the persistence of the observed user engagement changes and exploring the nuances behind the slight increase in `apple maps` searches could also yield valuable insights. Additionally, examining how platforms might adapt compliance strategies over time, and how users respond to these evolving digital environments, remains a critical area for ongoing study in the context of the DMA and digital market regulation.

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