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From digital search to deed: Forecasting UK housing purchases in Spain using Google Trends across the Brexit disruption

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Abstract

This paper examines the predictive relationship between online search behavior and international housing demand, focusing on UK citizens purchasing property in Spain from 2014 to 2024. Using Google Trends data for the search term “Spain villas” alongside official transaction records, we estimate autoregressive (AR), augmented (ARX), and interaction models to assess whether digital intent anticipates real estate purchases. Results show that search intensity significantly enhances model performance before the 2016 Brexit referendum. However, this behavioral elasticity declines thereafter, suggesting a structural break in the intent-action linkage. A Chow test confirms a statistically significant change in the data-generating process. Robustness checks using lagged and differenced specifications reinforce the main findings. We interpret this decoupling as driven by regulatory uncertainty, currency volatility, and psychological hesitancy—amplified by both Brexit and the COVID-19 pandemic. The study contributes to the literature on behavioral macroeconomics and cross-border housing by showing that digital signals are informative but context-sensitive. While Google search data capture intent, their ability to forecast real-world outcomes depends on institutional stability. These results underscore the importance of incorporating regime awareness when using behavioral indicators for forecasting in volatile policy environments.

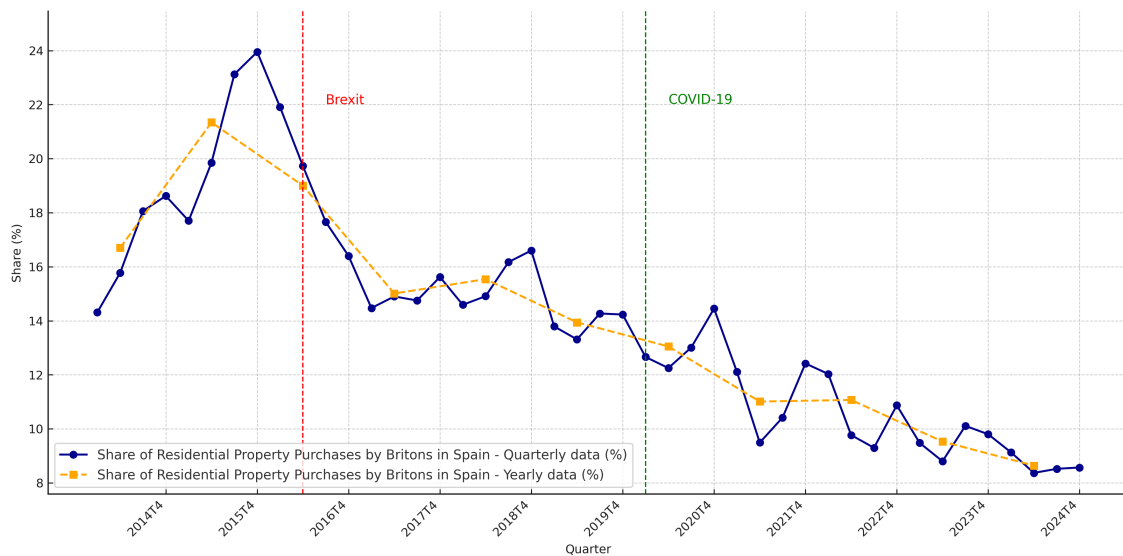
Keywords: Google Trends; behavioral forecasting; housing market; Brexit; UK; Spain; real estate demand

JEL Codes: E32, R21, D83, C53, F22

1. Introduction

Over the past decade, digital behavioral data have transformed the way economic analysis is conducted, by providing novel and large-scale sources of information that enhance existing quantitative techniques and even enable the development of new methods better suited to this type of data. Online search patterns, mobility traces, and social media signals, among other forms of digital behavioral data, have proven useful in anticipating a wide range of economic phenomena, including shifts in consumer sentiment, tourism flows, labor market dynamics, and asset prices. Nonetheless, despite their potential, digital behavioral indicators are not immune to disruptions that alter the relationship between intention and economic action, especially in the presence of institutional events, regulatory changes, or economic and geopolitical shocks.

Figure 1. Share (%) of residential property purchases by Britons in Spain (2014Q1–2024Q4)



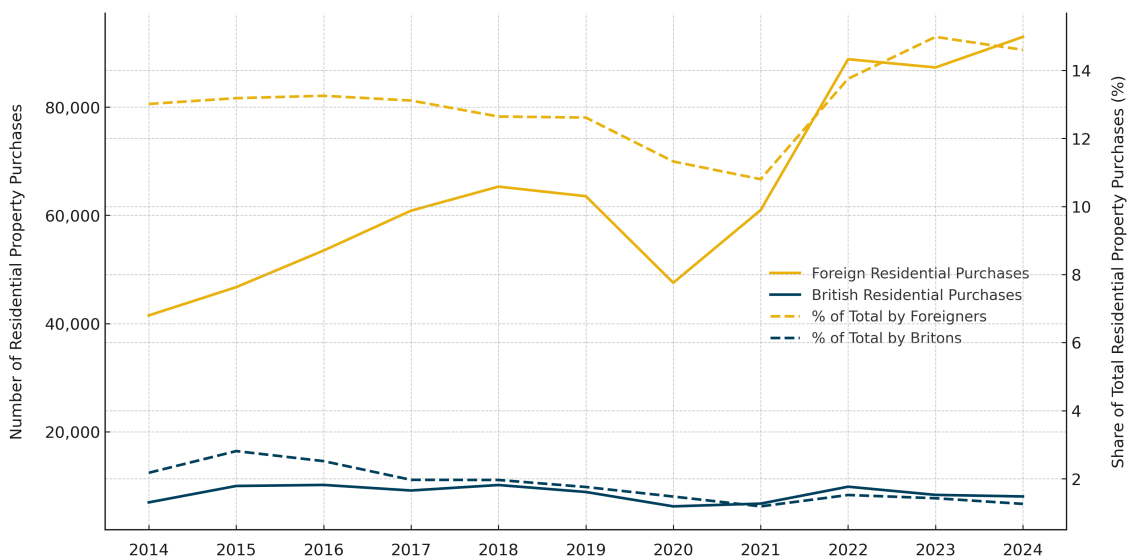
Source: Own elaboration based on Registradores de España. (2025). *Estadística Registral Inmobiliaria*. <https://www.registradores.org/>

This paper explores that possibility by focusing on the housing market—specifically, on residential property purchases in Spain by British nationals—as a relevant illustrative case to assess whether digital indicators of interest reliably anticipate actual cross-border economic transactions. The United Kingdom represents a particularly salient case for the study of residential property purchases in Spain by foreign nationals. As shown in Figure 1, British citizens have historically constituted the largest group of foreign buyers in the Spanish residential real estate market, accounting for over 21% of transactions in peak

years such as 2015. Although this share has gradually declined to 8.6% by 2024, British buyers continue to lead the nationality-based ranking of foreign property purchasers, underscoring the structural significance of their demand (Registadores de España, 2025).

Figure 2 illustrates the number of residential property purchases in Spain made by foreigners and, within this group, by British buyers, expressed in absolute terms. It also shows the respective shares of these purchases relative to the total number of residential property acquisitions recorded in Spain, including those by both foreigners and Spanish buyers. This representation highlights both the scale and the evolving significance of British demand within the broader context of international and domestic activity in the Spanish housing market.

Figure 2. Residential property purchases by Foreigners and Britons, and their share (%) of total acquisitions in Spain (2014–2024)



Source: Own elaboration based on Registradores de España. (2025). *Estadística Registral Inmobiliaria*. <https://www.registadores.org/>

The enduring appeal of Spain as a destination for British property buyers is based on a combination of economic factors, lifestyle preferences, and institutional conditions favorable to foreign ownership and long-term settlement. A significant proportion of these buyers are retirees or individuals approaching retirement, attracted by the prospect of a milder climate, lower living costs, and an improved quality of life (Huber and O’Reilly, 2004; Benson and O’Reilly, 2009; Savaş et al., 2023). This lifestyle-oriented migration pattern has remained notably stable over the past two decades, with Spain

consistently ranking as the main destination for UK nationals relocating abroad in later life (Hall and Hardill, 2016; Benson and O'Reilly, 2016).

The opportunity to integrate into well-established British communities along the coast—where the presence of compatriots facilitates adaptation and reduces perceived risks—further reinforces this pattern. The long-standing tradition of British tourism in Spain also contributes to emotional ties with the territory and a sense of cultural familiarity, particularly in regions such as Andalusia, the Valencian Community, Murcia, the Balearic Islands, and the Canary Islands.

This behavior aligns with the broader phenomenon of lifestyle migration, whereby relatively affluent individuals relocate in search of better climate, greater leisure opportunities, and enhanced personal well-being (Benson and O'Reilly, 2009). In such contexts, residential decisions are shaped more by subjective well-being, social networks, and long-term settlement goals than by strictly economic considerations. These patterns are further reinforced by processes of social integration and institutional adaptation in the host regions (Casado-Díaz et al., 2004). As Taltavull de La Paz and Gibler (2023) emphasize, Spanish housing markets have structurally adapted to accommodate sustained demand driven by lifestyle and well-being motivations. In line with this, the purchase of residential property in Spain by British nationals should not be understood solely as a financial investment, but also as access to a consumption good embedded in long-term life planning (Gibler et al., 2009).

The British case offers an additional dimension of analytical interest due to the sequence of major institutional shocks that have affected this group in recent years, most notably, the economic uncertainty generated by the 2016 Brexit referendum, the United Kingdom's formal withdrawal from the European Union in January 2020, and the onset of the COVID-19 pandemic shortly thereafter. British demand for residential property in Spain has shown particular sensitivity to such disruptions, especially those that compromise long-term residency planning and cross-border mobility.

The 2016 Brexit referendum triggered a major institutional rupture in UK–EU relations, introducing widespread legal and fiscal uncertainty for British nationals. Concerns emerged regarding residency rights, access to public healthcare, long-term legal status, taxation, exchange rate expectations, and freedom of movement within the Schengen Area. This surge in uncertainty significantly reshaped the expectations and intentions of

prospective British property buyers, contributing to a marked slowdown in actual transactions—despite the continued attractiveness of Spain as a lifestyle destination, as already discussed. As is well known, this process culminated in January 2020 with the United Kingdom’s formal withdrawal from the European Union.

This decoupling between interest and action became even more pronounced during the COVID-19 pandemic, which compounded institutional uncertainty with severe mobility restrictions and heightened perceptions of risk. Purchases by non-resident foreigners declined by over 25% in 2020, with British buyers experiencing an even sharper contraction of nearly 30% compared to 2019 levels (Registadores de España, 2025). This pattern reflects the combined impact of pandemic-related travel limitations and the persistent uncertainty resulting from Brexit (Montoriol-Garriga, 2025). Although online interest from the UK, measured through Google search activity related to Spanish property, reportedly remained high throughout this period, actual transaction volumes fell sharply. This observation points to a potential disconnection between online search interest in Spanish residential property by British nationals and their actual purchasing behavior. In this regard, the analysis we present aims to shed light on the relationship between online search behavior and residential property purchase decisions in Spain by British nationals.

The main aim of this study is to assess whether Google searches for terms such as “Spain villas,” conducted from the United Kingdom, can anticipate the actual volume of residential property purchases in Spain by British nationals, using search data corresponding to the period 2014–2024. The analysis focuses both on forecasting performance and on the structural effects of the shocks triggered by Brexit and the COVID-19 pandemic. To this end, we estimate autoregressive (AR) models and autoregressive models with exogenous behavioral variables (ARX), incorporating online search intensity. For this purpose, the study adopts a twofold analytical perspective. First, it evaluates whether incorporating Google Trends data improves the predictive accuracy of autoregressive models compared to specifications based solely on historical transaction data. Second, it analyzes the behavior of British property buyers in Spain, a large and behaviorally responsive group exposed to a prolonged period of institutional uncertainty following the Brexit referendum and the COVID-19 pandemic. The study leverages this discontinuity to explore whether these shocks disrupt the behavioral link between digitally expressed purchase interest and actual economic outcomes, thus providing a kind

of quasi-natural experimental setting to assess the robustness of digital indicators under conditions of structural disruption.

The results obtained in the analysis are noteworthy and, in our view, yield relevant insights in line with the aim of the study, both from an analytical perspective and for understanding the behavior of British buyers in the Spanish real estate market. Prior to the Brexit referendum, Google search volumes exhibited a strong correlation with property purchases by this group. However, from 2016 onward, that correlation weakened considerably. Although British users continued to actively search for terms such as “Spain villas” their actual residential purchases failed to keep pace. Chow-type structural break tests confirm the existence of a shift in behavioral elasticity, and models with interaction terms show a clear reduction in the predictive power of search intensity after Brexit, further amplified by the onset of the COVID-19 pandemic in 2020.

These findings translate into four main contributions of the paper. First, it provides empirical evidence on the predictive value of Google Trends in the context of international housing demand. Second, it documents a clear case of behavioral decoupling following an institutional shock. Third, it demonstrates that even the most sophisticated forecasting systems must adjust when the link between digital purchase intent and market action is disrupted. And fourth, it offers practical guidance for public and private actors seeking to monitor international housing markets in real time.

The remainder of the paper is structured as follows. Section 2 situates the study within the existing literature on behavioral forecasting based on digital search engine data, with particular attention to its applications in international housing markets, and its limitations under institutional disruption. Section 3 describes the data sources and presents key descriptive statistics. Section 4 outlines the empirical models used to assess the predictive capacity of search data. Section 5 reports the main results, while Section 6 examines the potential structural break induced by the Brexit referendum. Section 7 provides robustness checks using alternative specifications, and Section 8 discusses broader methodological and economic policy implications. Section 9 concludes.

2. Related literature

The increasing availability of Internet-generated data has opened new avenues for empirical economic analysis, particularly in contexts where traditional statistics are limited in frequency, scope, or behavioral insight. Digital traces, such as search queries,

offer timely, high-frequency signals that reflect individual interest, planning behavior, and market sentiment in real time. This conceptual perspective supports the use of tools like Google Trends for forecasting and nowcasting economic activity across diverse domains, including labor markets, consumption, tourism, and housing (Askitas and Zimmermann, 2015).

This study contributes to three strands of economic research: the predictive use of online behavioral data, the modelling of international housing demand, and the consequences of institutional shocks, particularly Brexit, on behavioral forecasting relationships in the housing market. Accordingly, this section reviews the empirical literature on the utilization of digital behavioral data, specifically from Google Trends, to forecast economic indicators and housing market dynamics, with a particular focus on methodologies assessing the predictive power of digital search behavior in anticipating real estate demand and transaction volumes.

The review is organized into three thematic areas: (1) economic forecasting using digital search data, specifically from Google Trends (2) applications in housing market analysis, and (3) the influence of institutional shocks on the relationship between digital intent and market action.

2.1 Google Trends and economic forecasting

The utilization of Google Trends (GT) data has emerged as a significant advancement in economic forecasting, offering real-time insights into public interest and behavior. Choi and Varian (2012) pioneered this approach, demonstrating that GT data could enhance the prediction of economic indicators such as unemployment claims and consumer sentiment. Subsequent studies have expanded on this foundation, applying GT data to various macroeconomic and sectoral contexts. Over the past decade, the use of Google Trends data has expanded significantly, evolving from descriptive visualization to predictive modeling across a wide range of disciplines. Jun et al. (2018) provide a comprehensive review of this trajectory, highlighting how GT has become a standard tool in economic forecasting and sectoral analysis. Their survey emphasizes not only the versatility of GT data across domains—including consumption, labor markets, and housing—but also the methodological advancements that have enhanced its forecasting potential. Given the breadth of that review, we do not attempt to summarize all

contributions discussed therein; instead, we selectively highlight a number of studies that are particularly relevant to the objectives and empirical focus of this paper.

A growing body of empirical research builds on this broader perspective by applying Google Trends data to specific forecasting tasks in macroeconomics and related fields. For instance, Ferrara and Simoni (2023) employed a preselection and shrinkage methodology to assess the utility of GT data in nowcasting GDP, finding that GT variables improve forecasting accuracy, particularly during periods of heightened economic volatility. Similarly, Kohns and Bhattacharjee (2023) incorporated GT data into a Bayesian structural time series model for growth forecasting, highlighting the model's enhanced performance in capturing real-time economic dynamics. Medeiros and Pires (2021) provide methodological guidance on the proper use of GT data in forecasting models, emphasizing the importance of keyword specificity, repeated sampling, and appropriate smoothing techniques. Their recommendations are particularly relevant in domains such as real estate, where online intent often precedes observable market behavior.

Huang et al. (2020) examine the role of Google Trends in analyzing housing demand in Taiwan, combining search data with fuzzy-set qualitative comparative analysis. Their findings show that GT indicators effectively capture seasonal dynamics and buyer behavior, offering a qualitative complement to traditional forecasting techniques. Lee et al. (2019) develop a hybrid forecasting model that combines ARIMA and GT-based search intensity to predict short-term housing transaction volumes in Korea. Their model outperforms traditional time-series approaches, highlighting the value of integrating behavioral signals from online searches into operational housing market forecasts. This reinforces the role of GT data as an actionable input for high-frequency forecasting applications.

In the realm of housing economics, GT data has been instrumental in forecasting housing market trends. Wu and Brynjolfsson (2015) illustrated that search queries related to real estate could predict housing prices and sales volumes, emphasizing the predictive power of digital footprints. Dietzel (2016) further explored this by analyzing sentiment-based predictions of housing market turning points using GT data, revealing that search behavior can serve as a leading indicator of market shifts. Belej (2023) extended this analysis to the Polish housing market, demonstrating that online engagement metrics, including GT data, can effectively predict housing price dynamics. Chauvet et al. (2016)

develop a Mortgage Default Risk Indicator based on Google search activity for terms such as “mortgage help” and “foreclosure assistance,” demonstrating its effectiveness in predicting house prices and foreclosure rates. This study highlights the utility of search-based indices in detecting stress in real estate markets. Similarly, Askitas and Zimmermann (2011) use Google search volumes for distress-related terms to detect early signs of mortgage delinquency. Their work emphasizes the timeliness of digital behavioral data as a proxy for financial distress in the housing sector. In other work, Chauvet et al. (2020) introduce an index of mortgage distress risk derived from Google search queries related to foreclosure assistance in U.S. housing markets. Their results reveal a negative relationship between search intensity and subsequent foreclosure rates and house price declines, suggesting that digital search patterns capture early warning signals of housing stress. This approach adds nuance to the predictive use of GT data, particularly in distressed or high-volatility contexts.

Likewise, Beracha and Wintoki (2013) show that abnormal spikes in Google search volume for real estate-related terms predict future changes in residential property prices across U.S. metropolitan areas. Their findings underscore the potential of digital search intensity as an early indicator of price turning points in housing markets. In a comparable line of inquiry, Oestmann and Bennöhr (2015) incorporate Google Trends data into panel regressions for 14 European housing markets and find that search query volumes significantly enhance the explanatory power of models predicting house price dynamics. Their results confirm that online behavior reflects relevant information beyond standard macroeconomic variables in cross-country settings.

Recent methodological contributions have refined the application of GT data. Bulut (2018), focusing on exchange rate forecasting, showed that incorporating Google search data can enhance model performance, even in volatile currency markets. Complementing this applied work, Hölzl et al. (2025) provide a systematic review of GT applications in the social sciences. They identify common methodological pitfalls, such as keyword selection bias, spurious correlations, and lack of validation, and offer recommendations to improve robustness, particularly in high-stakes forecasting scenarios.

Machine learning methods have further expanded the applicability of Google Trends data in real estate forecasting. Jiang (2025) employs a Gradient Boosting Decision Tree model to predict U.S. house prices, integrating GT-derived sentiment indicators into a non-linear framework. The study finds that incorporating search-based signals substantially

enhances predictive accuracy, particularly over longer forecast horizons. This approach exemplifies how digital behavioral inputs can complement advanced data science tools to anticipate market dynamics with higher temporal resolution.

These insights motivate the application of GT-based forecasting models to specific economic sectors, most notably housing markets, where behavioral signals may anticipate high-stakes investment decisions.

2.2 Real estate forecasting and cross-border behavior

International housing markets are subject to distinctive frictions, including information asymmetries, regulatory complexity, and exchange rate risk. In such contexts, online search behavior plays a critical role, often serving as the initial stage in a high-cost, high-commitment decision process. Artola et al. (2015) apply this logic to the tourism sector, demonstrating that UK-based Google searches for Spanish destinations effectively predict subsequent tourist arrivals. Their findings highlight the potential of digital signals to capture cross-border interest before any observable economic activity takes place.

Building on this logic, our paper focuses on a more complex and irreversible decision: the acquisition of real estate abroad. We investigate whether the relationship between digital intent and market action holds over time and under external shocks. Specifically, we use Google Trends data to examine whether digital search activity can forecast foreign property purchases, in this case, by UK citizens in Spain. Compared to domestic purchases, foreign housing decisions typically involve longer planning horizons, greater legal and fiscal awareness, and often align with long-term life choices such as retirement or emigration. These characteristics make international real estate an ideal setting to test the robustness and limits of behavioral forecasting tools.

The intersection of digital behavior and real estate forecasting has garnered increasing attention, particularly concerning cross-border investment dynamics. Buleczak (2021) examined the UK real estate market, finding that GT data could serve as a valuable predictor of housing activity, reflecting investor sentiment and intentions. This approach underscores the potential of online search behavior as a proxy for market engagement, especially in international contexts.

In the context of cross-border housing demand, understanding the motivations and constraints of foreign investors is crucial. Studies have shown that digital search patterns

reveal early signals of buyer interest before observable transactions take place. For example, Vasileiou et al. (2024) investigate the Greek housing market using a sentiment-based index constructed from GT data. Their EGARCH modeling reveals that search-based sentiment significantly affects market volatility, offering a behavioral lens on foreign investment dynamics in structurally sensitive markets. In the same vein, Nazemi et al. (2024) propose a sentiment-based indicator derived from Google Trends data to quantify behavioral shifts in housing markets. Their approach integrates search intensity across thematically grouped keywords, such as affordability, risk, and investment interest, into a composite sentiment index. Using machine learning techniques, they demonstrate that this index significantly improves the prediction of short-term movements in housing returns and volatility, underscoring the utility of GT data as a proxy for market sentiment in real estate analytics.

Coble and Pincheira (2021) provide empirical evidence on the predictive power of Google Trends for forecasting residential construction activity. Drawing on a set of search terms related to housing and construction, they show that GT-based indicators significantly enhance short-term forecasts of building permits in the United States. Their findings reinforce the broader claim that online search behavior contains forward-looking information about real estate dynamics, even when actual decisions are constrained by regulatory or macroeconomic factors. In the same vein, Das et al. (2015) analyze online search intensity for apartment rentals and find robust associations with vacancy rates, rental prices, and real estate returns. Their results suggest that digital search behavior captures key elements of market fundamentals, particularly in rental and multifamily segments.

Furthermore, integrating GT data into forecasting frameworks allows for a granular, geospecific tracking of intent. By analyzing search queries disaggregated by country of origin, researchers can identify shifts in interest among potential international buyers, thus enabling policymakers and developers to anticipate directional flows in second-home markets or seasonal demand surges.

Taken together, these studies suggest that GT-based signals offer meaningful insights into cross-border real estate behavior, yet their reliability may vary depending on institutional stability, a concern we address below in the following subsection.

2.3 Institutional shocks and behavioral decoupling

Institutional shocks, such as political referenda, regulatory overhauls, or currency instability, can profoundly alter the behavioral linkage between digital intent and realized economic action. The concept of behavioral decoupling refers to this disruption, where online indicators suggest persistent interest but market behavior no longer follows the historical pattern.

Born et al. (2019) examined the Brexit referendum's economic consequences and highlight how geopolitical uncertainty can dampen cross-border flows. Although British search interest in Spanish property remained elevated post-2016, realized purchases declined sharply, illustrating a break in the intent-action pipeline. Such patterns reveal the fragility of behavioral predictability under institutional stress.

This empirical insight is supported by Gabaix (2019), who develops the theory of rational inattention, the idea that agents allocate cognitive resources selectively, especially under informational noise or uncertainty. In this framework, GT data may capture interest or concern, but do not guarantee action when the payoff space becomes more ambiguous.

Consequently, while GT data can function as real-time signals of market sentiment, their interpretability must be contextualized. Researchers and practitioners must account for institutional discontinuities and model the conditional elasticity of digital indicators, particularly in globalized markets where legal, fiscal, or macroeconomic disruptions are non-trivial.

3. Data and descriptive statistics

This study relies on two quarterly data sources covering the period from the first quarter of 2014 to the fourth quarter of 2024: (1) the number of residential property purchases in Spain by UK nationals, obtained from the Colegio de Registradores de España (Registradores de España, 2025); and (2) the Google Trends index for the search term "Spain villas" based on queries originating in the United Kingdom.

The real estate transaction data reflect legally registered property acquisitions by nationality, thereby capturing effectively realized property purchases. The Google Trends series, scaled from 0 to 100 per quarter, measures relative search intensity for a semantically specific and geographically targeted term. All data are normalized to the

quarterly level to ensure temporal alignment between behavioral signals and recorded transactions.

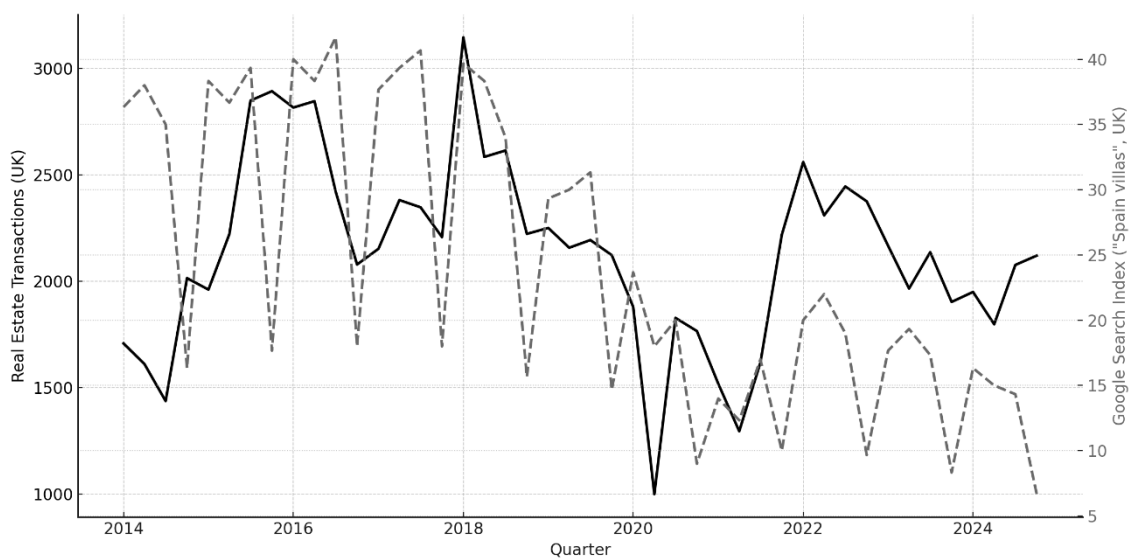
Table 1 reports summary statistics for both series. On average, UK nationals purchased approximately 2,120 residential properties in Spain per quarter over the sample period. The standard deviation of more than 480 transactions reflects substantial cyclical variation, influenced by macroeconomic shocks such as Brexit and the COVID-19 pandemic. The Google Trends index has a mean value of 25.9, with a maximum of 41.7 and a minimum of 6.7, indicating considerable fluctuations in digital search interest.

Table 1. Residential property purchases in Spain by British citizens (2014 – 2024)

Variable	Mean	Standard Deviation	Min
UK Real Estate Transactions	2,140.57	438.88	999.00
Google Search Index (UK)	24.41	11.23	6.67

Source: Own elaboration.

Figure 3. Residential property purchases in Spain by British citizens and Google Search Interest (2014–2024)



Source: Own elaboration.

Figure 3 plots the joint evolution of the two series. A strong visual correlation is evident prior to 2016, with both search intensity and transaction volumes moving in tandem.

Notably, from mid-2016 onward, this relationship begins to diverge: search interest remains at moderate levels, while transaction volume stagnates or even decline. This shift supports our central hypothesis: Brexit disrupted the behavioral pipeline linking digital intent to economic action.

The visual and statistical patterns presented here motivate a formal modeling exercise. In the next section, we outline the empirical strategy used to assess the predictive value of Google Trends data and to identify structural breaks in behavioral elasticity after 2016.

4. Empirical strategy

To evaluate the predictive relationship between digital behavior and real estate demand, we estimate a series of progressively augmented time-series models. Our approach builds on standard autoregressive forecasting frameworks, extended to incorporate behavioral variables and institutional discontinuities. Specifically, we address the following three empirical questions:

- a) Does Google search behavior predict UK property purchases in Spain?
- b) Has this predictive relationship changed following the Brexit referendum?
- c) Can the decline in behavioral elasticity be quantified using interaction models?

4.1 Baseline autoregressive model (AR)

We begin with a standard autoregressive model that captures the persistence of quarterly transaction volumes:

$$\log(y_t) = \alpha + \beta \cdot \log(y_{t-1}) + \varepsilon_t \quad (1)$$

where y_t denotes the number of residential property purchases in Spain by UK nationals at time t . Log-transforming the dependent variable allows for elasticity-based interpretation of coefficients and facilitates scale comparability with index-based predictors.

4.2 Behavioral-augmented model (ARX)

To assess whether online search activity provides additional predictive information, we extend the baseline model by including the Google Trends index:

$$\log(y_t) = \alpha + \beta \cdot \log(y_{t-1}) + \gamma \cdot g_t + \varepsilon_t \quad (2)$$

where g_t represents the normalized Google Trends index for the search term “Spain villas” based on queries originating in the United Kingdom. A positive and statistically significant γ would support the hypothesis that behavioral signals lead real estate transactions, consistent with the intent-to-action framework.

Both models are estimated using Ordinary Least Squares (OLS). We evaluate their performance by comparing in-sample explanatory power and out-of-sample forecast accuracy using standard metrics: R-squared, Adjusted R-squared, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC).

4.3 Structural break: Brexit interaction model

To examine whether the Brexit referendum altered the predictive power of Google Trends data, we extend the ARX specification by including an interaction term and a policy Brexit dummy:

$$\log(y_t) = \alpha + \beta \cdot \log(y_{t-1}) + \gamma \cdot g_t + \delta \cdot D_t + \theta \cdot (g_t \cdot D_t) + \varepsilon_t \quad (3)$$

In this specification, D_t is a dummy variable that takes the value 1 for all quarters from 2016Q2 onward (i.e., quarters following the Brexit referendum date) and 0 otherwise. The interaction coefficient θ captures whether the behavioral elasticity of search interest changes after the institutional shock. A statistically significant and negative θ would indicate behavioral decoupling, consistent with disruptions in the intent-to-action mechanism. We complement this interaction model with formal Chow tests for structural breaks and rolling window estimations to capture potential time variation in elasticities.

All models proposed are estimated using quarterly data from 2014Q1 to 2024Q4. Given the relatively small sample size (44 observations, corresponding to 11 years of quarterly data), we adopt a parsimonious specification strategy and pay close attention to the use of degrees of freedom.

5. Results

This section presents and discusses the empirical findings derived from the three main model specifications outlined previously: a baseline autoregressive model (AR), a behaviorally augmented model incorporating Google Trends data (ARX), and a third model that introduces an interaction term to capture institutional disruption post-Brexit.

Table 2 summarizes the comparative performance of these models, including two additional robustness checks: one that lags the behavioral variable, and another estimated in first differences. As shown, the ARX model outperforms the baseline in terms of R-squared and information criteria, indicating that online search activity enhances predictive accuracy. The interaction model achieves the best fit overall, capturing structural shifts in behavioral responsiveness linked to institutional discontinuities.

Table 2. Forecasting performance of Autoregressive Models with and without search-based behavioral signals

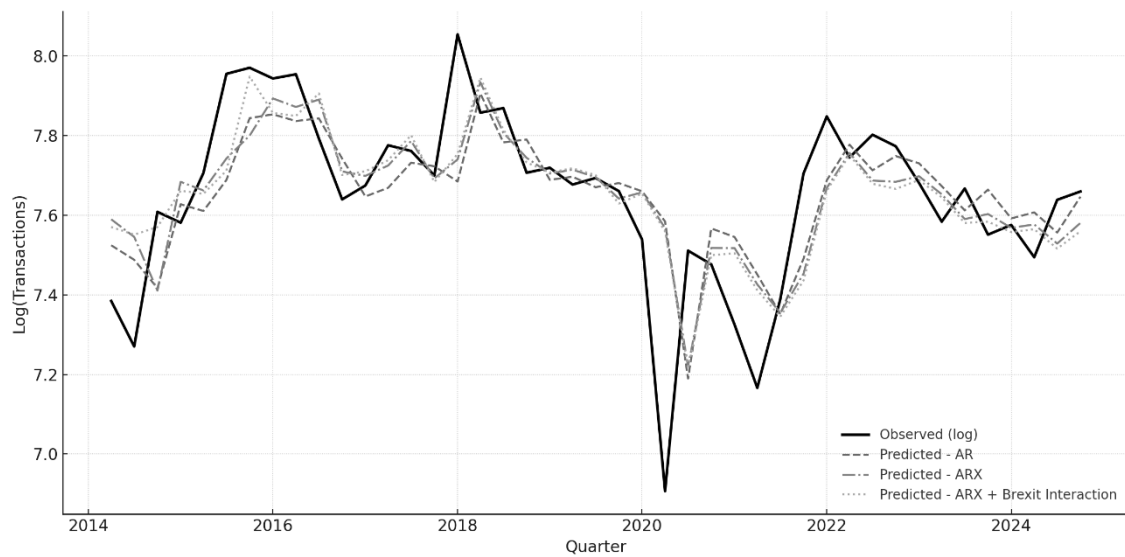
Model	R-squared	Adj. R-squared	AIC	BIC
AR	0.397	0.382	-26.13	-22.61
ARX	0.430	0.401	-26.53	-21.25
ARX + Brexit Interaction	0.461	0.404	-24.95	-16.15
Lagged Google Index	0.400	0.370	-24.34	-19.06
First Differences	0.068	0.020	-16.51	-11.29

Source: Own elaboration.

Figure 4 provides a visual comparison between observed property purchases (log-transformed) and predicted values across the three core models. While all specifications broadly reproduce the temporal pattern of UK housing demand in Spain, their predictive accuracy diverges after mid-2016. The AR and ARX models increasingly overestimate transactions during the post-Brexit period. In contrast, the interaction model better aligns with observed declines, reflecting its capacity to incorporate institutional shifts such as the 2016 referendum, the UK's formal withdrawal from the EU in 2020, and the onset of the COVID-19 pandemic.

As a first overall assessment, the results confirm that Google search intensity constitutes a valuable behavioral predictor of housing demand, particularly prior to the Brexit referendum. The ARX model captures this link, enhancing model fit beyond pure autoregressive dynamics. However, the inclusion of a post-Brexit interaction term proves crucial for modeling the decoupling observed in later years, consistent with the hypothesis that institutional uncertainty weakens the intent–action transmission mechanism.

**Figure 4. Observed and predicted property purchases in Spain by British citizens:
AR, ARX, and Interaction Models (2014–2024)**



Source: Own elaboration.

To further unpack these dynamics, Table 3 presents the full estimation results, including coefficient estimates, standard errors, p-values, and statistical significance levels. These results offer granular evidence regarding the strength and direction of key predictors across specifications.

As a first overall assessment, the results suggest that Google search activity is a valuable behavioral predictor of UK housing demand in Spain, particularly in the years preceding the Brexit referendum. The baseline autoregressive model captures the strong temporal inertia typical of real estate markets, but the inclusion of search-based behavioral data enhances explanatory power and forecasting accuracy. Most notably, the interaction model reveals a significant reduction in predictive strength after mid-2016, lending empirical support to the hypothesis of behavioral decoupling under institutional uncertainty. These patterns warrant closer examination of each model's individual performance and the timing of divergence between digital intent and observed transactions.

Table 3. Estimation Results: Autoregressive and Behavioral Models

Model	Variable	Coef.	Std. Err.	P-Value	Signif.
AR	const	2.881	0.918	0.003	***
	log_sales_lag	0.624	0.120	0.000	***
ARX	const	3.267	0.939	0.001	***
	log_sales_lag	0.561	0.125	0.000	***
	google_index	0.0038	0.0025	0.138	
Interaction	const	3.085	0.960	0.002	***
	log_sales_lag	0.552	0.126	0.000	***
	google_index	0.0047	0.0026	0.076	*
	brexit	-0.153	0.068	0.032	**
	google_inter	-0.0027	0.0012	0.028	**
Lagged GT	const	3.243	0.938	0.001	***
	log_sales_lag	0.553	0.127	0.000	***
	google_lag	0.0034	0.0025	0.183	
First Diff.	const	0.011	0.096	0.911	
	d_log_sales_lag	0.153	0.274	0.579	
	d_google_index	0.0013	0.0022	0.565	

Source: Own elaboration.

To better understand the contributions and limitations of each model, we now examine their individual estimation results in greater detail.

5.1 Autoregressive baseline (AR)

The baseline autoregressive model serves as a benchmark by capturing the inherent persistence in quarterly property purchases. As reported in Table 2, the model yields an R-squared of 0.397 and an adjusted R-squared of 0.382. The lagged dependent variable

(log-transformed) is highly statistically significant, with a coefficient of 0.624 ($p < 0.01$), confirming the inertial nature of real estate demand. This result is consistent with the view that housing market dynamics, particularly in cross-border contexts, evolve gradually and exhibit strong temporal dependence.

5.2 Augmented model with Google Trends (ARX)

Extending the baseline specification by including Google search activity moderately improves model performance. The adjusted R-squared increases to 0.401, and the AIC improves slightly (-26.53 versus -26.13 in the AR model). The coefficient on the Google Trends index is positive, suggesting that digital search behavior contains forward-looking information relevant to forecasting property purchases. However, it does not reach conventional levels of statistical significance ($p \approx 0.14$), indicating that its predictive power—while directionally consistent—may be limited in a context marked by structural change.

5.3 Interaction model with Brexit

The third model introduces a post-Brexit dummy and an interaction term between the dummy and Google search intensity to test for structural changes in behavioral elasticity. Although this model achieves the highest R-squared (0.461), its adjusted R-squared (0.404) is only marginally higher than that of the ARX model, and its AIC and BIC are worse—reflecting the trade-off between improved fit and loss of degrees of freedom in a small sample.

Critically, the interaction term is negative and statistically significant ($p = 0.028$), indicating a weakening in the relationship between online search behavior and actual property transactions after the 2016 Brexit referendum. In other words, while British users continued searching for “Spain villas” these digital signals translated into fewer real estate transactions than before, pointing to a decoupling between intent and action.

As shown in Figure 4, both the AR and ARX models tend to overpredict demand after mid-2016, while the interaction model better matches the observed slowdown. This suggests that regulatory uncertainty, exchange rate volatility, and increased risk perception likely disrupted the behavioral mechanism that connects digital signals to real-world transactions.

This disruption intensified from 2020 onward, as the COVID-19 pandemic layered additional mobility constraints and macroeconomic stress onto an already uncertain institutional environment. These findings reinforce central insight: behavioral indicators based on digital data are not structurally invariant. Their predictive value depends on context, and institutional shocks can profoundly alter the transmission channel from intent to economic action.

5.4 Structural and specification tests

To ensure the robustness of the econometric apparatus and assess the internal coherence of behavioral modeling, we conducted a series of formal specification and stability tests. First, we implemented a Chow test to examine the presence of a structural break in the relationship between digital search intensity and housing demand. Using 2016Q2—the quarter of the Brexit referendum—as the breakpoint, the test yields an F-statistic of 4.01 ($p = 0.027$), allowing us to reject the null of parameter stability at conventional confidence levels. This provides formal econometric support for a structural rupture consistent with the behavioral decoupling documented in section 6.

Second, we applied Ramsey tests to evaluate potential functional form misspecification across the main models. The autoregressive baseline model (AR) shows no significant misspecification ($p = 0.1252$), while the ARX model also passes the test ($p = 0.1447$). However, the interaction model displays a RESET p-value of 0.0492, indicating possible nonlinearities or omitted variables. This reinforces the need for caution when interpreting behavioral decoupling under high institutional turbulence and suggests that structural changes may introduce shifts not fully captured by linear specifications.

Finally, comparing adjusted R^2 values confirms the relative improvement offered by behavioral variables. The AR model explains 38.2% of variation, the ARX model increases this to 40.1%, and the interaction model reaches 40.4%. While the incremental gain appears modest, the structural break and RESET tests underscore that post-Brexit dynamics are not merely noisy but structurally different. This motivates the modeling strategy adopted in the next section and highlights the importance of embedding behavioral data within evolving institutional contexts.

6. Behavioral decoupling in the aftermath of Brexit

The results presented above suggest a structural break in the relationship between online search activity and actual housing transactions among UK nationals in Spain. Before the Brexit referendum, digital intent—as captured by Google Trends data—was a strong predictor of real estate purchases. However, this link weakens markedly after 2016, pointing to a phenomenon of behavioral decoupling that warrants formal econometric testing.

To assess this rupture, we conduct a Chow test using 2016Q2—the quarter of the Brexit referendum—as the structural breakpoint. The null hypothesis posits parameter stability across subsamples. In our case, the test rejects this null at conventional levels ($F = 4.01$, $p = 0.027$), providing statistical evidence that the predictive relationship between digital intent and housing transactions changes significantly post-referendum. This result confirms the presence of a structural break in the data-generating process and reinforces the decoupling hypothesis.

The implications are substantive: Brexit is not merely a contextual backdrop but an event that fundamentally altered the behavioral dynamics of UK property demand in Spain. Several mechanisms can explain this shift. First, regulatory uncertainty regarding residency rights, healthcare access, and taxation likely increased the perceived cost and complexity of acquiring property abroad. Second, the sharp depreciation of the British pound following the referendum raised euro-denominated prices, eroding British purchasing power. Third, psychological and informational frictions—fueled by political instability and media narratives—may have induced caution or inaction, even as digital interest remained elevated.

This process culminated in January 2020 with the UK's formal exit from the EU, followed almost immediately by the outbreak of the COVID-19 pandemic. The combination of these dual shocks introduced exceptional macroeconomic and institutional volatility, further inhibiting the translation of digital signals into actual behavior.

Importantly, while search intensity remained relatively stable, its informational content deteriorated. This finding underlines a key insight: behavioral indicators derived from digital data are context-dependent. Their predictive power hinges on the perceived feasibility of action, which can be disrupted by exogenous institutional shocks. Brexit

thus acts as a natural experiment in which an external event serves the usual link between intention and outcome, reducing the structural reliability of digital traces.

More broadly, our findings caution against treating digital intent as a universally stable predictor. In settings marked by institutional turbulence or policy uncertainty, digital signals may no longer anticipate real-world behavior. Behavioral forecasting must therefore be contextualized within broader institutional frameworks to avoid overestimating the validity of search-based proxies. Models that rely on digital intent should explicitly incorporate variables capturing regulatory risk, macroeconomic constraints, or uncertainty shocks to enhance their robustness under non-stationary conditions.

7.2 First-difference model

We also estimate a model in first differences to examine the short-term variation in both searches and transactions:

$$\Delta \log(y_t) = \alpha + \beta \cdot \Delta \log(y_{t-1}) + \gamma \cdot \Delta g_t + \varepsilon_t \quad (5)$$

This model yields a much lower R-squared (0.068) and adjusted R-squared (0.020), with a substantial deterioration in fit (AIC = -16.51, BIC = -11.29). None of the regressors are statistically significant, indicating that short-run fluctuations in search intensity do not translate clearly into contemporaneous changes in transaction volumes. This result highlights the limitations of different specifications when behavioral responses are gradual and affected by discrete institutional shocks.

Table 4. Robustness Checks

Model	R-squared	Adj. R-squared	AIC	BIC
Lagged Google Index	0.400	0.370	-24.34	-19.06
First Differences	0.068	0.020	-16.51	-11.29

Source: Own elaboration.

Here, the explained variation falls sharply (R-squared = 0.068). This result suggests that, while levels of Google search activity and transaction volumes are strongly correlated,

their short-term changes are considerably noisier and harder to predict. Given the small number of quarterly observations and the presence of institutional disruptions, such as Brexit and COVID-19, this loss of explanatory power is not surprising. It also highlights the challenges of using differenced specifications when the underlying behavioral process is gradual and subject to discrete shocks.

Overall, both robustness checks confirm the main insight of our analysis: Google Trends exhibit significant predictive value for the levels of real estate activity, particularly in the pre-Brexit period. Their explanatory power weakens in lagged or differenced specifications, likely due to timing misalignment or structural breaks in behavioral elasticity. This decline is especially pronounced in the first-difference model, where the volatility of short-term changes is compounded by the small sample size and the presence of disruption shocks, such as Brexit and the COVID-19 pandemic. We interpret these patterns as consistent with our behavioral framing: digital intent tends to precede market action, but the translation mechanism is fragile and particularly vulnerable to periods of heightened uncertainty.

8. Main contributions and insights

The findings of this paper offer both empirical and conceptual contributions to the study of behavioral macroeconomics and digital data forecasting. By focusing on a well-defined case—the relationship between Google search behavior and real estate purchases by UK nationals in Spain—we isolate a clear mechanism through which online intent translates into market action. At the same time, we show how institutional disruptions, notably Brexit and the COVID-19 pandemic, can weaken this transmission channel, raising important implications for theory and practice.

• Behavioral indicators and elasticity

Our results validate the premise that digital search intensity contains predictive information. In the pre-Brexit period, Google Trends data, specifically searches for “Spain villas”, serve as a significant forward-looking indicator of housing demand. This finding aligns with models of rational agents who engage in informational search prior to committing to large-scale investment decisions such as cross-border home purchases.

However, we also show that the behavioral elasticity of action to intention is not structurally stable. Following the Brexit referendum, the same level of search activity no

longer leads to comparable transaction volumes. This reflects a key limitation of digital behavioral indicators: they capture interest, not feasibility. When uncertainty rises or when legal and financial frictions increase, intent may persist but fail to convert into action.

This insight is generalizable. Increased online searches for jobs or durable goods do not necessarily imply higher employment or consumption if institutional or economic constraints prevail. Accordingly, behavioral data should be interpreted as conditional signals, not autonomous drivers of economic outcomes.

- *Forecasting under institutional change*

The post-Brexit decline in the predictive power of search data illustrates the risks of relying on behavioral indicators in periods of institutional disruption. Models calibrated under stable regimes may misfire when structural conditions shift. Our findings emphasize the need for structural monitoring and recalibration of forecasting models that incorporate digital data.

More broadly, digital indicators must be embedded within frameworks that account for regime shifts or external constraints. Forecasting models that ignore such discontinuities are prone to systematic error, as illustrated by the consistent over-prediction of housing demand in the post-2016 period.

- *Real estate markets and cross-border intent*

This paper contributes to the literature on international real estate by documenting how behavioral decoupling manifests in cross-border property markets. Compared to domestic purchases, foreign acquisitions tend to be more discretionary, more exposed to policy uncertainty, and more sensitive to macroeconomic volatility. These features make them ideal contexts for observing intent–action divergence.

From a policy perspective, our findings suggest that high-frequency digital indicators such as Google Trends can complement official transaction statistics, particularly when monitoring foreign demand. However, their value depends on a correct reading of when digital signals genuinely anticipate market outcomes—and when they do not. Understanding this boundary requires combining economic reasoning with insights from institutional and behavioral analysis.

- *Methodological implications*

Finally, our modeling approach, combining AR and ARX specifications, structural break tests, and interaction terms, provides a general template for testing the stability of behavioral predictors over time. This methodology offers a flexible yet rigorous framework to assess whether and when digital indicators retain their forecasting power.

Future research can apply this strategy to other markets, behavioral signals, or national contexts, extending the analysis of digital intent and its conversion into economic behavior. As digital data sources continue to expand in frequency and granularity, their forecasting value will depend less on data availability and more on our structural understanding of when behavioral signals succeed (or fail) as predictors of real-world action.

9. Concluding remarks

This paper has examined the relationship between online search behavior and international real estate demand, focusing on UK citizens purchasing property in Spain between 2014 and 2024. Using Google Trends data for the search term “Spain villas” and official registry records, we find robust evidence that digital interest predicts housing transactions, particularly prior to the Brexit referendum of 2016.

Our main contribution lies in demonstrating that this behavioral predictability is not stable over time. Following the Brexit vote, the elasticity between Google search intensity and property purchases declines significantly. This suggests a form of behavioral decoupling, in which intent persists but is no longer matched by economic action. The causes likely include regulatory uncertainty, macroeconomic volatility, and subjective risk perceptions, all amplified institutional shocks and the global health crisis.

These findings carry three broad implications. First, behavioral data are valuable forecasting tools, but their reliability depends on context. Second, institutional and epidemiological shocks can sever the link between intent and action, rendering historical patterns obsolete. Third, predictive models using digital data should incorporate regime awareness, either through structural modeling or continuous recalibration.

Future research can extend this analysis to other countries, search terms, and economic domains. Additional work is also needed to understand the psychological and institutional channels that shape the translation of digital behavior into observable outcomes. This case

study offers a cautionary yet promising insight for economists working with digital behavioral data. While such indicators can outperform traditional predictors in terms of speed and frequency, they continue to be subject to disruption. Researchers and practitioners must therefore complement machine-generated insights with institutional awareness and policy context. Until then, analysts and policymakers should remain cautious: Google knows what people are thinking, but not always what they will do.

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