UDC:
DOI:

METHODOLOGICAL CHALLENGES IN DEMOGRAPHIC RESEARCH AND CREATING POPULATION POLICIES

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ABSTRACT

This paper examines several interrelated, recurring methodological problems that limit the comparability of demographic data in North Macedonia and the wider post-Yugoslav Balkan region: changes in census methodology and in the definition of the resident population; repeated administrative-territorial reorganization of municipalities; the prolonged, multi-decade absence of census enumeration, illustrated by North Macedonia's own nineteen-year gap between the 2002 and 2021 censuses; the restricted temporal and spatial resolution of settlement-level data; and instability in the recording of ethnic structure, mother tongue and religion. These problems are situated within the Modifiable Areal Unit Problem and successive United Nations vital-statistics standards, illustrated with evidence from the municipality of Kichevo, and compared with parallel cases from Serbia, Croatia, Bosnia and Herzegovina, Romania and Czechia. The paper concludes by considering the growing role of alternative and complementary data sources and outlines a research practice better suited to longitudinal and territorially disaggregated demographic analysis in North Macedonia.

Keywords: statistical data, census comparability, territorial-administrative reorganization, ethnic structure, migration statistics, Modifiable Areal Unit Problem

INTRODUCTION

The contemporary study of population is unimaginable without the use of statistical data, and the scope and quality of the available data are of paramount importance for the results obtained. Data used in demographic research should derive from organized, institutionally coordinated collection efforts and should allow continuous monitoring of changes in the size and structure of the population, support

the analysis of demographic processes, and provide a basis for projecting future trends. For this purpose, population data need to be reliable, relevant, of appropriate coverage, applicable to the specific research question, and — perhaps most importantly for longitudinal and territorial analysis — comparable, both methodologically and spatially (Madjevikj & Ljakoska, 2018; Apostolovska Toshevska & Madjevikj, 2008).

In practice, however, comparability is precisely what is most difficult to achieve when working with historical census series for North Macedonia, or indeed for most countries of the former Yugoslavia and the wider Balkan region. This paper identifies and examines several interrelated, recurring methodological problems in demographic research in North Macedonia; some of these are the following: (1) changes in census methodology and in the definition of the resident population between census years; (2) repeated administrative-territorial reorganization, which reassigns settlements between municipalities and disrupts longitudinal analysis at the local level; (3) the prolonged, sometimes multi-decade absence of any census enumeration, illustrated most starkly by North Macedonia's own nineteen-year gap between the 2002 and 2021 censuses; (4) the restricted temporal and spatial resolution of available data, since population data at the level of the individual settlement are, as a rule, available only in census years; and (5) instability, both administratively and politically driven, in the recording of ethnic structure, migration etc.

The aim of this paper is to bring these problems together within a single methodological framework, to situate them within the formal concept of the Modifiable Areal Unit Problem (MAUP) and within the successive United Nations standards for census and vital-statistics methodology, to illustrate them with concrete evidence from North Macedonia — with particular reference to the municipality of Kichevo — and to compare the North Macedonian case with closely parallel evidence from Serbia, Croatia, Bosnia and Herzegovina, Romania, Czechia, and, more selectively, further afield. In doing so, the paper also considers the growing role of alternative and complementary data sources, and reflects on what a more methodologically self-aware demographic geography of North Macedonia might look like going forward. These are not purely academic concerns: reliable, comparable population data form the basis for population development policies and employment policies, and are equally necessary for designing and implementing policies for more balanced regional development — the distribution of activities and functions, infrastructure, and settlement systems across the territory — so that the methodological deficiencies documented in this paper translate directly into weaker foundations for the population policies built upon them.

THEORETICAL FRAMEWORK: THE PROBLEM OF SPATIAL AND METHODOLOGICAL COMPARABILITY

The difficulty of comparing demographic data across changing territorial units and across successive census methodologies is not merely an incidental technical

inconvenience specific to North Macedonia; it is a long-recognized, formally named problem in quantitative geography and demography. The Modifiable Areal Unit Problem (MAUP) refers to the fact that the spatial units used in an analysis can take many different shapes and sizes, and that this choice — rather than any underlying substantive reality — can materially affect the outcome of a statistical analysis (Openshaw & Taylor, 1979). The problem has a representational as well as an analytical dimension: Jovanović and Živković (2008) argue that thematic maps comparing demographic indicators across census years or spatial units require an explicit, two-part cartographic unification — a normative unification of the mapped indicator itself and a graphic unification of the sign values used to depict it — without which map symbols calibrated to one territorial division or time period cease to be visually or numerically comparable with those calibrated to another, a cartographic analogue of the zonation and scale effects described above.

Voss (2004) traces the intellectual lineage of this problem back to Gehlke and Biehl's (1934) pioneering study of the effect of grouping on correlation coefficients calculated from census-tract material, and to Robinson's (1950) demonstration that relationships among variables computed at different levels of aggregation can differ substantially — a paper that, in Voss's account, became required reading for generations of demographers and contributed to a broader crisis of confidence in purely quantitative geography during the 1980s. Ratkaj (2007), applying the same framework to residential segregation indices in Belgrade, notes that traditional, non-spatial segregation measures "unrealistically treat administrative borders as barriers, neglecting the influence of neighbourhood" — a critique directly applicable to the treatment of Macedonian municipal boundaries discussed in Section 5 below. Ratkaj also observes that statistical agencies often retain traditional, methodologically dated indicators specifically because changing them "could cause additional problems in the comparability of statistical data" — an institutional example of the trade-off between methodological improvement and the preservation of long time series that recurs throughout this paper.

A second, complementary strand of theoretical grounding comes from the successive United Nations standards for vital statistics. The UN Statistical Office's Principles for a Vital Statistics System (1953), and its two subsequent revisions, Principles and Recommendations for a Vital Statistics System, Revision 1 (1973) and Revision 2 (1999), together document a continuous, nearly seventy-year international effort to standardize demographic definitions precisely because, as the 1953 Statistical Commission itself put it, "even in developed countries, the international study of demographic problems is made difficult by lack of statistical comparability" (United Nations, 1953). Revision 1 (1973) already anticipated the shift toward the "resident population" concept that would later be adopted, at different points, by Serbia, North Macedonia, Czechia, and most other European states (United Nations, 1973, para. 51), while explicitly recommending that where national circumstances require departure from international standards, publications should be "accompanied by an explanation of these departures" (United Nations, 1973, para. 61) — a recommendation echoed almost verbatim in Revision 2 a quarter-century later

(United Nations, 1999) and realized in practice by, for example, the United Kingdom Office for National Statistics' dedicated "metadata" documentation of methodological breaks in its divorce statistics (ONS, 2015).

DATA SOURCES AND METHODOLOGY

The population census and vital (demographic) statistics remain the principal sources of data for demographic research in North Macedonia, as elsewhere in the region (Madjevikj & Ljakoska, 2018). Beyond these, official statistics are published by the State Statistical Office (SSO) through its MAKStat database (SSO, n.d.), by international organizations such as Eurostat and the UN Population Division, and, increasingly, through specialized institutional portals. This paper draws on that conventional statistical base together with national strategic and legal documents — including the successive laws on the territorial organization of local self-government, the Law on Balanced Regional Development, and the two national strategies for demographic development of the Republic of Macedonia (2008–2015 and 2015–2024) — the successive United Nations standards for censuses and vital statistics, and a comparative body of demographic-geographical literature from North Macedonia, Serbia, Croatia, Bosnia and Herzegovina, Romania, and elsewhere.

Field research and direct data collection, alongside published statistics, play an important complementary role in understanding population development processes (Madjevikj & Ljakoska, 2018), a point already made explicit within the authors' own research group as early as 2008, when Apostolovska Toshevska and Madjevikj, writing on the treatment of socioeconomic data in geography teaching, listed methodological and spatial comparability among the core principles that must govern any use of statistical data, and observed that "given that several territorial-administrative reorganizations of space have been carried out in Macedonia, when analysing data relating to municipalities, it is essential to take into account which settlements are included in the municipality, and any changes that have occurred" (Apostolovska Toshevska & Madjevikj, 2008). The present paper can be read as a systematic elaboration, sixteen years on, of that same methodological concern.

A closely related methodological distinction, concerns absolute versus relative demographic indicators. Madjevikj and Apostolovska Toshevska (2013) note that absolute values give only a limited, first-order picture of population size and composition, and that it is the further processing of these values into relative indicators (percentages, coefficients, indices) that yields a more realistic understanding; because conditions change frequently, such indicators require regular updating, and their quality directly determines the value of the results obtained. This is, in effect, a general statement of the comparability principle applied throughout the present paper: an indicator computed once, from a single set of absolute values, becomes progressively less reliable the longer it goes without being recalculated against updated data — precisely the situation created by prolonged inter-censal gaps of the kind discussed in Section 9.

METHODOLOGICAL CHANGES ACROSS CENSUS YEARS

The population of the territory of present-day North Macedonia has been recorded, with varying methodology, since 1948. Ljakoska et al. (2024) report the total population figures by census year, summarized in Table 1 below — the 2021 figure representing a decline of 9.19% relative to 2002. These raw totals cannot be read as a straightforward demographic time series, because the definition of "total population" itself changed between census years: the 1994 census excluded persons absent from the country for one year or more, while the 2021 census included 132,260 persons whose data were obtained from administrative sources rather than direct enumeration (Ljakoska et al., 2024).

Table 1. Population of North Macedonia by census year, 1948–2021, with inter-censal and average annual growth rates

Census year	Total population	Years since previous census	Inter-censal growth (%)	Average annual growth (%)
1948	1,152,986	—	—	—
1953	1,304,514	5	+13.14	+2.63
1961	1,406,003	8	+7.78	+0.97
1971	1,647,308	10	+17.16	+1.72
1981	1,909,136	10	+15.90	+1.59
1994	1,945,932	13	+1.93	+0.15
2002	2,022,547	8	+3.94	+0.49
2021	1,836,713	19	−9.19	−0.48

Source: compiled by the authors from Ljakoska et al. (2024). Growth rates calculated by the authors; shaded intervals (1981–1994 and 2002–2021) correspond to the methodological breaks and the prolonged inter-censal gap discussed in Sections 4 and 6.

Table 1 recasts these figures as average annual growth rates between successive censuses, which brings the effect of the two methodological breaks into sharper relief: the average annual growth rate falls from around 1.6% in both of the preceding inter-censal periods (1961–1971 and 1971–1981) to just 0.15% for 1981–1994 — the interval spanning the 1994 methodological change — before recovering to 0.49% for 1994–2002 and turning negative, at –0.48% per year, for the unusually long 2002–2021 interval discussed in Section 9.

Because a single inter-censal period can conflate a genuine change in demographic behaviour with a change in what is being counted, the sharp deceleration around 1994 cannot be read as evidence of a sudden slowdown in natural increase or migration alone.

A parallel methodological discontinuity affects the numerator of fertility measures rather than the denominator of population totals. Since 2004, children born abroad to Macedonian citizens have been recorded in SSO vital statistics as a distinct category, excluded from the total count of live births reported for the country; before that date such births were included in the national total without separate identification.

Because outmigration accelerated sharply after 2004, nearly 75,000 children were born abroad to Macedonian nationals between 2005 and 2021 alone, rising to 5,503 in 2021 — a year in which registered live births inside the country numbered 18,648. The effect is spatially uneven: in the Polog region, which accounts for 36.6% of children born abroad nationally, seven municipalities (Brvenica, Vrapchishte, Gostivar, Mavrovo-Rostushe, Plasnica, Centar Zhupa, Novo Selo) recorded more children born abroad to their residents in 2021 than children born within the municipality itself. A municipal-level fertility time series that does not account for this reclassification will therefore systematically overstate fertility decline precisely where emigration is most intense (authors' calculations, based on SSO data).

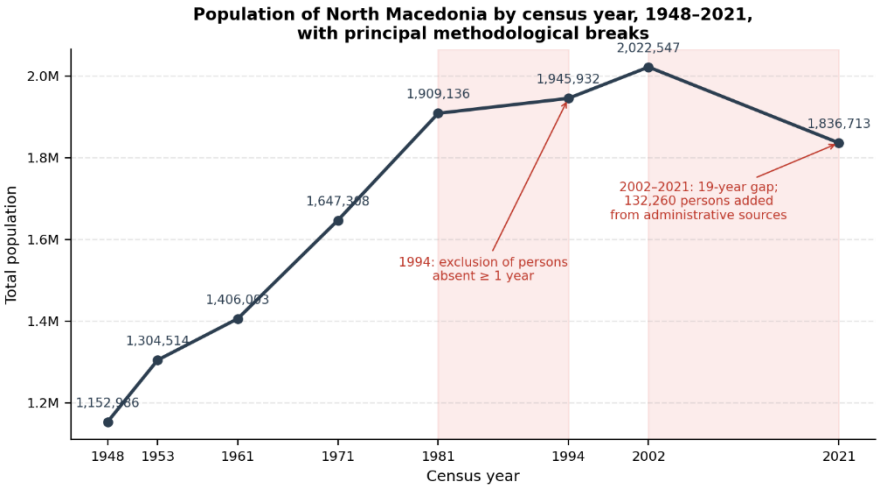


Figure 1. Population of North Macedonia by census year, 1948–2021, with principal methodological breaks. **Source**: authors' elaboration based on data in Table 1.

A comparison of the two censuses' own methodological explanations shows that the underlying definitional break lies before 2002 rather than between 2002 and 2021. Both censuses define the counted population around the same core concept of place of usual residence, with near-identical treatment of citizens temporarily abroad, foreign residents, and diplomatic and international staff (SSO, 2002; SSO, 2022). What changed between the two rounds is the degree of international regulatory anchoring rather than the underlying concept itself: the 2002 census presented this definition only as a step toward harmonization with European and international statistical practice, without reference to any binding regulatory framework, and its own methodological notes concede that "these changes do not allow a complete comparability of the data" with the previous censuses (SSO, 2002). The 2021 census, by contrast, grounds its methodology explicitly in the UNECE/Eurostat Conference of European Statisticians Recommendations for the 2020 Censuses and in five specific EU regulations governing census content, dissemination, and metadata, and states

as one of its explicit purposes the determination of changes since the 2002 census (SSO, 2022) — treating comparability with 2002 as an attainable methodological goal rather than foreclosing it, as the 2002 census's own notes foreclosed comparability with the censuses that preceded it.

This pattern recurs, with strikingly similar figures, throughout the region. In Serbia, the 2002 census applied a revised definition of permanent population, counting only persons abroad less than one year as residents, against the 1991 methodology which included all citizens working abroad regardless of duration (Djurdjev, Arsenović & Dragin, 2010). A regional study of the Raška district independently confirms this, attributing an otherwise anomalous 1991–2002 population decline "primarily to the change in census methodology and the exclusion of the majority of citizens on forced labour abroad" (Bakić & Radić, 2017).

At the international level, the United Nations distinguishes between de facto and de jure census enumeration, differing in how long an absent household member continues to be counted (UNFPA, n.d.). A systematic Eurostat/Council of Europe review of 44 European countries confirms this is a structural feature of European statistics, not a marginal ambiguity: 34 of the 44 use some version of the "usual residence" concept, 7 use only a "legally registered" concept, and Serbia alone relies exclusively on the latter (Eurostat/Council of Europe, n.d.) — the same trade-off already noted by Ratkaj (2007) for segregation indices.

Czechia's 2021 census offers a related European example: a move toward a "combined" census supplementing direct enumeration with administrative-register data, drawing citizenship and marital status directly from registers while keeping ethnicity, mother tongue and religion as census-only variables, "not available from any register because of their confidentiality and subjectivity" (Vachuška & Kurkin, 2022). North Macedonia's 2021 census followed a structurally similar path, supplementing direct enumeration with administrative data for 132,260 persons (Ljakoska et al., 2024), though without the same published transparency as to which variables derive from which source, a point taken up again in Section 10.

A related dimension of data quality concerns vital statistics. WHO's country-level cause-of-death estimates for 2000–2015 quantify the completeness of death registration for North Macedonia at 87–103% against estimated total deaths, with 9% of deaths coded to "garbage" causes (WHO, 2017). Because completeness is assessed against population estimates that ultimately derive from the census, vital-statistics quality is not independent of the census-methodology problems already discussed — the UN's own vital-statistics standards stress that "conflating incomplete vital registration data with census data of dubious quality necessarily results in poorly estimated life tables" (United Nations, 1999).

A closely related break occurred in the treatment of economic activity: Serbia's 2011 census replaced the three-way classification used previously (economically active, persons with personal income, dependent population) with a two-way active/inactive split, with the consequence that "a complete comparison of the 2011 census data with earlier censuses is not fully possible" (Vachuška & Kurkin, 2022). The authors' own research group has documented an equivalent, independent break

in North Macedonia: analysing labour-contingent formation in the Pelagonia region, Apostolovska Toshevska and Madjevikj record that "because of the methodological changes in the defining of persons that comprise the work force up to 1994, some of the comparisons related to 2002 are not made" (cited in Ljakoska et al., 2024) — a first-hand acknowledgement that intended comparisons had to be abandoned because of exactly this kind of definitional discontinuity.

A comparable discontinuity affects measures of economic activity. Under a new EU regulatory framework applied by the SSO from 2023 onward, replacing the methodology used through 2022, the working-age population used to compute activity and employment rates was redefined from persons aged 15–79 to persons aged 15–89, while the definition of employment itself was tightened: subsistence farmers producing mainly for household consumption, previously classified as employed, are now excluded unless production is intended mainly for sale or exchange, and temporarily absent workers are classified as employed only if the expected absence does not exceed three months. Because subsistence agriculture is disproportionately concentrated in the same depopulating rural municipalities discussed throughout this paper, employment and activity rates computed before and after 2023 are not strictly comparable at the local level, adding a labour-market analogue to the census-methodology discontinuities already described.

TERRITORIAL-ADMINISTRATIVE REORGANIZATION AND DATA COMPARABILITY

The administrative-territorial organization of North Macedonia's municipalities has undergone repeated change since independence: 123 municipalities under the 1996 Law on the New Administrative-Territorial Division (Official Gazette, Nos. 49/1996, 59/1996); 84 municipalities under the 2004 reorganization (Official Gazette, No. 55/2004); and, following a postponement enacted in August 2008 (Official Gazette, Nos. 98/2008, 101/2008), a final merger to 80 municipalities after the local elections of March 2013 (Ljakoska, 2016; Ljakoska & Madjevikj, 2017; Ljakoska et al., 2024).

The municipality of Kichevo illustrates the consequences of this process with particular clarity. Until 1996 the territory corresponded to a single administrative unit; the 1996 reorganization divided it into five separate municipalities — Kichevo, Drugovo, Vraneshtica, Zajas and Oslomej — administered and reported separately for seventeen years, with sharply differing ethnic composition (Macedonian-majority in Kichevo, Vraneshtica and Drugovo; Albanian-majority in Zajas and Oslomej) before the five were reunited in 2013 (Ljakoska, 2016).

Any researcher wishing to trace long-run population change for this territory — as in the analysis of rural depopulation in the former municipalities of Drugovo and Vraneshtica (Ljakoska & Iliev, 2013) — must first reassemble the data from five separate administrative sources. Table 3 illustrates the scale of this reassembly problem: for the period 1953–2002, comparable population figures for the present-day municipality of Kichevo exist only as the sum of five independently reported

former municipalities, each with a markedly different ethnic trajectory.

Table 2. Chronology of administrative-territorial reorganization of municipalities in North Macedonia, 1996–2013

Year enacted	Legal instrument	Official Gazette No.	Resulting no. of municipalities	Effective from
1996	Law on the New Administrative-Territorial Division of the Republic of Macedonia	49/1996; 59/1996	123	1996
2004	Law on Territorial Organization of Local Self-Government	55/2004	84	2004
2008	Law Amending the Law on Territorial Organization of Local Self-Government (postponement of merger)	98/2008; 101/2008	84 (merger deferred)	2013 (deferred)
2013	Merger takes effect following local elections	—	80	March 2013

Source: compiled by the authors from Ljakoska (2016), Ljakoska & Madjevikj (2017) and Ljakoska et al. (2024).

Comparable territorial fragmentation is extensively documented for Serbia. Knežević (2014) shows that Eastern Serbia's administrative-territorial division changed repeatedly between 1834 and 1961, concluding that continuous demographic monitoring across the full period is not possible using directly comparable statistical units. A companion paper (Knežević & Vojković, 2015) on delimiting a demographic study area concludes that "the key role in determining the spatial extent rests on two factors: the nature of the research and the accessibility of scientifically usable data."

The most extreme documented case of territorial fragmentation is Bosnia and Herzegovina, whose entity boundary physically splits more than 300 settlements; comparing 2013 census data with 1991 requires descending to individual census enumeration circles, which the authors describe as making full comparability "almost impossible" without such disaggregation (Lukić Tanović & Marinković, 2024).

Statistical regionalization for planning and EU-accession purposes reproduces the same tension. North Macedonia's Nomenclature of Territorial Units for Statistics (NTES), corresponding to the EU's NUTS system, establishes eight NTES 3 planning regions, with NTES 4 corresponding to the 80 municipalities and NTES 5 to the 1,776 settlements. Iliev (2018) notes that NTES 3 regions were selected "due to the highly limited availability of data for smaller administrative units" — the territorial level for an entire empirical study dictated by data availability rather than the research question. Bosnia and Herzegovina, by contrast, has not yet adopted official statistical regions at all (Mutabdžija, 2018).

Table 3. Population of the present-day municipality of Kichevo, by former municipality, census years 1953–2002

	Total	Macedonians	Albanians	Turks	Roma	Vlachs	Serbs	Bosniaks	Other
Kichevo Municipality									
1953	11167	4786	761	4781	54	4	484	0	297
1961	11838	7662	1310	2107	0	0	397	0	362
1971	16810	10493	3105	2041	17	0	306	0	848
1981	24207	13893	5446	2189	310	5	203	0	2161
1994	27543	16126	7195	2236	1401	15	99	0	471
2002	30138	16140	9202	2430	1630	76	86	7	567
2021	24768	13027	5808	2069	2001	67	54	8	1734
Municipality Drugovo									
1953	10157	9497	181	443	5	0	8	0	23
1961	8367	8108	52	217	0	0	17	0	9
1971	6431	6082	38	271	0	0	15	0	25
1981	4704	4241	77	218	0	0	11	0	157
1994	3555	3110	131	291	0	0	7	0	16
2002	3249	2784	155	292	1	0	8	0	8
2021	2748	2158	142	261	0	2	5	1	179
Municipality Vraneshtica									
1953	4146	3793	0	332	0	0	9	0	12
1961	3503	3273	5	215	0	0	4	0	6
1971	2944	2699	9	205	0	0	9	0	22
1981	2287	1998	4	125	0	0	8	0	152
1994	1650	1319	8	315	0	0	7	0	1
2002	1322	1033	10	276	0	0	2	0	1
2021	1003	689	9	221	0	0	1	3	80
Municipality Oslomej									
1953	7688	1212	6299	150	0	0	13	0	14
1961	7838	976	6815	11	0	0	12	0	24
1971	8481	622	7828	7	0	0	10	0	14
1981	9144	323	8728	0	6	0	7	0	80
1994	9136	160	8967	0	0	0	2	0	7
2002	10425	110	10257	0	0	0	0	1	57
2021	4819	39	4558	1	0	0	0	1	220
Municipality Zajas									
1953	6572	969	5544	26	9	0	10	0	14
1961	7171	874	6134	99	0	0	7	0	57
1971	8425	769	6881	21	0	0	8	0	746
1981	9805	613	9082	3	9	0	12	0	86
1994	10055	271	9465	0	0	0	2	0	7
2002	11605	211	11308	0	0	0	6	0	80
2021	6331	107	5856	1	2	1	0	0	364
The present Municipality Kichevo									
1953	39730	20257	12785	5732	68	4	524	0	360
1961	38717	20893	14316	2649	0	0	437	0	458
1971	43091	20665	17861	2545	17	0	348	0	1655
1981	50147	21068	23337	2535	325	5	241	0	2636
1994	51939	20986	25766	2842	1401	15	117	0	502
2002	56739	20278	30932	2998	1631	76	102	8	713
2021	39669	16020	16373	2553	2003	70	60	13	2577

Source: compiled by the authors from Ljakoska (2016), based on data from the State Statistical Office of the Republic of Macedonia, Census 2002, Book X, and SSO MakStat database.

At the European level, the same tension is addressed institutionally through the EU's INSPIRE Directive, which harmonizes administrative and statistical spatial-data units across member states (Bartha & Kocsis, 2011), and through functional alternatives such as France's commuting-based "aire urbaine" and Sweden's 72 functional regions, used instead of NUTS II units precisely because the latter "may conceal significant disparities" (Ferry & Vironen, 2010). The regional SEEMIG project, covering eight South-East European countries, developed a comparable common methodology for migration data production systems (Kiss, 2013).

THE RESTRICTED RESOLUTION OF SETTLEMENT-LEVEL DATA

Another problem concerns the temporal resolution at which detailed population data are available. For individual settlements, consistent data are generally available only for census years; inter-censal estimates, where published at all, are typically produced only for municipalities or statistical regions (Iliev, 2018).

A related but distinct problem concerns the definition of the settlement itself as a stable statistical unit across census years. In one documented cluster of settlements, four (Eleshec, Naselba Istok, Sveti Stefan, and Rača) do not appear as separate statistical units in the 1981, 1994, and 2021 censuses, being recorded as independent settlements only in 2002, while a fifth (Lagadin) appears only in the last two census years. From 1948 to 1994 these settlements were not recorded separately in the statistical records, their population instead calculated jointly with another settlement — Rača together with Velestovo and Dolno Konjsko in Konjsko; Eleshec and Lagadin in Elshani; Sveti Stefan in Shipokno — while some were formed only in the 1970s as a result of population movement toward more favourable, nearby locations. Where a settlement is recorded independently in some census years but merged with another settlement in others, a direct year-on-year comparison of its population is not methodologically sound unless a consistent set of spatial units is first reconstructed for the whole period. Gaps or inconsistencies in the recorded number of households can complicate this reconstruction further, even for settlements whose identity is not otherwise in dispute. At this finer spatial scale, the underlying problem is the same one already discussed for total and resident population in Section 4.

Nejašmić (2011), writing on applied population geography in Croatia, frames this as a structural dependency on the census that constrains the entire sub-discipline, and illustrates its practical cost with the total fertility rate, which cannot be used in Croatia in the same way as in countries with well-developed vital statistics because the denominator required for its calculation — the number of women of fertile age — is obtainable only from the census; he further notes, in language closely paralleling the Macedonian and Bosnian cases already discussed, that Croatia's own repeated administrative-territorial changes "seriously hamper, and for some population characteristics entirely preclude, reliable retrospective analysis." Spasenović and Devedžić (2012), analysing fertility in Belgrade, record the identical constraint for a

core fertility indicator: "the average number of children per woman is not given at municipal level in statistics; it is especially difficult to secure a longer time series of this indicator."

Studies conducted specifically at the settlement scale confirm the practical severity of the restriction. Popović (2020), examining the functional organization of rural settlements around the city of Zaječar, restricts his analysis to "the last three inter-census periods" (1981–2011) explicitly "because of data availability caused by restricted indicators... on the level of individual settlements," while Krajić (2013), analysing settlements of Srem, notes that detailed structural data from the 2011 census (by age and sex) had still not been published at the time of writing, forcing reliance on the 2002 census instead — a reminder that even where a census has been conducted, the release of settlement-level detail can lag by years.

INSTABILITY IN THE RECORDING OF ETHNIC STRUCTURE

The recording of ethnic (and, in some census years, linguistic and religious) structure, which is subject to two distinct sources of instability: changes in the census category system itself, and the subjective, self-declared character of ethnic affiliation is one of the problems worth mentioning.

The categorical scheme itself has changed across censuses. The 1948 census recorded no ethnic breakdown at all. From then through 2002, the standard classification distinguished Macedonians, Albanians, Turks, Roma, Vlachs, Serbs, and Others; the 2002 census added Bosniaks as a distinct category for the first time. The 2021 census introduced a further-disaggregated scheme: Macedonians, Albanians, Turks, Roma, Vlachs, Serbs, Bosniaks, Other, Not declared, Unknown, and Persons whose data were obtained from administrative sources. In Table 3, the last three 2021 categories — Not declared, Unknown, and Persons from administrative sources — are folded into "Other" for comparability with earlier census years.

Census data for 1953–2002 show the Macedonian population share in the present-day municipality of Kichevo falling from 50.9% to 35.7%, while the Albanian share rose from 32.2% to 54.5%, overtaking the Macedonian share for the first time in 1981 (Ljakoska, 2016). Because the five former municipalities that now constitute Kichevo differed sharply in ethnic composition, the 1996–2013 territorial fragmentation discussed in Section 5 did not merely complicate the measurement of total population but also altered the composition-weighted ethnic structure attributed to "Kichevo" as a statistical unit at each point when its boundaries changed; as Ljakoska (2016) concludes, "the changes of the municipality's boundaries greatly affect the changes of the percentage share of ethnic groups."

The same instability is visible at the national level, and extends beyond ethnic self-declaration to the two related categories of mother tongue and religion. Dimitrov (2005), comparing the 1994 and 2002 censuses nationally, finds that the recorded

Macedonian-majority share fell from 66.6% to 64.2% while the Albanian share rose by 3.5 points, with 64 of the country's 123 municipalities registering a numerical decline in at least one ethnic group. The population classified by mother tongue did not track declared nationality one-for-one, and the 2002 census introduced an entirely new category, Bosniak, with 17,018 persons who by definition could not have been recorded as such in 1994. A parallel divergence appears in the religious count, with the Muslim share rising independently of any single ethnic group's growth. Taken together, these national-level contrasts confirm that the Kichevo case is not an isolated territorial anomaly but an instance of a broader pattern in which ethnicity, mother tongue and religion are recorded as three formally distinct census questions whose answers need not move in parallel, so that any of the three can be used, depending on the analytical purpose, to tell a different quantitative story about the same intercensal period.

A second, independent source of instability is methodological change in census categories themselves. Knežević (2011) documents, for Serbia, the category "Yugoslav" rising sharply between 1961 and 1971 before collapsing by 2002, and the category "Muslim," which passed from a religious designation in 1948 through an ethnic category in 1961 to substantial replacement by "Bosniak" in 2002 — trajectories driven by shifting political circumstances rather than demographic change, with equivalent instability independently documented for "Šiptar"/Albanian in 1948–1953 (Radovanović, 1996). Trnavčević and Knežević (2023) formalize a demographic test for such "floating" categories: for Albanians in Serbia between 2002 and 2011, recorded natural increase was positive (+7,892) while recorded absolute population change was strongly negative (–55,838), evidence that census and vital-statistics data on ethnicity "cannot fully represent an objective basis for ethnodemographic studies."

Czechia's 2021 census offers a contrasting example of institutional candour on this same point: the Czech Statistical Office classifies ethnicity, mother tongue and religious belief as data obtainable only from the census form itself, explicitly "because of their confidentiality and subjectivity" (Vachuška & Kurkin, 2022) — an official acknowledgement that these variables differ in kind from most other census content.

The regulatory framework surrounding ethnic and linguistic data in North Macedonia adds a further layer of sensitivity. Under the Law on the Use of Languages, in force since 2008, the language of any ethnic community constituting at least 20% of a municipality's population acquires official status (Ljakoska, 2016) — the same 20% threshold that recurs in the national Guide for Implementation of the National Strategy for Equality and Non-Discrimination in assessing whether a given community's representation in public administration and social-support statistics is adequate. Because this threshold is itself calculated from census-derived local ethnic-structure data, its practical application inherits the comparability problems documented throughout this paper — a further instance of a methodological limitation with direct downstream consequences for public policy.

THE UNDERESTIMATION OF MIGRATION AND EMIGRATION

Of the demographic phenomena addressed in this paper, migration is the one whose official measurement is most consistently and most severely deficient — a pattern with a specific disciplinary explanation. Morgan and Lynch, reviewing the sources of demography's success as a cumulative science, note that births and deaths are "biologically based" and "anchored in an unmistakable and universal reality," permitting relatively reliable cross-temporal and cross-group measurement, whereas migration was long ago described by Kirk as the "step-child of demography" precisely because it "defied refined measurement comparable to that associated with fertility and mortality" — a scale-dependency of migration data quality that Eklund et al. (2016) document extends well beyond the Balkans to environment-migration research generally. The North Macedonian, Serbian, Bosnian and Romanian evidence assembled in this paper bears this characterization out in detail.

For North Macedonia specifically, Sotiroski and Hristoski (2014) document official institutions "concealing" emigration figures and cite starkly inconsistent estimates of the Macedonian emigrant population: 550,000 according to Eurostat (2012) against a far smaller official figure. Only 50,000 persons were officially recorded as having left the country between 1989 and 1994, yet the 1994 census itself recorded 173,611 Macedonian citizens already living abroad — a discrepancy corroborated by both national demographic-development strategies, which state in near-identical language sixteen years apart that "statistical data at the national level on the volume of emigration abroad do not reflect the real situation" (Government of the Republic of Macedonia, 2008, 2015).

Romania offers a starkly quantified regional parallel: Kiss (2013) reports that Romania's population register "has practically collapsed," with officially registered emigration of roughly 128,000 persons (2001–2011) against a World Bank estimate of 2.8 million Romanians resident abroad in 2010 — official statistics capturing under 10% of the estimated outflow. Serbia's 2020 UNDP-sponsored "Depopulation Data Challenge" produced a Facebook-based estimate of roughly 860,000 emigrants, against a 2011 census figure of about 313,000 (Drašković & Nikitović, 2022).

Nikolić (2024) demonstrates the practical consequences of this measurement problem with unusual precision, comparing three methodologically distinct approaches to measuring Serbian internal migration for the identical 2002–2011 period: a vital-statistics method, a census-based retrospective method, and administrative records of registered address changes. The three methods classify a substantially different number of municipalities as net-immigration areas for the same period — a threefold-plus range of estimates for a single underlying demographic reality — and in suburban settlements whose boundaries changed through partial annexation, unrealistically high recorded birth and death counts appear relative to registered population, a settlement-level artefact of exactly the kind of boundary change discussed in Section 5.

THE PROLONGED ABSENCE OF CENSUS ENUMERATION

Perhaps the single most consequential illustration of the problems documented in this paper is the fact that North Macedonia conducted no population census for nineteen years, between 2002 and 2021; a planned census in 2011 was abandoned mid-process. The principal point of dispute concerned exactly the de facto/de jure definitional question already discussed in Section 4 — whether to count as residents persons who had been absent from the country for more than one year. In the absence of a census, official population figures for the intervening two decades rested on extrapolation from the 2002 count combined with vital statistics; by the time of the eventual 2021 census, the State Statistical Office itself acknowledged that the true population was likely substantially below the extrapolated official figure of roughly 2.08 million, with unregistered emigration the principal source of the discrepancy. The international consequences of the gap were already visible well before 2021: preparing its 2004 Revision of the World Population Prospects, the United Nations Population Division could anchor North Macedonia's total population only to the 2002 census, while its fertility, mortality and international-migration inputs for the country ran no later than 2002, 2001 and 1998 respectively (United Nations, 2005) — meaning that, only three years into what would become a nineteen-year inter-censal gap, the country's contribution to a major international demographic dataset was already resting on migration statistics up to four years out of date. The 2021 census was ultimately conducted using a combination of direct enumeration and cross-checked data from six national administrative databases, a methodological innovation discussed further in Section 10.

Bosnia and Herzegovina provides an almost exact structural parallel, with an even longer gap: twenty-two years between the 1991 and 2013 censuses, again over whether to count citizens working abroad as residents (Lukić Tanović & Marinković, 2024). The 2013 census, conducted under international monitoring because of the sensitivity of the residency question, still ended with an extralegal decision on 196,000 disputed cases and two competing official results differing by 58,081 persons (4.7%). As of 2023, Bosnia and Herzegovina had neither budgeted for nor legislated a new census, despite most European countries having completed their 2021 round.

Taken together, these cases show that the prolonged absence of census enumeration is not a uniquely Macedonian phenomenon but a recurring feature of post-Yugoslav statistical systems wherever population counts intersect with contested questions of ethnic composition, territorial status, or the scale of emigration. In each case, the underlying dispute is ultimately reducible to the same definitional question already identified in Section 4 as a source of ordinary inter-censal discontinuity — the treatment of persons temporarily or permanently absent from the country — but escalated, by its political stakes, from a technical footnote into a multi-year or multi-decade breakdown of the statistical system itself.

DISCUSSION: ALTERNATIVE DATA SOURCES AND METHODOLOGICAL RESILIENCE

The evidence assembled in Sections 4–9 indicates that none of the problems addressed in this paper is unique to North Macedonia. Serbia offers the most extensively documented set of parallels, from Vojvodina and Eastern Serbia to national-level ethnic-category instability and multi-method migration comparisons (Djurdjev, Arsenović & Dragin, 2010; Knežević, 2011, 2014; Knežević & Vojković, 2015; Trnavčević & Knežević, 2023; Nikolić, 2024). Croatia and Bosnia and Herzegovina demonstrate that even more EU-integrated or more constitutionally fragmented neighbours face structurally identical problems, Bosnia's case being an even more extreme version of North Macedonia's own census gap (Nejašmić, 2011; Mutabdžija, 2018; Lukić Tanović & Marinković, 2024). Romania extends the pattern of migration under-measurement beyond the Balkans, while Czechia shows that even well-resourced, transparent systems are not immune to these tensions, merely better placed to mitigate them (Kiss, 2013; Vachuška & Kurkin, 2022). At the supranational level, the EU's INSPIRE Directive, the NUTS/NTES apparatus, and successive UN vital-statistics standards confirm that this tension is treated as requiring formal institutional resolution rather than as an incidental inconvenience. The problems identified in this paper are therefore best understood as a general feature of demographic research on any territory marked by repeated post-socialist administrative reorganization combined with politically sensitive census methodology — and methodological solutions developed elsewhere in the region, from constant-area reconciliation schemes to cross-country migration-data methodologies, merit serious consideration for adaptation to the Macedonian case. Serbia's own account of its 2022 census places this choice of method within a wider European pattern: across the European Union's roughly 2020 census round, the national statistical institute reports that 10 member states conducted a register-based census, 11 a combined census drawing on both direct enumeration and administrative sources, and 6 a traditional, fully field-based census (RZS, 2022). North Macedonia's 2021 census and Serbia's own 2022 census both fall into the middle category in practice — each supplementing direct, door-to-door enumeration with administrative data for a subset of the population — even though only the Macedonian census is formally described in these terms in the sources reviewed here. Table 4 summarizes these and the other methodological similarities and differences between the two countries' census practice discussed throughout this paper.

If the classical decennial census, taken together with periodically revised administrative boundaries, cannot on its own deliver the continuous, spatially consistent data series that demographic research at the local level requires, two broad directions of response emerge from the literature reviewed here.

The second direction concerns methodology in the narrower sense: a more deliberate combination of quantitative census-based analysis with qualitative and mixed-methods approaches. Finney (2020) calls for population geographers to pursue "epistemological opportunities" through mixed-methods research; Nejašmić

(2011) proposes a Demographic Information System linked to GIS as a partial technical response to census-dependency; and Vidicki and Stojšin (2021, 2023) frame the issue as one of overcoming "methodological dogmatism" — the tendency to treat a single research tradition as self-sufficient when, as the Kichevo ethnic-structure case illustrates clearly, a purely quantitative reading of census tables can actively mislead rather than merely under-inform. Schatz (2012) offers a concrete technique: "data-linked nesting," sampling interview respondents directly from an existing census or survey list to allow direct comparison between qualitative and quantitative sub-samples. Older, historically grounded sources of qualitative demographic evidence — from nineteenth-century parish registers reconstructed by Drandić (2013) in the near-total absence of any regular census, to contemporary biographical and retrospective survey methods (Antoine & Rakotonarivo, 2012) — indicate that the impulse to complement official statistics with other forms of evidence is older than the current "mixed methods" vocabulary suggests. Drandić's reconstruction of consistent, disaggregated birth and marriage time series for a period with no census illustrates, in miniature, what a settlement-level demographic study of North Macedonia could ideally construct across the 2002–2021 gap discussed in Section 9.

Table 4. Methodological similarities and differences between North Macedonia and Serbia in census practice

Aspect	North Macedonia	Serbia
Census cycle	Irregular — nineteen-year gap (2002–2021); planned 2011 census abandoned	Regular decennial cycle (1948–2022), no equivalent gap
Territorial coverage	Full national territory in every census	Kosovo excluded from 1991 (boycotted by Albanian population), and 2002/2011/2022 ("conditions did not exist"); reduced coverage in Preševo and Bujanovac, 2011 (boycott)
Residence definition	"Usual residence" concept introduced 2002; SSO states this "does not allow a complete comparability" with earlier censuses (SSO, 2002)	Revised "permanent population" definition, 2002 (only persons abroad under one year counted as residents); Vojvodina recalculation under new methodology: −43,694 persons, −2.2% (Djurdjev, Arsenović & Dragin, 2010)
EU/international alignment	2021 census applies five EU regulations and the UNECE/Eurostat CES 2020 Recommendations (SSO, 2022)	2011 census introduced the international "usual residence" concept (Vachuška & Kurkin, 2022)
Administrative-source integration	2021: direct enumeration supplemented by six national administrative databases for 132,260 persons (Ljakoska et al., 2024)	Not identified to the same extent in the sources reviewed here
Economic activity methodology	Working-age population redefined from 15–79 to 15–89 years from 2023; subsistence farmers reclassified as not employed	2011 census replaced the three-way classification (economically active / persons with personal income / dependent population) with a two-way active/inactive split (Vachuška & Kurkin, 2022)
Ethnic categories	1948: no ethnic breakdown; Bosniak added 2002; Not declared / Unknown / Administrative-source categories added 2021	"Yugoslav" category rose 1961–1971, then collapsed by 2002; "Muslim" moved from a religious (1948) to an ethnic (1961) category, largely replaced by "Bosniak" (2002) (Knežević, 2011)

Official acknowledgement of non-comparability	Yes — SSO (2002): "these changes do not allow a complete comparability of the data"	Yes — RZS (2024): comparisons "must take into account the methodological and territorial changes that occurred from census to census"
Alternative migration-data sources	Sotiroski & Hristoski (2014): Eurostat estimate of 550,000 emigrants against a far smaller official figure	UNDP "Depopulation Data Challenge" (2020): Facebook-based estimate of roughly 860,000 emigrants against a 2011 census figure of about 313,000 (Drašković & Nikitović, 2022)
Census methodology type (EU c.2020 context)	2021 census used a combined method — direct enumeration supplemented by administrative registers for 132,260 persons (Ljakoska et al., 2024)	2022 census used the traditional method (door-to-door enumeration), for the first time with electronic rather than paper questionnaires; RZS notes that across the EU's c.2020 census round, 10 member states used a register-based census, 11 a combined census, and 6 a traditional census (RZS, 2022)

Source: authors' compilation, based on sources cited throughout this paper.

Taken together, these considerations point toward a research practice for North Macedonia that: (a) documents explicitly, for every longitudinal or territorially comparative study, the administrative-territorial and methodological changes intervening between the census years or vital-statistics periods being compared, following the model of the UK Office for National Statistics' dedicated metadata publications; (b) applies schematic reconciliation techniques of the kind developed by Knežević (2014) to construct spatially consistent time series independent of the prevailing administrative division of any single year; (c) treats settlement-level ethnic and demographic indicators with particular caution, given their demonstrated sensitivity to both territorial reorganization and category redefinition; and (d) actively incorporates complementary data sources — administrative, geospatial, and increasingly digital-trace — as a matter of course, publishing, wherever an administrative source is used to supplement direct enumeration, an explicit account of exactly which variables derive from which source, on the Czech rather than the more opaque Macedonian 2021 model.

CONCLUSION

Statistical data on population remain indispensable to demographic research, to regional and spatial planning, and to the formulation of population and ethnic-groups policy in North Macedonia. Yet the evidence reviewed in this paper shows that the raw output of successive censuses cannot be treated as a straightforwardly comparable time series. Changes in census methodology and in the definition of the resident population, repeated administrative-territorial reorganization at the municipal level, a prolonged nineteen-year absence of census enumeration between 2002 and 2021, the restricted availability of settlement-level data outside census years, and instability — administratively, politically and demographically driven — in the recording of ethnic structure and the measurement of migration together constitute a coherent set of methodological constraints on longitudinal and territorially disaggregated demographic analysis. The case of the municipality of Kichevo

illustrates how territorial and ethno-demographic instability can compound one another within a single case; the case of North Macedonia's own census gap, and its almost exact structural parallel in Bosnia and Herzegovina's twenty-two-year gap, illustrates how the same underlying definitional dispute can, under sufficient political pressure, escalate from a routine inter-censal footnote into a multi-decade breakdown of the statistical system itself.

These problems are not specific to North Macedonia: comparable evidence from Serbia, Croatia, Bosnia and Herzegovina, Romania, and further afield, together with institutional responses at EU and UN level, indicates that they are a structural feature of demographic research in territories marked by repeated post-socialist administrative reorganization and by politically sensitive census methodology. This comparative regularity is, in one sense, reassuring — methodological solutions developed elsewhere in the region, from constant-area reconciliation schemes to formal tests for statistically "floating" ethnic categories to jointly developed cross-country migration-data methodologies, are directly transferable to the Macedonian context — but it also underlines the scale of the underlying problem. Future demographic research on North Macedonia would benefit from the systematic, explicit documentation of methodological and territorial discontinuities in any historical data series used; from greater engagement with complementary, non-census data sources, transparently documented at the level of individual variables; and from closer methodological dialogue with the substantial body of comparable research already produced for neighbouring countries of the former Yugoslavia and the wider region.

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МЕТОДОЛОШКИ ПРЕДИЗВИЦИ ВО ДЕМОГРАФСКИТЕ ИСТРАЖУВАЊА И КРЕИРАЊЕ НА ПОЛИТИКИ ЗА НАСЕЛЕНИЕТО

Современото проучување на населението е незамисливо без користење на статистички податоци. Притоа, од непроценливо значење се обемот и квалитетот на истите. Податоците кои се употребуваат во демографските истражувања треба да произлегуваат од организирано собирање на податоци од институции и релевантни извори. Истите треба да овозможуваат континуирано следење на промените коишто се случуваат во обемот и структурата на населението, анализирање на демографските процеси, но воедно, да претставуваат и основа за предвидување на идните развојни тенденции.

За податоците кои се однесуваат на населението неопходно е истите да ги задоволат следните карактеристики: да се веродостојни, релевантни, со соодветен опфат, да се употребливи за конкретно истражување, да обезбедуваат споредливост (методолошка и просторна) и слично. Освен достапните статистички податоци, неопходно е и собирање на податоци за одредена проблематика директно на терен. Таквите податоци заедно со достапните статистички податоци имаат значајна улога во согледувањето на развојните процеси кај населението, но истовремено и во планирањето на идните демографски тенденции. Врз основа на тоа е возможно да се креираат политиките за развој на населението, вработеноста и слично. Тие се неопходни за креирање, а потоа и спроведување на политики за рамномерен регионален развој, за разместеност на дејностите и функциите, инфраструктурата и.т.н.

Целта на трудот е да укаже на значењето и улогата на податоците, согледување на одредени нивни недостатоци, особено во поглед на некои содржини, како и примена во креирањето на политики за населението.

Клучни зборови: статистички податоци, демографски истражувања, политики за население.