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## Forecasting Migration and Integration Trends Using Digital Demography – A Case Study of Emigration Flows from Croatia to Austria and Germany

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## Article

Tado Jurić\*

# Forecasting Migration and Integration Trends Using Digital Demography – A Case Study of Emigration Flows from Croatia to Austria and Germany

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**Abstract:** This paper was created as a result of the observed instability of external emigration data from Croatian official data in comparison to data from the statistical offices of the European Union (Eurostat) and Germany (DESTATIS). In this study, the author presents a descriptive analysis of alternative data sources (big data), which could be useful for determining emigration flows from Croatia to Austria and Germany, as well as for estimating and forecasting. The second goal of this paper is to show that this approach can be useful for assessing the degree of cultural assimilation/integration of Croatian emigrants using the tools of Google Trends and Facebook Analytics. To estimate the model, linear regression was used to measure the correlation between the number of searches ( $x$ ) and the number of moves ( $y$ ) evidenced by the official statistics.

**Keywords:** digital demography, migration, Croatia, Germany, Austria

## Introduction

The methodological inconsistency between national Croatian and external data sources such as the statistical office of the European Union (Eurostat) and the Federal Statistical Office of Germany (DESTATIS) has emerged as a problem in Croatian demographic research. The difficulty is especially noticeable with regard to external migration flows from Croatia (Jurić 2018). German and Croatian official data give conflicting results that vary from year to year, with discrepancies that range from 40% to as high as 80% (Pavić and Ivanović 2019). Not a merely

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administrative issue, this problem has led to real negative consequences in the adoption of adequate demographic revitalisation measures. On the one hand, to make appropriate decisions regarding the number of potential migrant workers, the administration needs to have information on recent migration flows and the availability of such workers within European Union (EU) countries. On the other hand, the country from which the labour force is drawn, such as Croatia, needs to have estimates of the workforce that has remained at home. In the most recent United Nations (UN) report, Croatia and the Western Balkans region were declared one of the most demographically endangered areas in the world (United Nations 2020). Any further emigration of citizens poses a serious threat to its stability and overall well-being.

The true picture is seriously distorted because over 60% of Croatian emigrants ignore the Croatian legal requirement for citizens to deregister from the country when emigrating (Pavić and Ivanović 2019). In seeking employment and social rights Croatian emigrants have more incentives to register in their destination countries, whereas they are afraid of losing existing rights by deregistering from Croatia. Such hindrances to accuracy suggest that a supplementary method of estimating the number of emigrants should be developed.

Since there has been a substantial increase in internet access compared to the creation of credible migration monitoring registration systems, the development of statistical tools that combine traditional and new sources of information is likely to become an accepted approach to monitoring demographic trends of all kinds (Spyratos et al. 2018). Web-assisted research has been consistently validated in several other scientific fields, such as public health, economics, etc. In demography, researchers have begun to use non-traditional or alternative data (mobile phone records, social media use, satellite maps, and internet-based platforms: so-called big data), particularly to understand migration and mobility in light of new methodological approaches (Wanner 2020). Despite the existence of research on the use of large data sources in the field of demography in Europe, studies have generally been rare and no such research has ever been conducted in Southeastern Europe. Previous research has established that digital data can be employed to study migration, but there are still significant methodological issues and scepticism regarding the feasibility of using alternative data sources. Because more research is necessary to assess the value of using big data for such research, this paper represents an attempt to measure the extent to which Google search activities can predict Croatian citizens' intentions to emigrate. It focuses on emigration from Croatia to Austria and Germany (with a few other examples) as a case study, but this approach can also be applied to emigration from all countries of the Western Balkans region: they all share similar characteristics vis-à-vis emigration push factors and the instability of official data, and the emigration destinations are the same (OECD 2020).

It has been proved that an individual's intention to migrate can serve to predict future behaviour (Böhme, Gröger, and Stöhr 2020; Carling 2017). Exposure to information plays a crucial role in providing people with the necessary information and resources to decide whether to stay in their countries or migrate (Steiner 2017). I hypothesise that an increase in the number of Google searches will, following a delay of about six months, translate to an increase in the number of emigrants. To standardise the data for Google Trends, I extracted data for the period from 2004 to 2020. I then divided the keyword frequency for each migration-related word, which gave me a search frequency index. I then compared the search queries with official statistics using a linear regression method. Since Facebook's Application Programming Interface (API) can provide insights into particular interests of the observed population, based on likes, pages visited, and other signals, it can illuminate the cultural assimilation and integration of Croatian emigrants into other countries.

The structure of the paper is as follows: after briefly showing the results of relevant studies on innovative data sources in demographics, I explain this study's methods and show the limitations of this conceptual orientation. I then discuss emigration from Croatia and reveal the results achieved via this approach. In the section on results, I show the correlation between the Google search index and the official German statistics, as well as discuss how to forecast migration with Google Trends and how to use the Facebook Analytics tool and Google Trends as sources for verifying and evaluating the degree of integration.

## **Innovative Data Sources in Demography – A Review**

Human migration within Europe is difficult to measure due to the demise of national European borders in the traditional sense and the lack of efficient statistical systems in numerous EU countries (OECD 2018). Traditional statistics, based on registers, censuses, or surveys, often fail to measure the complexity of migration flows in and to the EU (Wanner 2020). The pandemic accelerated the uptake of digital solutions in data collection techniques (Sogomonjan 2021). Given the ever-growing digital footprint left on the web, such data are increasingly being used for different types of research. Traditional data sources, based either on surveys or registers, generally fail to provide statistical information on migration flows quickly and do not facilitate the accurate short-term anticipation of these flows (Wladyka 2017). This limitation is one reason underlying the development of new methods based on alternative sources, so-called big data. In 2014 the UN

conducted the first research on the use of big data for demographic research, with its report released in March 2018 (United Nations 2014, 2019). These data were shown to provide useful insights into the quantitative and qualitative characteristics of international and other migrations. After the UN confirmed the relevance of these data, explorations have been carried out on social networks, and several studies have used big data sources to directly analyse migration-related phenomena (Zagheni and Weber 2015). A particularly impressive contribution to this area has been made by Zagheni, Weber, and Gummadi (2017), who used the data from Facebook’s advertising platform to assess international migrants in the US. Furthermore, the geo-data of Twitter users has proved useful in studying the relationship between internal and international migration, while the data from LinkedIn has provided insights into global migration patterns (Dubois et al. 2018; Hawelka et al. 2014; State et al. 2014).

The European Commission has arrived at a conclusion similar to the UN’s—large data sources, though they cannot replace traditional sources of information, can be used to assess trends (European Commission 2016). Furthermore, it has been established that both kinds of data sources can complement each other (Spyratos et al. 2018). In addition to being extremely robust, these data are easily collected, are generated in real time, and provide significant insights into the opinions of individuals. Digital traces shed a much deeper light onto attitudes, which can easily be disguised within other forms of data collection (Böhme, Gröger, and Stöhr 2020).

Would-be migrants often use online searching to get answers about the country they plan to emigrate to (Gabrilovich 2020). The first successful analysis of Google Trends migration data examined the searches of certain Arabic terms in Turkey and Germany via words such as “Greece” or “Germany” during the “Migration Crisis of 2015” (Connor 2017a, 2017b). This study showed that digital traces of internet searches can illuminate the movement of migrants (Connor 2017b). Böhme, Gröger, and Stöhr (2020), using a combination of economic- and migration-related keywords to forecast the levels of migration between groups of countries, achieved a fairly robust degree of predictive power. Wladyka (2017), in estimating flows from Latin America to Spain, observed that the predictive power of Google varies from one country to another. The present paper thus serves, within the wider international environment, as an additional indicator and test of this method’s efficacy and accuracy.

When using this method, it is especially important to choose search terms with the clearest possible indications of the motive for the search. For example, if someone in Croatia googles “Germany” from Croatia this does not necessarily imply an intention to move there; it might simply indicate a desire for tourist information. Compared to other approaches, such as the analysis of Facebook data, the advantage of Google Trends is that limitations related to penetration rates and fake accounts are not prevalent.

Big data sources, such as those generated from social networks, have also been used to evaluate issues related to integration and cultural assimilation. Facebook is a great reservoir of untapped data that can be used for this purpose (Zagheni et al. 2020). Facebook offers several socio-demographic pieces of information, as well as information automatically inferred from users' interactions, their network of friends, and related sites, such as their interests (Jurić 2022). All these variables are regularly updated and can be downloaded for free for certain intervals, so this data set is “a kind of constantly updated census” (Zagheni, Weber, and Gummadi 2017).

Facebook and Google Trends can also serve as quite reliable tools to monitor the degree of integration of Croatian migrants into German society, especially through the analysis of Facebook interests. Dubois et al. (2018) estimated the level of assimilation of Arabic-speaking migrants in Germany based on Facebook data. Herdagdelen et al. (2016) used the same source to describe the composition of immigrants' social networks in the United States. The Facebook Marketing API has hundreds of thousands of interests to target ads. In this paper, I collected the data for 30 interests of emigrant Croats in Germany. I then compared these data with data from the German population. My objective here was to obtain a result that could serve as a basis for comparing the integration of Croatian immigrants to Germany with the domicile population in terms of the interests expressed by both population groups. This shows that this model can be extended to the study of the cultural assimilation and integration of a certain immigrant population, in this case Croats within the societies of Germany and Austria, respectively. Zagheni, Weber, and Gummadi (2017), testing this model on the US, proved the validity of the method.

The question of the rate of internet penetration in the observed societies is certainly important in this method. By mid-2020, 58% of the world's population was estimated to be internet users, compared to almost 90% in the EU (StatCounter 2020). Within the EU, the same study showed that usage in Croatia is 81%. The data show that when it comes to the use of internet services, Croatia is generally comparable to the EU average. The Google search engine is by far the most popular in Croatia, preferred by 97.21% of users (StatCounter 2020) and roughly aligned with overall EU totals (92.92%). The percentage of citizens with no experience using the internet increases with advancing age. Most Croatian citizens not using the internet are over 65 (Jurić 2021a). Since members of this age group rarely emigrate, they are irrelevant to our study. In 2019 the total active Facebook users in Croatia, divided approximately equally by gender, represented 51% of the population, making Facebook the most visited social network among Croatian citizens (Vuković 2019).

## Methodological Design

The basic method used for analysing Google search is based on search language and geolocation, and for Facebook on the primary language of users and geolocation. Both tools allow analysis according to the country where the specific observed group uses these applications and the language of use. The control mechanism for determining data deviations was performed by comparing official databases, including the Croatian Bureau of Statistics (Državni zavod za statistiku, DZS 2021, 2015–2020), the German Federal Office for Migration and Refugees (Bundesamt für Migration und Flüchtlinge, BAMF) migration reports for 2018 and 2019 (BAMF 2018 and 2019), the Federal Statistical Office of Germany (DESTATIS 2021), Austria's Federal Statistical Office (Statistik Austria 2021), and Eurostat.

The ability to track Facebook users by language (in this case, Croatian) and geolocation is a key methodological design component of this study. The simplest way to track changes is via year-over-year comparisons. Here it is important to note that the researcher has to keep their own data archive because Facebook offers data only for the present. The process evolved as follows. I collected the state-level estimates of Croatian expatriates from the Facebook Audience Insights database and the Facebook Marketing API, which supports the extraction of various socio-demographic data available in the API. Since the API can also provide insights into certain interests of the observed population, based on likes, pages visited, and other signals (Dubois et al. 2018), I used this instrument to analyse the level of integration/cultural assimilation.

As a simplified example of the integration of Croats into German society, I took the interests of Croatian language Facebook users in Germany interested in typically German interests—the national Bundesliga soccer league, German music, media, and politics—and compared them with the same set of German language interests in Germany. The conclusion was arrived at as follows: If the Croatian population had a similar level of interest to that of the host, this was a good indicator of integration in terms of cultural taste (Dubois et al. 2018). The basic procedure was therefore to compare the obtained data and focus on whether the interests expressed by the Croatian immigrants overlapped with those of the German population.

To triangulate the results and verify the data, I compared this set of data with previous studies of emigration from Croatia to Germany (Jurić 2017, 2018), official German and Austrian statistics, as well as with my parallel study conducted from 2018 to 2020 in Germany. For this study, a survey was conducted in the system of Croatian teaching abroad, which I then combined with semi-structured interviews with employees of Croatian Catholic missions/parishes and teachers of

Croatian in Bavaria. I included a sample of 568 emigrants to more fully understand the research topic.

The methodology used by Google Trends is also based on search language and geolocation. Using this method, one should take care to choose specific migration-related queries; but one should also pay attention to variation in the search index depending on the keywords of a given query. Certain delimiters such as “–” and “+” allow users to change the combinations of keywords searched. A search for a single keyword will yield the search frequency index counting all searches containing that keyword, including searches that contain other words (Wilde, Chen, and Lohmann 2020). To standardise the data, I requested data for the period 2004–2020 but focused on the period after Croatia became an EU member (2013 onwards). I then divided the keyword frequency for each word, giving me a search frequency index. I then compared searches for every year with official statistics to establish the significance of the results (Böhme, Gröger, and Stöhr 2020; Wilde, Chen, and Lohmann 2020). Initially, I chose keywords by brainstorming possible words that I believed to be predictive, specific, and common enough for use in forecasting (see Table 1).

I am aware that potential migrants may use other methods to gather information on living and working conditions in Germany or Austria, such as the accounts of friends or family members who have already immigrated to these countries. Nevertheless, there are numerous indications that potential migrants are largely gathering or refining information through Google searches before emigrating.<sup>1</sup> According to Wanner (2020), one can expect to find a relationship between the intention to emigrate and particular behaviours.

## Limitations of the Methodological Concept

This study, like all others of this type, is bound by significant limitations. Although previous research in this area has established the feasibility of using digital data to study migration (Zagheni et al. 2020; Zagheni, Weber, and Gummadi 2017), methodological issues remain. One basic objection to these data is that they are not representative of the observed population (Cesare et al. 2018). At the same time, ever more studies have provided evidence that samples obtained from Facebook do not significantly differ from those obtained by more traditional recruitment and sampling techniques in central demographic and psychometric characteristics,

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<sup>1</sup> I tested this assumption with a survey in the Croatian Facebook group in Germany *Idemo u svijet – Njemačka*, which numbers over 300,000 mostly immigrant Croats in Germany (92% of respondents confirmed this assumption).



Table 1: Keyword and topic selection criteria.

General terms	Economics	Housing, life	Activities	Cities
Emigration to Germany, to Austria	Application for job in Germany, Austria	Registration of residence in Germany, in Austria	– How to write a <i>Lebenslauf</i> (CV)	Vienna
– <i>Studium</i>	– <i>Gehalt</i> (salary)	– Accommodation, flat, housing	– How to complete a <i>Bewerbung</i> (job application)	Graz
– <i>Schule</i> (school)	– Wage	– Life in Germany, Austria	– Learning German	Linz
– <i>Arbeit</i> (work)	– Job in Germany, Austria (car mechanic, plumber, haulier, waiter, nurse)	– Enrolment of a child in school		Munich
– Employment				Stuttgart
– Passport				Frankfurt
– Citizenship				Berlin

Source: Author's construction.

especially if post-stratification weights are adequately applied (Kalimeri et al. 2020; Pötzschke and Braun 2017; Schneider and Harknett 2019; Zagheni and Weber 2015; Zhang et al. 2018).

Facebook and Google Trends data do not provide information on the number of years Croatian citizens have spent in Germany, a key variable for studying integration and assimilation processes (Jurić 2022). Furthermore, Google Trends offers no demographic data on population structure. However, previous studies (Jurić 2017, 2018) give us the option of verifying the results. The problem with Facebook data lies in the possibility that users have multiple unconnected accounts, which can produce data distortion.

A certain number of users, we should note, might be members of our target group but use Facebook in another language, and thus Facebook would not have listed them in the database. Furthermore, a problem arises from Facebook's annual network estimates being available only for user age groups from 18 to 64 years of age (Spyratos et al. 2018). There are also important limitations in using these tools (Facebook and Google Trends) due to the unequal representation of females and members of older age groups.

When interpreting the results of the Google Trends analytics tool, a problem arises with the identification of the analysed group according to the search language used. Namely, as Serbian, Bosnian, Montenegrin, and Croatian are quite similar languages, it is not always possible to find a separate term used exclusively in Croatian (Jurić 2022). Furthermore, according to external alternative data (from Croatian Catholic missions in Germany and from Facebook) one-fourth of all Croatian immigrants in the contemporary migration wave are Croats from Bosnia-Herzegovina with Croatian citizenship—double citizenship, that is, granted on grounds of their ethnicity (Jurić 2018). It is important to emphasise here that the majority of Croats from Bosnia-Herzegovina have Croatian citizenship, too, and, as a rule, have their registered residence in Croatia. Neither official Croatian nor German statistics (which keep records according to citizenship) manage to address this statistical problem (Jurić 2022). The issue also affects the methodological procedure as it pertains to the sizable Serbian minority in Croatia, although it is worth emphasising that ethnic Serbs from Croatia generally use the Serbian language, which is guaranteed by the Law on the Rights of National Minorities.

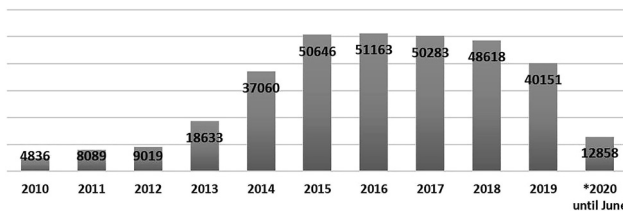
To test the prediction, I consider a period reflecting a constant relationship between the intention to emigrate and its realisation. Therefore, it is necessary to avoid periods characterised by changes in immigration policies or by an unexpected situation such as the current Covid-19 pandemic—and in this regard, I believe that this period has been significantly extended since 2020 and that the assessment will stabilise when the pandemic ends. For Latin American citizens aiming to immigrate to Spain, Wladyka (2017) estimated an approximately

seven-month time lag between the searches on specific terms, which also overlaps with my calculations up through the time that the pandemic arrived in Europe (Wanner 2020).

Although these open questions pose serious challenges to the making of clear estimates, statistics offers a range of tools to deal with imperfect data, such as the “R”-tool—a method that, though it is currently beset with several limitations, a growing number of researchers have been improving (Pötzschke and Braun 2017; Zhang et al. 2018), and it seems to be only a matter of time before it becomes an integral part of demographic science.

## The “EU Migration Wave” of Croatian Citizens

To provide the required framework for the comparison of official data with data obtained from Google Trends, I will briefly look at migration processes within Croatian society since 2013. Since Croatia became a member of the EU in 2013, about 50,000 people annually have left the country for Germany alone (which accounts for 85% of all emigration) (Jurić 2021b). Mass immigration to Germany began on 1 July 2015, when Germany opened its labour market to workers from Croatia. Although many predicted that Croatia’s accession to the EU would have only a moderate impact, it has in fact greatly facilitated emigration (Jurić 2021c). Thus, since Croatia joined the EU, emigration has every year seen an increase, particularly in the period from 2015 to 2018 (see Figure 1). According to the 2020 BAMF data, 426,845 Croatian citizens are currently living in Germany. Since Croatia acceded to the EU, the number of Croatian citizens in Germany has doubled. As many as 298,112 Croatian citizens immigrated to Germany in the period 2013–2020 (BAMF 2020a). The 2020 data are incomplete, but BAMF shows



**Figure 1:** The emigration of Croatian citizens to Germany from 2010 to 2020.

Source: Author’s construction based on data from BAMF (2020b).

that by June 2020, 12,858 new Croatian citizens had immigrated to Germany, which suggests that the emigration trend remains, even despite the pandemic, which significantly reduced the influx of foreign nationals into Germany (BAMF 2020a). The immigration of Croatian citizens to Austria also reveals a rapid increase, though not as dramatically as in the case of Germany (see Table 2).

**Table 2:** Total number of emigrants from Croatia to Austria from 2013 to 2020.

	2013	2014	2015	2016	2017	2018	2019	2020
No. of emigrants	58,619	61,959	66,475	70,248	73,334	76,682	79,999	83,596
Increase from previous year	322	3340	4516	3773	3086	3348	3317	3597

Source: Author's calculation based on data from Statistik Austria (2021).

In addition to emigration, other negative demographic factors are at work. The Croatian birth rate, declining for years, is below the EU average (Eurostat 2021). The emigrants themselves perceive the main motives for emigration from Croatia to be non-economic (Jurić 2017). Jurić (2017) shows that 55% of Croatian emigrants in the so-called EU immigration wave to Germany had been employed and demonstrates that Croatian emigrants move primarily not because of poverty but instead due to the perception of social injustice in Croatia. On display in the analysis of emigrant attitudes was the belief that there are no “institutionalised values of work ethic” and honesty in general in Croatia. The research points to a clear linkage of political ethics, weak institutions, and emigration. Topping the list of motives contributing to emigration are the immorality of Croatia's political elites, as well as legal uncertainty, nepotism, and corruption (Jurić 2017). Economic reasons to emigrate are certainly taken into consideration, but they are also directly related to the sociopolitical set of push factors. The study concluded that the push factors from Croatia are stronger than the pull factors from Germany (Jurić 2018).

The benefits that Germany has derived from immigration are best illustrated by the portion of immigrants there with some level of higher education from 2001 to 2020, which comes to 32% on average (Schellinger 2015). The share of highly educated Croatian immigrants is 12% higher than in the age group 25–40 in Croatia and amounts to 37.8% (Jurić 2017). Over the next 25 years, Germany will require about 15 million workers in the service industries (Bertelsmann Stiftung 2015), a necessity that will certainly exert an impact on the trend of Croatian workers immigrating to the country.

# Results and Discussion: Google Trends and Facebook as Tools for Migration Forecasting

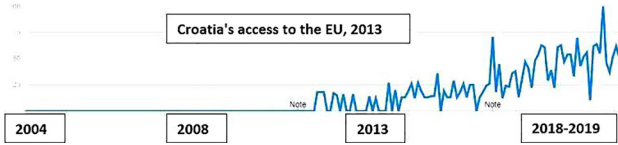
## Correspondence Between Google Migration-Related Searches and the Migration Flows

In this section, I provide a descriptive analysis of alternative data sources to determine whether, based on past data, regularities of emigration movements can be observed. For this purpose, I compare Google Trends data to official statistics. The basic assumption: if Google Trends data from previous periods show overlap with official statistics, then Google Trends data can also be used to predict migration (see Figures 5–8). The main advantage of this approach lies in the timely manner in which the data can be obtained.

To estimate, linear regression was used to measure the correlation between the number of searches ( $x$ ) and the number of moves ( $y$ ) evidenced by official statistics. I present correspondence between migration flows and Google search results in Croatian from Austria and Germany. All data sources are based on the analytical tool Google Trends.

A search of the various terms with collocation *Hrvatska* (Croatia) from 2014 to 2019 in Germany reveals that this term is the most searched in the places in Germany where official German statistics designate an above-average number of Croatian citizens. Google Trends showed an increase in searches for, and constant interest in, for example, the terms “Croats in Stuttgart” and “Croats in Munich” (terms checked in Croatian – geolocation Germany), cities where most Croatian immigrants have settled in the last seven years (Jurić 2022). By browsing for terms with the adjective “Croatian” (“Croatian cafés”, “Croatian lawyer”, “Croatian associations”, “Croatian football club in Germany”, “Mass in Croatian”, etc.), I once again arrived at the same results, confirming the assumption that the trend of Croats citizens immigrating to Germany has intensified. As the presence of Croats in Germany grows, so does the use of the Croatian language in the virtual world of Germany.

The appearance of Croatian in Germany can be followed using a very simple method: monitoring the Croatian diacritical marks “č + š + ž + ć”, which do not exist in German (see Figure 2). It is unquestionable that a portion of the searches that use these marked letters are evidence of the Serbian, Bosnian, and Montenegrin languages. Nevertheless, the citizens of Bosnia and Herzegovina and of Serbia in the period under analysis (until 2019) could not immigrate to Germany as easily as the citizens of Croatia were able to, because Croatia has been an EU member since 2013. This supports the claim about the validity of the indication of

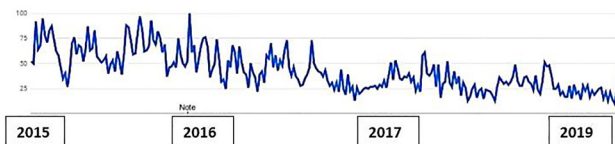


**Figure 2:** Presence of the Croatian language in the virtual world of Germany (2000–2019).  
Source: Author’s construction.

The “note (1)” mark in the image indicates the time from which Google Trends indicates an improvement to GT geographical assignment (applied from 1 January 2011). The “note (2)” mark indicates an improvement to data collection systems (from 1 January 2016). This applies to all images.

increasing immigration from Croatia. Would-be immigrants to Germany from Serbia and Bosnia-Herzegovina, at that time, were faced with stricter employment restrictions (cf. Westbalkanregelung § 26). One explanation for why these terms are searched in Croatian and not in German in Germany and Austria lies in the presence of many Facebook groups founded by Croatian immigrants, through which Croatian citizens try to get information about what life and work in the new environment will be like. For example, the Facebook group *Idemo u svijet – Nemačka* (Let’s go out into the world – Germany) alone counts close to 140,000 members (see Jurić 2021a).

The analysis of digital traces shows that potential Croatian emigrants, when planning their migrations, most often search for the terms *Schule* (school), *Arbeit* (job), *Bewerbung* (job application), and *Lebenslauf* (CV). “Job application” is the most searched term in the Croatian language in Germany, followed by “CV” (in Croatian, *životopis*), i.e. they are seeking out instructions on how to write a CV according to German standards. That these terms are searched in Croatian, it should be noted, indicates that Croatian migrants are the ones doing the searches; the terms *životopis* (CV) and *zamolba za posao* (job application) are specific to the Croatian language and are not used in other languages of the Western Balkans. A useful insight is also obtained if we home in on search queries with the German term *Bewerbung* (job application) from within Croatia (see Figure 3).



**Figure 3:** Search queries for *Bewerbung* (job application) in German from 2015 to 2020 in Croatia.  
Source: Author’s construction.

I noticed that searches for “job application” in German in Croatia were particularly intensive before Croatia acceded to the EU (2013) and in the year following the announcement of the lifting of the employment restriction. I compared this observation with findings from Germany, Austria, Sweden, and Ireland, all of which confirmed the same matrix. I take this finding as initial evidence that the emigration flows of Croatian citizens to Germany and Austria can be predicted. A particularly interesting circumstance is that “job in Germany” seems to have been searched by currently employed people: time stamps reveal these searches to have occurred before and after what are usually working hours, that is, 6:20 a.m. and 3:30–5 p.m., respectively (cf. Jurić 2017).

Figure 4 shows that following the outbreak of Covid-19 in the EU, interest in the term “job in Germany” in Croatia almost completely disappeared. As soon as the lockdown was lifted in May 2020, however, it once again increased. The phenomenon reflected here is a sharp dip in migration: during 2020, 26,000 Croatian citizens immigrated to Germany, a decrease of 40% compared to previous years. Here we find a clear correlation between search term and actual levels of migration.



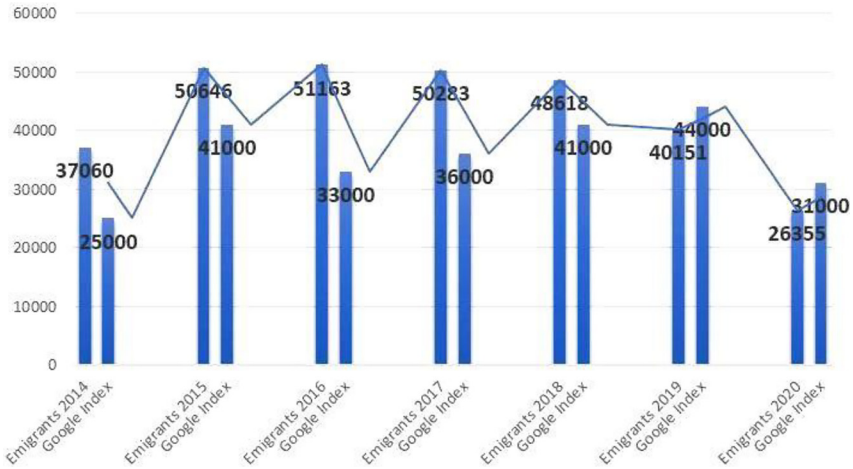
**Figure 4:** Search for the term *Arbeit in Deutschland* (work in Germany) in Croatia, including during the Covid-19 crisis and lockdown (15 September 2019 – 16 August 2020).

Source: Author’s construction.

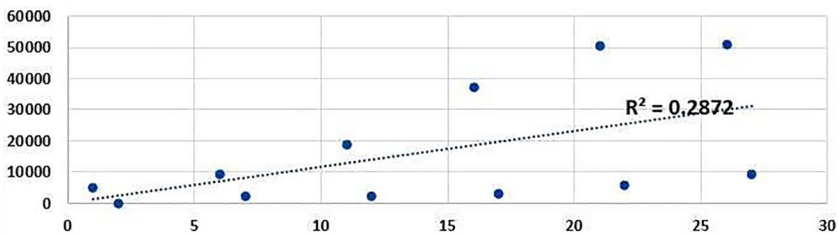
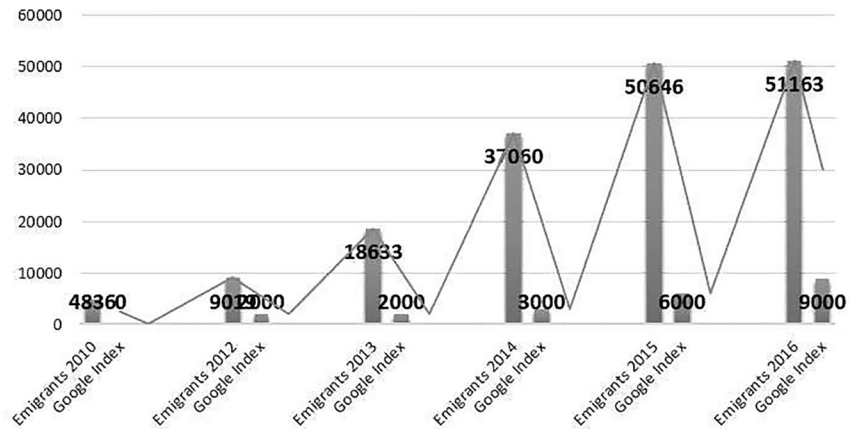
The Google search index cannot estimate the exact number of searches, so although this tool cannot pinpoint the exact number of Croatian emigrants in Germany (Jurić 2021c), the trend’s increase can be noticed precisely and can thus serve as an indicator. To test this method’s capacity for forecasting Croatian emigration flows in their continuation, I show the correlation between Google migration-related searches and the official statistics.

I chose the term “school” because it has proved to be one of the most frequent searches made by Croatian migrants in Germany, and it is related to learning German as well as Croatian teaching abroad organised by the Ministry of Education of the Republic of Croatia in Germany (see Figure 5).

The example in Figures 6a and 6b is interesting because it shows a specific word for the term “salary” that is used only in the Croatian language. This word’s monolingual uniqueness allowed for a distinction to be made vis-à-vis the Serbian and Bosnian languages, i.e. what is spoken by immigrants to Germany from Serbia and



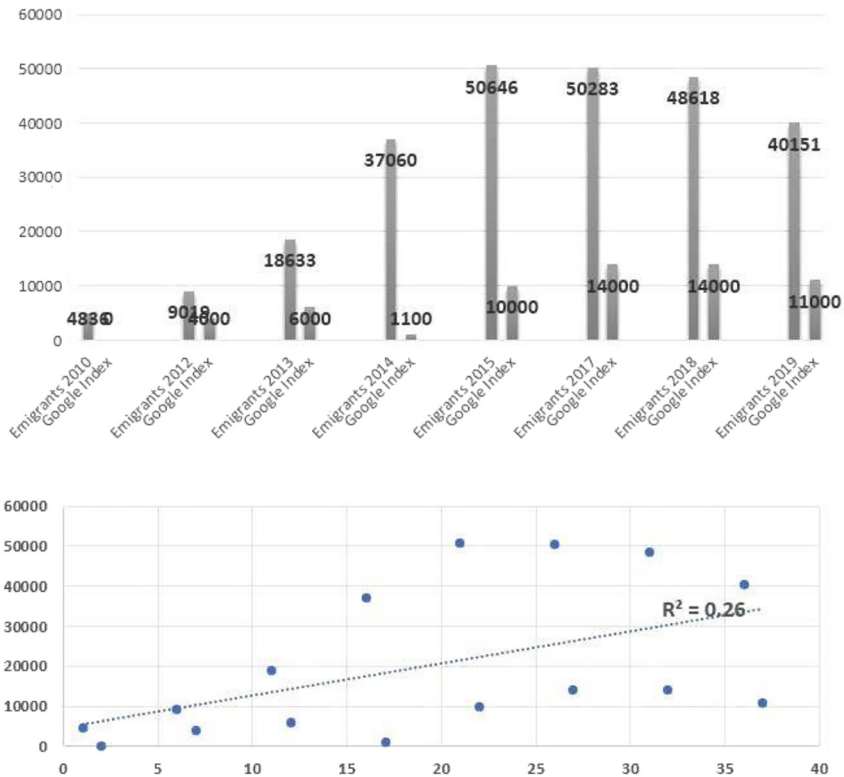
**Figure 5:** Correlation between the Google search index for the query in Croatian *škola* (school) in Germany and the official German statistics for immigrant Croatian citizens from 2014 to 2020. Source: Author’s construction.



**Figures 6a and 6b:** Correlation between the Google search index for the query in Croatian *plaća* (salary) in Germany and the official German statistics for Croatian immigrants in the years 2010, 2012–2016. Source: Author’s construction.



from Bosnia and Herzegovina. This tested correlation shows that the increase in frequency of a Google search, i.e. the Google search index for the specifically migration-related query *plaća*, is correlated with stepped-up emigration from Croatia, and that the decrease in such Google searches is consequently correlated with reduced emigration by Croatian citizens.  $R^2$  is 0.2872 and shows a positive correlation.



**Figure 7:** Correlation between the Google search index for the query in German *Gehalt* (salary) in Croatia and the official German statistics for Croatian immigrants in the selected years 2010, 2012–2015, 2017–2019.

Source: Author's construction.

In the following, I show that the verification can also be performed in the opposite direction, i.e. from Croatia in German, which again gives reliable estimates (see Figure 7).

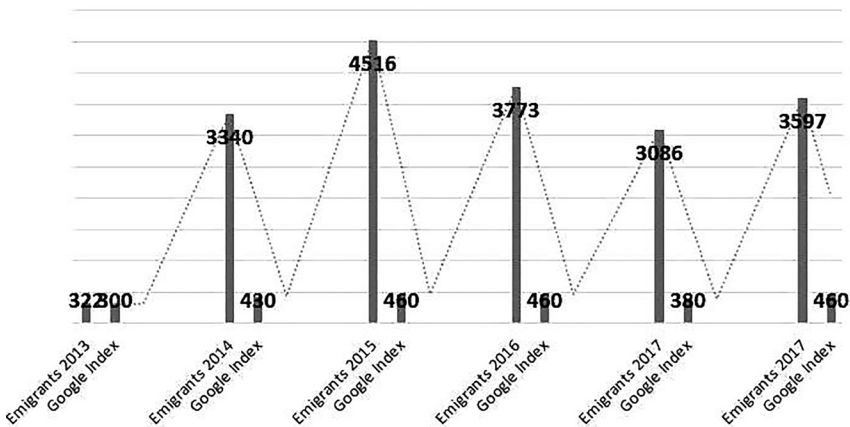
This tested correlation shows that the increase in Google searches in Croatia for the specifically migration-related query *Gehalt* is correlated with increased emigration from Croatia and that the decrease in Google searches is correlated with a decline in Croatian emigration.  $R^2$  is 0.26 and shows a positive correlation. The usefulness and the main advantage of this approach is the timely identification of external migrations,

which sheds light on migration trends one year before official data are available and can be used to model projections and predict subsequent trends.

For example, if, at the end of December 2022, the Google index for the query *Gehalt* in Croatia for the entire observed year is 10,000, this means that in 2022 between 40,000 and 45,000 individuals from Croatia immigrated to Germany. Furthermore, should the Google index be 5000 in the middle of the year, one can forecast that between 20,000 and 22,000 individuals will immigrate to Germany by the end of the year. According to the same methodology, it is possible to predict the number of potential immigrants to Germany from other countries in Southeastern Europe (with a new calculation according to the methodology presented here). Of course, one must account for the overall social context of both home and destination countries, as disruptive events like the current pandemic and the varying national policies in response may influence such currents and trends.

Here it is important to note that since the time the Covid-19 crisis began in Europe (starting early in 2020) the Google index from Croatia for Germany has not dropped significantly compared to the previous year a likely indication that interest in emigration has not declined. According to these findings, potential emigrants are waiting for movement restrictions to ease. In turn there has been a prolongation of the usual period in which expressions of interest eventually leads to migration itself.

In the case of Austria, I calculated the annual inflow of Croatian citizens to Austria according to Statistik Austria and compared these data with the Google Trends index. As in the case of Germany, the Google Trends index coincides with official indicators (see Figure 8). The increase in the search for the term *posao* in Croatian in Austria correlates with the increase in immigration shown in the Austrian official statistics.



**Figure 8:** Correlation between Google search index for query in Croatian *posao* (work) in Austria and the official Austrian statistics on Croatian immigrants in the years 2010, 2012, 2015, 2019, 2020. Source: Author’s construction.

All tested correlations reveal that the increase in particular Google searches, i.e. the Google search index figures for specific migration-related queries, is correlated with increased emigration from Croatia, and that the decrease in such Google searches is correlated with decreased emigration on the part of Croatian citizens. The observed regularities enable timely data and modelling of future trends.

Furthermore, the Google Trends tools enable comparison of up to five simultaneous trends. As an example, I compared a group of terms related to life in Ireland, Sweden, Austria, Germany, and the US and found that among these nations Croatians are most interested in living and working in Germany and Austria (which confirms the course of emigration in the last 10 years). In this context, the increase in search queries related to the terms “life in Austria” and “life in Germany” are very indicative, revealing that trends have not changed.



**Figure 9:** Overview of searches for the term *Bewerbung* (“job application” in German) and *zamolba za posao* (“job application” in Croatian) from 2009 to 2020 by their intensity in Croatia. Source: Author’s construction.

The marks “Napomena (1) and (2)” (in Croatian) in the image means “note” and indicate the same as in Figure 2.

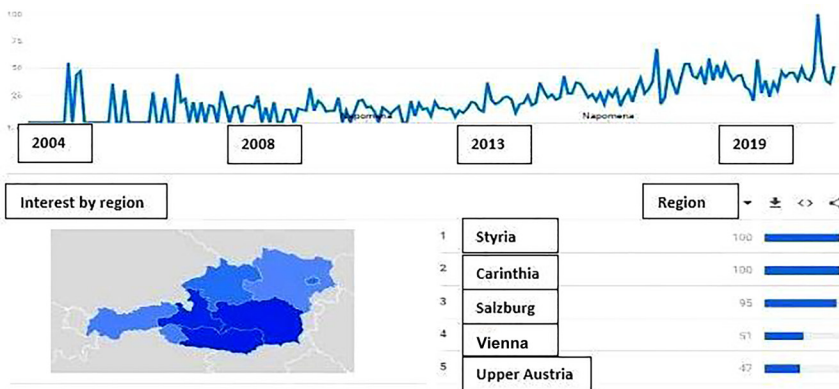
As shown in Figure 9, search queries for the German term for “job application” (*Bewerbung*) in Croatia were more common than for the equivalent expression in Croatian (*zamolba za posao*), i.e. the search for the term in the Croatian language showed a significant decline from 2015 onwards, while searches for the term in German increased, especially at the end of 2020. It is also evident that this is an upward trend compared with the longer period 2012–2020. This is another strong indication that Croatian citizens are increasingly preparing to immigrate to Austria and Germany.

The tested crosschecks of the migration-related searches according to geolocations again correspond to what is known from the official data. The main regions of emigration in Croatia are the Brod-Posavina and Osijek-Baranya counties in relative numbers and Zagreb in absolute numbers. Great interest was also shown in the Međimurje county (which is closest to Austria). A new trend,

not recorded in previous years, is an upswing in emigration from the Split-Dalmatia county, likely correlated with the emergence of the pandemic and the lack of work options due to the underwhelming tourist season, as well as fears that the situation will persist.

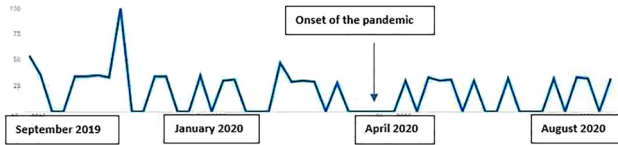
In the case of Austria, I faced methodological limitations because of the arrival of the Covid-19 pandemic in Europe in March 2020. Namely, all the older EU member states had the right to impose restrictions on employing workers coming from the newer EU states for up to seven years. Austria applied restrictions on Croatian citizens for the full period from Croatia's entry in 2013 until 30 June 2020. The pandemic has very probably prolonged the period between emigration-related searches and migration to Austria. Although the trend of Croatian citizens immigrating to Austria increased during 2020, this uptick is not as significant as it was in the case of Germany after the lifting of employment restrictions.

Immigration to Austria in the near future might have somewhat different features from immigration to Germany: when immigrating to Austria, it is rare to find entire families moving, as is the case with immigration to Germany. I justify this finding based on the fact that interests in enrolling children in Austrian schools and all categories from this set of terms are not searched in Croatia as intensively as in the case of Germany. I believe that there will be frequent weekly migrations due to Croatia's proximity to Austria (especially from the northern Croatian counties). Further indicative sets of terms are "registration of residence in Austria" and "deregistration of residence from Croatia" (see Figures 10 and 11). I checked these findings from an Austrian perspective in the Croatian language.



**Figure 10:** Search queries *prijava prebivališta u Austriji* (registration of residence in Austria) in Austria in Croatian from 2004 to 2020.

Source: Author's construction.

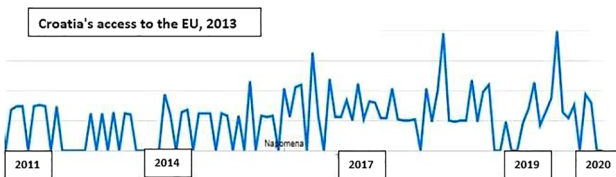


**Figure 11:** Searching for *odjava prebivališta* (deregistration from Croatia) in Croatia, 2019–2020. Source: Author’s construction.

It is indicative that the term “deregistration from Croatia” has been growing rapidly in searches since 2018. We can see that Croatian citizens mostly immigrate to Styria, the region closest to Croatia, but they also go to Vienna, Carinthia, and the province of Salzburg (this finding is confirmed by the Austrian statistics). On the other side, search queries on “registration of residence in Austria” coincide with the observed search queries on “deregistration from Croatia” in Croatia.

## The Facebook Analytics Tool and Google Trends as Sources for the Measurement of Integration and Cultural Assimilation

When measuring integration and cultural assimilation with the Facebook Analytics tool and Google Trends, I have paid special attention to indicators that include employment, education, and language acquisition, as these indicators show fields in which migrants and their children differ from the local population.



**Figure 12:** The increase of interest of Croats in Germany in education, 2011–2020. Source: Author’s construction.

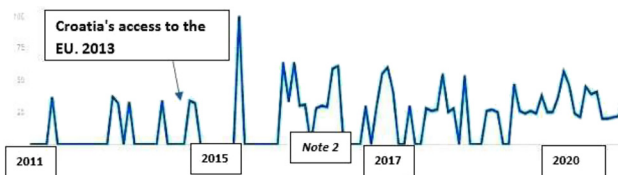
As shown in Figure 12, a strong indication of the intention of Croatian immigrants to integrate in Germany is their interest in education, as well as an increase in searches related to the term “school”, which I have previously shown.

A look into the most frequently visited Facebook pages by Croatian citizens in Germany indicates that their interests are quite similar to the interests of the German population. This confluence could be a valid indication of the Croatian

population's high degree of integration into German society, according to the method of Zagheni et al. (2018). The first four interests are German soccer clubs, followed by pages where Croats can learn the German language. The high interest in learning German is a strong indicator of the desire to integrate into German society. The next large group of the most visited Facebook pages comprises Croatian “domestic” clubs, cafés, and restaurants. A further indication of cultural integration is the numerous interests of Croatian migrants in German media, Web portals, series, films, and music, along with attendance at events of German culture as well as local or regional museums (Schneider and Harknett 2019).

Furthermore, lifestyle information can also provide very useful insights into the degree of integration as well as instances of “neighbourhood life” such as activities organised by citizens' associations or attendance at matches run by amateur sport associations. All these insights are available through the Facebook Analytics application, which is designed for marketing purposes and therefore encourages users to express such interests on their Facebook profiles. In addition, Facebook indirectly collects such data by analysing the number of “likes” that users express according to preferences, and also data based on user interaction and participation in certain public events (Facebook location report).

The high level of integration of Croatian citizens into German society is not surprising. The children of this immigrant group in Germany from the 1960s and 1970s are known to be one of the most integrated groups of immigrant background in Germany, according to a series of studies. This is supported, for example, by the data from the German Ministry of Education and Research and other studies (BAMF 2005; Fertig 2004; Jurčević 2014; Köck, Moosmüller, and Roth 2004). The official German statistics show a twofold increase in 2015 in the number of Croatian residents applying for German citizenship over previous years (DESTATIS 2021) (Figure 13).



**Figure 13:** Search queries in Croatian for *njemačko državljanstvo* (German citizenship) from 2011 to 2020 in Germany.

Source: Author's construction.

To acquire German citizenship, immigrants need to pass the so-called integration test and demonstrate language proficiency at the intermediate level. The number of such cases involving Croatian immigrants has risen sharply since

Croatia acceded to the EU. For instance, in 2014, 3889 citizens of the Republic of Croatia received a German passport, whereas before 2013 this number had been around 500 per year (Jurić 2017).<sup>2</sup>

The search query *prijava prebivališta* (registration of residence) in Germany, as in Austria, shows a rapid spike in the use of the Croatian language in Germany. On the other hand, the interest shown by Croatian citizens in deregistering their residency in Croatia is noticeable, yet again an indication that confirms the validity of such measurements.

In Germany numerous social media groups and portals have been created where Croatian citizens exchange, in Croatian, information about life in Germany (see, for example, the Facebook group *Idemo u svijet – Njemačka*). The increase in these social media groups may indicate the desire of Croatian citizens not only for the fastest possible integration into the German way of life but also their wish to maintain contact with compatriots from their homeland. In a parallel study (Togonal, Jurić, and Raič 2022), conducted via interviews and surveys among new Croatian immigrants in Germany with a sample of 476 respondents, I found that language, according to 47.2% of the respondents, was the most difficult obstacle for new Croatian immigrants in integrating and adapting to life in Germany. About 11.3% claimed it was the different social habits (socialising, going out, etc.), 5% stated the obstacle was the “big city,” and 3% cited differences in the law between the two countries.

Interesting insights emerge from an analysis of the German perspective. For example, Germans often put forth the search query “Do Croats receive social income support in Germany?” (*Hartz IV + Kroaten*) from 2019 to 2020. Their interest in this group of terms can probably be boiled down to the following question: “How well are Croats integrated into German society and are they a useful part of the community?” Such insights once again confirm the importance of research issues in the field of integration and how this method can be used in this field. The 2019 BAMF data reveal more than 200,000 Croats in Germany as employed, with 67,000 retired and 16,000 receiving social assistance.

The highest frequency of Facebook use in Croatian was found in the German *Länder* of Baden-Württemberg, Bavaria, and Hesse, which corresponds with the official data on the number of Croatian citizens there. Other interesting

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<sup>2</sup> Croatian citizens (like all EU citizens) can apply for German citizenship after eight years of permanent residence in Germany. This condition can be shortened to six years if the person passes an integration course. Marriage to a German shortens this condition to three years, and children of such marriages are automatically granted German citizenship. Children born in Germany to non-German parents are also granted German citizenship provided that one parent has been living in the country regularly for at least eight years. EU citizens are allowed to have dual citizenship with Germany and their home country in the EU.

socio-demographic data available through the Facebook tool reveal that 61% of Croats in Germany are married, which I confirmed in an earlier study (Jurić 2018) that showed a large proportion of Croatian migrants to have emigrated with their entire family. Men make up 56% of the users, women 44% (which corresponds to the official data). Facebook also correctly notes that 25–40-year-olds make up the largest age group of migrants from Croatia.

The main benefit of these insights is prospective: measuring the Google Trends index and Facebook insights over a longer period will yield valid calculations on future trends. I conclude that Google Trends tools are better at discovering intentions to emigrate, while Facebook tools are more suitable for monitoring socio-demographic structure and the interests of emigrants.<sup>3</sup> However, this is a descriptive study and many more studies are needed to improve this method. Ever more researchers are contributing to this effort, so I believe it is only a matter of time before it becomes an integral part of demographic science.

## Conclusion

This study was created as a result of the observed shortcomings in data from Croatian official records related to emigration. I show that the analytical tools of Facebook and Google Trends can be useful sources to fill this data gap.

To estimate the model, linear regression was used to measure the correlation between the number of searches ( $x$ ) and the number of moves ( $y$ ) evidenced by the official statistics. There was a clear correlation between the Google Trends index and migration flows from Croatia. When using Google Trends, it is especially important to choose the right migration-related search terms that give the greatest possible indications of the searchers' intentions.

Facebook has proven to be particularly useful not only for monitoring socio-demographic indicators but also for evaluating how integrated Croatian emigrants are in German society. Since the Facebook API can provide insights into certain interests of the observed population, based on likes, pages visited, and other signals, it can offer insight into the cultural assimilation and integration of Croatian migrants in their adopted countries. Compared to Facebook, the advantage of Google Trends is that limitations related to penetration rates are not prevalent, and neither are fake accounts.

According to the results of this study, there is a clear correlation between the Google migration-related searches and migration flows from Croatia. The

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<sup>3</sup> Since Facebook does not register the socio-demographic structure of people under 18, additional applications such as Instagram and YouTube could be used to gain insights into this population.



usefulness and the main advantage of this approach is the timely identification of external migrations, which provides insights into migration trends one year before official data become available and can be used to model projections and predict further trends.

Analysis of digital traces showed that when planning the migration, migrants most often search for the terms “school”, “job,” and “job application”. Due to the outbreak of the Covid-19 pandemic, the time between emigration preparation and migration has lengthened, but the pandemic has not stopped the trend of emigration of Croatian citizens to Germany and Austria. The data generated by Facebook correlates with official German statistics regarding the total number of Croatian citizens in Germany. In the case of Austria, I calculated the annual inflow of Croatian citizens according to Statistik Austria and compared these data with the Google Trends index. As in the case of Germany, the index coincides with the official indicators. The tested crosschecks of migration-related searches according to geolocations again correspond to the official data. The main regions of emigration in Croatia are the Brod-Posavina and Osijek-Baranya counties in relative numbers and Zagreb in absolute numbers. The main regions of Croatian immigration are Bavaria, Baden-Württemberg, and Hesse in Germany, and Styria and Vienna in Austria.

A strong indication of the intention to integrate into German society is shown by the interest of Croatian emigrants in the learning of German as well as in education in the country. The insights from digital demography enable the monitoring of the success of immigrant integration and glean numerous insights that official statistics often fail to collect.

Such insights are, moreover, relevant for national and EU policymakers in their preparation of appropriate EU-level strategies aimed at developing measures to encourage people to remain in the demographically affected areas of the EU periphery. This issue is already seriously affecting the pension, education, and health care systems of the entire region of Southeastern Europe. Croatia, being part of the EU, can be used as a laboratory to understand the changes in mobility patterns in Southeastern Europe.

Despite the many advantages of this method, there are still significant open methodological issues. The basic objection to these data is that they are not representative of the observed population. At the same time, more and more studies argue convincingly that samples obtained from Facebook and Google Trends do not significantly differ from samples obtained from more traditional recruitment and sampling techniques (Kalimeri et al. 2020). Despite its limitations, I believe that the model presented here and its results open up a useful and important field of research.

**Compliance with ethical standards:** The research was conducted in accordance with ethical regulations. Based on the displayed results, it is not possible to reveal the personal identities of these applications' users.

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## Bionote

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