LATVIJAS UNIVERSITĀTE

Promocijas darbs – rakstu kopa

Rīga 2026

Sindija Balode-Kraujiņa

SOCIĀLI TELPISKĀ DIFERENCIĀCIJA RĪGAS CENTRA APKAIMĒS

The Series of Articles

SOCIO-SPATIAL DIFFERENTIATION IN THE INNER CITY OF RIGA

LATVIJAS
UNIVERSITĀTE

EKSAKTO ZINĀTŅU UN
TEHNOLOĢIJU FAKULTĀTE
ĢEOGRĀFIJAS NODAĻA

Sindija Balode-Kraujiņa

SOCIĀLI TELPISKĀ DIFERENCIĀCIJA RĪGAS CENTRA APKAIMĒS

PROMOCIJAS DARBS – RAKSTU KOPA

zinātniskā doktora grāda (Ph. D.) iegūšanai
sociālajās zinātnēs
Nozare: sociālā un ekonomiskā ģeogrāfija
Apakšnozare: cilvēka ģeogrāfija

Rīga 2026

Promocijas darbs izstrādāts laikā no 2021. līdz 2025. gadam Latvijas Universitātes Eksakto zinātņu un tehnoloģiju fakultātes Ģeogrāfijas nodaļā.

Finansiālu atbalstu promocijas darba izstrādei snieguši:

- Atveseļošanas un noturības mehānisma projekts "Latvijas Universitātes iekšējā un ārējā konsolidācija" (Nr. 5.2.1.1.i.0/2/24/I/CFLA/007),
- ES ESF projekts "LU doktorantūras kapacitātes stiprināšana jaunā doktorantūras modeļa ietvarā" (Nr. 8.2.2.0/20/I/006),
- VPP projekts "Jauni risinājumi demogrāfijas un migrācijas procesu izpētē latviskas un eiropeiskas zināšanu sabiedrības attīstībai" (Nr. VPP-LETONIKA-2021/4-0002).

Zinātniskā vadītāja:
Prof. *Dr. geogr.* **Zaiga Krišjāne**

Zinātniskais konsultants:
Prof. *Dr. geogr.* **Māris Bērziņš**

Recenzenti:
Prof. *RNDr.* **Martin Ouředníček**, Kārļa Universitāte, Čehija
Asoc. prof. *Dr. geogr.* **Ženija Krūzmētra**, Latvijas Biozinātņu un tehnoloģiju universitāte, Latvija
Prof. *Dr. habil. chem.* **Māris Kļaviņš**, Latvijas Universitāte, Latvija

Promocijas padome:
Prof. *Dr. geogr.* Agrita Briede, padomes priekšsēdētāja
Prof. *Dr. geogr.* Oļģerts Nikodemus, priekšsēdētājas vietnieks
Prof. *Dr. geogr.* Zaiga Krišjāne
Prof. *Dr. geogr.* Māris Bērziņš
Asoc. prof. *Dr. geogr.* Elīna Apsīte-Beriņa
Doc. *Dr. geogr.* Jānis Brizga
Prof. *Dr. habil. chem.* Māris Kļaviņš

Promocijas darba aizstāvēšana notiks 2026. gada 21. janvārī plkst. 12.00 Latvijas Universitātes Eksakto zinātņu un tehnoloģiju fakultātes promocijas padomes publiskajā sēdē Jelgavas ielā 1 – Dabas mājā, Rīgā, 702. telpā.

Ar promocijas darbu un tā kopsavilkumu var iepazīties Latvijas Universitātes Bibliotēkā Jelgavas ielā 1, Rīgā.

ISBN 978-9934-36-491-4
ISBN 978-9934-36-492-1 (PDF)

ANOTĀCIJA

Pilsētas visā pasaulē piedzīvo straujas demogrāfiskās pārmaiņas un pieaugošu sociāli telpisko noslāņošanos, kas saasina sociālās nevienlīdzības problēmas un apdraud ilgtspējīgas attīstības perspektīvas. Šī parādība ir īpaši sarežģīta postsociālisma pilsētvidē, kur attīstību ietekmē centralizēti plānotās ekonomikas mantojums, straujā un sistēmiskā pāreja uz tirgus ekonomiku un integrācijas process Eiropas Savienībā. Šī promocijas darba mērķis ir izvērtēt sociāli telpiskās diferenciācijas iezīmes Rīgas centra apkaimēs. Izmantojot inovatīvu ģeotelpiskās analīzes pieeju un 2021. gada tautas skaitīšanas datus, pētījuma rezultāti rāda, ka Rīgas centra apkaimes attīstās nevienmērīgi, veidojot sociāli un telpiski polarizētu ainavu. Tajā vienlaikus pastāv gan fragmentēta ģentrifikācija, gan "pilsētas ienākšanas telpa" jaunajiem imigrantiem, kuriem raksturīga augsta telpiskā nošķirtība, turklāt tās intensitāte atšķiras atkarībā no analīzes mēroga. Šo sociāli telpisko diferenciāciju veido vairāku procesu mijiedarbība, tostarp iedzīvotāju polarizācija nacionālā līmenī, selektīva suburbanizācija un jaunu migrācijas plūsmu koncentrēšanās iekšpilsētā.

Atslēgas vārdi: sociāli telpiskā diferenciācija, iekšpilsēta, imigrācija, multiskalāra analīze

SATURA RĀDĪTĀJS

IEVADS

Pilsētu attīstību būtiski ietekmē iedzīvotāju skaita un sastāva pārmaiņas (Fihel & Okólski, 2019; Kulcsár & Brown, 2017). Pieaugot migrācijas intensitātei, pilsētu iedzīvotāju sastāvs kļūst aizvien daudzveidīgāks, kas savukārt pastiprina nepieciešamību analizēt procesus, kas veido un uztur sociāli telpisko nevienlīdzību (King & Okólski, 2019). Lai gan sociāli iekļaujoša vide ir ilgtspējīgu pilsētu un noturīgu vietējo kopienu pamats (United Nations, n.d.), pilsētas saskaras ar pieaugošu sociāli telpisko diferenciāciju, kas ietekmē to struktūru un izpaužas kā sociāli telpiska nevienlīdzība. Pilsētas telpa šajā izpratnē nav tikai pasīvs fons – tā aktīvi veido sociālās attiecības, ekonomiskās struktūras un politisko dinamiku, kas savukārt atgriezeniski ietekmē pašu telpu (Diener & Hagen, 2019). Turklāt pieaugoša nevienlīdzība un izmaiņas sociālajā ģeogrāfijā nav lokāla parādība, bet gan daļa no plašākām globālām tendencēm, ko raksturo "Globālās segregācijas tēze", kas apkopo novērojumus par pieaugošu sociālekonomisku telpisku nošķiršanos visā pasaulē (van Ham et al., 2021). Pilsētas vienlaikus ir gan ekonomiskās izaugsmes centri, gan telpa, kurā koncentrējas lielākā sociālo grupu dažādība un nevienlīdzība (Tammaru et al., 2015). Tādējādi, pētot lokālas parādības plašākā reģionālā un globālā ietvarā, iespējams identificēt līdzības un atšķirības sociāli telpiskajā diferenciācijā, sekmējot izpratni par sarežģīto procesu dinamiku, kas veido mūsdienu pilsētu.

Eiropas pilsētu daudzveidību nosaka ekonomisko, sociālo un fizikālo dimensiju mijiedarbība ar demogrāfiskiem un migrācijas procesiem (Musterd et al., 2017). Negatīva dabiskā ataudze un migrācija ir kļuvušas par noteicošajiem faktoriem iedzīvotāju skaita un sastāva izmaiņās Eiropā, imigrācijai sasniedzot vēsturiski augstāko līmeni, ko turklāt raksturo pieaugoša izcelsmes valstu un migrācijas motivāciju dažādība (Amran et al., 2019; Van Mol & de Valk, 2016). Turklāt Eiropas pilsētās ir novērojama augsta imigrantu koncentrācija tieši to centrālajās daļās (Martori & Apparicio, 2011; Salvati, 2017; Stillwell & Phillips, 2006), demonstrējot pieaugošu etnisko dažādību iekšpilsētu apkaimēs.

Sociāli telpiskie procesi ir cieši saistīti ar pilsētas attīstības cikliem, īpaši suburbanizāciju un reurbanizāciju, kas, bieži norisinoties paralēli, rada sarežģītu pilsētas decentralizācijas un recentralizācijas mijiedarbību (Dembski et al., 2021). Suburbanizācija ir pilsētas attīstības modeļa otrais posms pēc urbanizācijas un attiecīgi visai sena un plaši pētīta parādība Eiropā, kam turklāt ir būtiska loma kā reurbanizācijas un ģentrifikācijas priekšnoteikumam (Zukin, 1987). Eiropas iekšpilsētās aizvien biežāk tiek novērota iedzīvotāju skaita stabilizācija un pieaugums (Buzar et al., 2007; Salvati et al., 2019), līdz ar to palielinās arī ar reurbanizāciju saistīto procesu izpētes nozīmība, turklāt būtiski ir ne tikai analizēt iedzīvotāju skaita dinamiku, bet arī iesaistīto iedzīvotāju grupu raksturlielumus, kas ļauj noteikt mazāk redzamas pārmaiņas, piemēram, jaunas sociālās grupas iekšpilsētā (Rérat, 2019).

Sociālās un telpiskās diferenciācijas procesi Eiropā nav viendabīgi. Vēsturisku, ekonomisku un politisku faktoru ietekmē tie atšķiras ne tikai starp valstīm, bet arī pilsētām un to apkaimēm, Centrālās un Austrumeiropas (CAE) reģiona pilsētām piedāvājot unikālu kontekstu. To attīstību raksturo centralizēti plānotu ekonomiku mantojums, sistēmiska un strauja pāreja uz tirgus ekonomiku un integrācija Eiropas

Savienībā (Křížková & Šimon, 2022), kas rada no Rietumeiropas pilsētām atšķirīgas sociāli telpiskās diferenciācijas iezīmes. Vēsturiski CAE pilsētām ir bijis raksturīgs zemāks sociālekonomiskās un etniskās telpiskās nošķiršanās līmenis (Hess et al., 2018; Krišjāne et al., 2015) un noteikta telpiskās vienlīdzības saglabāšanās pat pēc sistēmiskām pārmaiņām (Marcińczak et al., 2015). Tomēr mūsdienās papildus pieaugošai sociālekonomiskajai polarizācijai CAE pilsētas ietekmē arī tādi procesi kā pilsētu sarukšana un iedzīvotāju novecošanās (Haase et al., 2016), kā arī jaunas selektīvas un marginālas ģentrifikācijas formas, kas saistītas ar mājokļu tirgus un iedzīvotāju sastāva īpatnībām (Kubeš & Kovács, 2020), veicinot neviendabīgu iekšpilsētu attīstību.

Rīga, Latvijas galvaspilsēta, ir spilgts piemērs šo sarežģīto procesu mijiedarbībai. Tās morfoloģisko struktūru raksturo vēsturiska iekšpilsēta, ko aptver padomju okupācijas laikā centralizēti plānoti lielmēroga dzīvojamie rajoni, kurus savukārt ieskauj neatkarības perioda CAE raksturīgās novēlotās suburbanizācijas rezultātā veidojusies ārpilsēta. Padomju okupācijas laikā Rīga piedzīvoja liela mēroga imigrāciju no PSRS valstīm, kas būtiski mainīja tās demogrāfisko sastāvu. Atgūstot neatkarību, Latvijā bija augstākais mazākumtautību īpatsvars Baltijas valstīs, tām veidojot gandrīz pusi no valsts iedzīvotājiem, un valstī joprojām saglabājas nevienmērīgs mazākumtautību sadalījums ar augstu koncentrācijas pakāpi lielākajās pilsētās, īpaši Rīgā. Papildus pilsēta ir piedzīvojusi pakāpenisku iedzīvotāju skaita samazināšanos un novecošanos, ko veicinājusi negatīva dabiskā ataudze un negatīvs migrācijas saldo. Vienlaikus ir novērojamas jaunas migrācijas plūsmas, ko stimulē globalizācija, ģeopolitiskā situācija un dalība Eiropas Savienībā, pārveidojot Latvijas migrācijas ainavu. To raksturo ievērojams imigrantu skaita pieaugums no trešajām valstīm, tostarp Indijas, Uzbekistānas un Vjetnamas, un augsta imigrantu koncentrācijas pakāpe Rīgā.

Lai gan procesu mijiedarbība un telpiskais neviendabīgums dažām pilsētas apkaimēm ir ļāvis piedzīvot demogrāfisku, sociālu un ekonomisku izrāvienu, citas ir piedzīvojušas lejupslīdi (Sechi et al., 2022). Šajā pētījumā galvenā uzmanība pievērsta Rīgas iekšpilsētas kodolam – teritorijai, kas ietver Centru, Avotus, Grīziņkalnu, Brasu, Skansti, Pētersalu-Andrejsalu un Vecpilsētu. Pēc ilgstošas iedzīvotāju skaita lejupslīdes šajā teritorijā vērojamas tādas pārmaiņas kā iedzīvotāju skaita stabilizēšanās, sociālekonomiskās plaisas ar pārējo pilsētu palielināšanās, bieža dzīvesvietas maiņa (Krišjāne & Bērziņš, 2014) un augstākā jauno etnisko grupu koncentrācija. Tā kā tradicionālās telpiskās analīzes metodes ietver ar modificējamas apvidus vienības problēmu (MAUP) (Openshaw, 1996) saistītus ierobežojumus, īpaši attiecībā uz analīzes mērogu, piemēram, detalizētai analīzei ļaujot noteikt iezīmes, kas plašākā mērogā nav pamanāmas (Ouředníček & Pospíšilová, 2016), lai veicinātu izpratni par sociāli telpiskās diferenciācijas iezīmēm pilsētās, ir būtiski izmantot ģeotelpiskās analīzes metodes, kas ir noturīgas pret šādiem ierobežojumiem un sniedz priekšrocības un detalizētu ieskatu dažādu, tostarp nelielu, sociālo grupu izvietojuma analīzē.

Promocijas darba mērķis

Promocijas darba mērķis ir izvērtēt sociāli telpiskās diferenciācijas iezīmes Rīgas centra apkaimēs.

Pētāmie jautājumi

1. Kādi globālie, reģionālie un lokālie procesi nosaka pilsētvides pārmaiņas iekšpilsētā?

2. Kā pilsētvides pārmaiņas ietekmē sociāli telpisko diferenciāciju iekšpilsētā?
3. Kā ģeotelpiskās analīzes metodes ļauj atklāt jaunas sociāli telpiskās diferenciācijas iezīmes un intensitāti pilsētas apkaimēs?

Hipotēze

Rīgas centra apkaimēs sociāli telpisko diferenciāciju veido globālu, reģionālu un lokālu procesu mijiedarbība, kur būtiska loma ir augstai jauno imigrantu grupu koncentrācijas pakāpei.

Promocijas darba uzdevumi

Promocijas darba mērķa sasniegšanai izvirzīti šādi darba uzdevumi:

1. Globālo, reģionālo un lokālo procesu, kas nosaka pilsētvides pārmaiņas iekšpilsētā, un to mijiedarbības izpēte.
2. Empīrisko pētījumu apkopošana par iedzīvotāju sastāva pārmaiņām un sociāli telpisko diferenciāciju iekšpilsētā.
3. Teorētisko nostādņu par modificējamas apvidus vienības problēmu apkopošana un mērogjutīgas metodoloģijas izstrāde.
4. Pilsētvides pārmaiņu analīze Rīgas apkaimju līmenī, kā arī plašākā Rīgas piepilsētas un Latvijas reģionu kontekstā.
5. Multiskalāra Rīgas centra apkaimju iedzīvotāju analīze pēc tautības un nodarbinātības radošajās industrijās, izmantojot egocentrisko apkaimju metodi, lai noteiktu sociāli telpiskās diferenciācijas iezīmes.

Promocijas darba zinātniskā novitāte

1. Novērtēta pilsētas vēsturiskās attīstības, morfoloģiskās struktūras un pilsētu ģeogrāfijas procesu (piemēram, ģentrifikācijas, suburbanizācijas) ietekme uz iekšpilsētas sociālo polarizāciju, kā arī atšķirīgu apkaimju attīstības trajektoriju nodalīšana.
2. Analizētas un noteiktas jaunas sociāli telpiskās diferenciācijas iezīmes Rīgas centra apkaimēs, atklājot iepriekš nepētītas jauno etnisko grupu izvietojuma un koncentrācijas iezīmes.
3. Latvijas pilsētvides pētījumu kontekstā izmantots un pielāgots inovatīvs telpiskās analīzes rīks *EquiPop Flow*, kas ļauj samazināt tradicionālo metožu ierobežojumus un sniedz precīzāku priekšstatu par sociāli telpiskiem procesiem dažādos līmeņos, neatkarīgi no teritoriju administratīvā un/ vai statistiskā iedalījuma.
4. Demonstrēta rīka *EquiPop Flow* plašāka pielietojamība arī citu iedzīvotāju sastāva raksturlielumu telpiskajā analīzē.
5. Ņemot vērā pilsētu attīstības un ilgtspējības pētījumu virziena prioritāro nozīmi ES un Latvijā, tā rezultāti ir izmantojami integrācijas politikas veidošanā, kā arī pašvaldības darbā.

Tēzes

1. Rīgas centra apkaimju sociāli telpisko diferenciāciju nosaka demogrāfiskas polarizācijas, selektīvas suburbanizācijas, fragmentētas ģentrifikācijas un jaunu starpvalstu migrācijas plūsmu koncentrēšanās mijiedarbība.
2. Rīgas centra apkaimēs veidojas neviendabīga sociāli telpiskā ainava, kurai raksturīga etniska un sociālekonomiska hierarhija, kā arī "pilsētas ienākšanas telpas" veidošanās.

3. Mērogjutīgas ģeotelpiskās analīzes metodes izmantošana demonstrē to, ka telpiskā nošķiršanās ir atkarīga no analīzes mēroga un īpaši nozīmīga nelielu sociālo grupu izpētē, atklājot ļoti augstas jauno imigrantu grupu telpiskās nošķiršanās iezīmes mikro līmenī.

Rezultātu aprobācija

Promocijas darba rezultāti publicēti sešos zinātniskajos rakstos un apspriesti 10 starptautiskajās konferencēs.

Ar promocijas darbu saistītās zinātniskās publikācijas

Balode, S., & Bērziņš, M. (2025). Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods. *Frontiers in Sustainable Cities*, 7:1612980. https://doi.org/10.3389/frsc.2025.1612980

Balode, S., & Bērziņš, M. (2025). Exploring patterns of ethnic diversification and residential intermixing in the neighborhoods of Riga, Latvia. *Urban Science, 9*(7), 274. https://doi.org/10.3390/urbansci9070274

Balode, S., & Krišjāne, Z. (2024). Divergent population dynamics: the case of the inner city of Riga. *Rozwój Regionalny i Polityka Regionalna*, *68*, 69–82. https://doi.org/10.14746/rrpr.2024.68.06

Krisjane, Z., Berzins, M., Krumins, J., Apsite-Berina, E., & **Balode, S**. (2023). Uneven geographies: ageing and population dynamics in Latvia. *Regional Science Policy and Practice*, *15*(4). https://doi.org/10.1111/rsp3.12648

Citas zinātniskās publikācijas

Balode, S., & Berzins, M. (2024). Beyond the traditional dichotomies in studying ethnic residential geographies in Riga. *Folia Geographica*, *21*, 48–60. https://doi.org/10.22364/fg.21.4

Balode, S. (2023). Shifting inner-city sociodemographics: the case of Riga. *Folia Geographica*, *20*(2), 64–73. https://doi.org/10.22364/fg.20.2.7

Dalība konferencēs

1. 12. starptautiskā konference *International Conference on Population Geographies* ar referātu *"A Study of Ethnic Residential Patterns in the Inner City of Riga Using Scalable Individualised Neighbourhoods"* 2024. gada 2. jūlijā Belfāstā, Apvienotajā Karalistē.
2. Starptautiskā konference *European Population Conference 2024* ar referātu *"Mapping the Residential Geographies of Ethnic Diversity in Inner Riga"* 2024. gada 14. jūnijā Edinburgā, Apvienotajā Karalistē.
3. 9. *NoRSA* konference ar referātu *"Patterns of Socioeconomic Residential Segregation: Exploring the Intersections of Occupation and Ethnicity in Riga"* 2024. gada 3. maijā Viļņā, Lietuvā.
4. 10. starptautiskā konference *International Urban Geographies of Post-Communist States Conference* ar referātu *"Ethnic Diversity in the Inner-City Core of Riga"* 2023. gada 20. septembrī Rīgā, Latvijā.

5. 9. *EUGEO* kongress ar referātu *"Patterns of Socio-spatial Distribution of the Residents of Riga, Latvia"* 2023. gada 5. septembrī Barselonā, Spānijā.
6. *American Association of Geographers* ikgadējā sanāksme ar referātu *"Shifting Demographics in the Inner City of Riga"* 2023. gada 26. martā Denverā, ASV (virtuāla dalība).
7. 8. starptautiskā konference *Central European Conference in Regional Science* ar referātu *"Divergent Population Dynamics: The Case of the Inner City of Riga"* 2022. gada 23. novembrī Poznaņā, Polijā (virtuāla dalība).
8. 11. starptautiskā konference *Population Geographies* ar referātu *"Demographic Processes in the Central Neighborhoods of Riga, Latvia"* 2022. gada 25. augustā Tokijā, Japānā (virtuāla dalība).
9. 3. starptautiskā konference *International Conference on Migration and Mobilities* ar referātu *"Demographic Processes in the Central Neighborhoods of Riga"* 2022. gada 6. jūlijā Sentendrjūsā, Apvienotajā Karalistē.
10. 9. starptautiskā konference *International Urban Geographies of Post-Communist States Conference* ar referātu *"Who Lives in the City Center? The Case of Riga"* 2022. gada 29. jūnijā Budapeštā, Ungārijā.

1. tabula. **Autores ieguldījums promocijas darba izstrādē.**

Pētīto procesu ietekme	**Pētītie procesi**	**Zinātniskās publikācijas nosaukums**	**Autores ieguldījums * neliels ieguldījums, ** mērens ieguldījums, *** liels ieguldījums**				
			Pētījuma dizains	**Metodoloģija**	**Datu analīze un vizualizācija**	**Rezultātu interpretācija**	**Manuskripta sagatavošana**
Sociāli telpiskā diferenciācija Rīgas centa apkaimēs	Jauno etnisko grupu izvietojums un koncentrācijas pakāpe Rīgas centra apkaimēs, izmantojot egocentrisko apkaimju pieeju	Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods	**	***	***	***	***
	Apkopotu etnisko grupu izvietojuma un koncentrācijas pakāpes dinamika Rīgā	Exploring patterns of ethnic diversification and residential intermixing in the neighborhoods of Riga, Latvia	**	**	***	***	***
	Iedzīvotāju skaita dinamika Rīgas iekšpilsētā un piepilsētā saskaņā ar pilsētas attīstības modeli	Divergent population dynamics: the case of the inner city of Riga	***	***	***	***	***
	Iedzīvotāju skaita izmaiņas un novecošanās procesi Latvijā	Uneven geographies: ageing and population dynamics in Latvia	*	*	*	**	***

Darba struktūra

Promocijas darba kopsavilkums ietver globālo, reģionālo un lokālo procesu, kas nosaka sociāli telpisko diferenciāciju iekšpilsētā, un ar tās pētniecību saistīto metodoloģisko izaicinājumu izklāstu; pētījuma teritorijas – Rīgas centra apkaimju – un pētījumā izmantoto datu un metožu aprakstu; galvenos rezultātus un diskusiju, kā pamatā ir autores zinātniskās publikācijas; secinājumus un priekšlikumus turpmākajiem pētījumiem.

1. PĒTNIECISKIE JAUTĀJUMI

Sociāli telpiskā diferenciācija ir pamatjēdziens pilsētu pētniecībā, kas apzīmē sociālo grupu telpisku nošķiršanos, ko dažādos kontekstos nosaka atšķirīga sociālo, ekonomisko, kultūras, politikas un institucionālo faktoru mijiedarbība dažādos līmeņos (Orum, 2019). Galvenā sociāli telpiskās diferenciācijas izpausme ir telpiskā nošķiršanās jeb segregācija pēc dzīvesvietas, kas sociālās grupas nošķir pēc šādām pazīmēm: etniskā piederība, sociālekonomiskais stāvoklis vai vecums (Andersson et al., 2018), kā rezultātā veidojas diferencēta piekļuve resursiem, pakalpojumiem un iespējām, kas savukārt pastiprina pastāvošo sociālo nevienlīdzību (Massey & Denton, 1988). Šajā kontekstā iedzīvotāju dzīvesvietas izmaiņas pilsētā ir ne tikai reakcija uz strukturāliem sociālekonomiskiem procesiem, bet arī pilsētu transformāciju virzītājspēks, kas dažādos kontekstos izpaužas atšķirīgi. Sociāli telpisko diferenciāciju veicina vairāki savstarpēji saistīti procesi, kas darbojas globāli, reģionāli un lokāli, tostarp globalizācija, migrācija un sociālekonomiskas pārmaiņas. Šie dažādā līmeņa procesi mēdz viskoncentrētāk mijiedarboties un izpausties tieši iekšpilsētās, veidojot jaunas sociāli telpiskās diferenciācijas formas.

1. jautājums. **Kādi globālie, reģionālie un lokālie procesi nosaka pilsētvides pārmaiņas iekšpilsētā?**

Sociāli telpiskās pārmaiņas pilsētās ir cieši saistītas ar globalizāciju, kuras rezultātā globāli ekonomiski, politiski un kultūras procesi būtiski pārveido pilsētvidi. Izrietošā ekonomiku pārstrukturēšana, tostarp deindustrializācija un finanšu, tehnoloģiju un pakalpojumu nozares izplešanās, veicina jaunu elites sociālo grupu veidošanos un citu sociālo grupu atstumtību (Tammaru et al., 2020). Tādējādi globalizācija ir strukturāls process, kas mijiedarbībā ar labklājības politiku, mājokļu sistēmu un nodarbinātības struktūru ietekmē telpisko nošķiršanos (Tammaru et al., 2015). Globalizācija arīdzan izraisa jaunas migrācijas plūsmas, kas, sajaucoties ar vēsturiskajām migrācijas iezīmēm, pārveido Eiropas etnisko ainavu (King & Okólski, 2019). Pastāvot tiešai saiknei starp imigrācijas līmeni un etniskās telpiskās nošķiršanās pakāpi (Skifter Andersen et al., 2016), pieaug sociāli telpiskās nevienlīdzības riski (Amran et al., 2019; Dembski et al., 2021), kas vistiešāk ietekmē tās pilsētas, kurās novērojama augstākā migrantu koncentrācija (Benassi et al., 2020). Kā norāda *Catney et al. (2023)*, lai izprastu pārmaiņas nevienlīdzības ģeogrāfijā Eiropas pilsētās, ir būtiski integrēt pētījumus par etnisko dažādību, telpisko nošķiršanos pēc dzīvesvietas, kā arī iekšējo migrāciju.

Eiropas pilsētās novērojama iedzīvotāju novecošanās un retākos gadījumos arī pilsētu sarukšana, ko virza demogrāfiskā pāreja, zems dzimstības līmenis, izmaiņas mājsaimniecību struktūrā un gados jaunu iedzīvotāju emigrācija (Botev, 2012; Kashnitsky et al., 2021; Kazimierczak & Szafrańska, 2019; Wolff & Wiechmann, 2018), kā rezultātā palielinās arī telpiskā nošķiršanās starp gados jaunākiem un vecākiem iedzīvotājiem (Sabater et al., 2017). Pilsētu attīstību skaidro *van den Berg et al. (1982)* modelis, to iedalot četros secīgos posmos: urbanizācija, suburbanizācija, deurbanizācija

un reurbanizācija. Modeļa pirmajos divos posmos funkcionālā pilsētas teritorija piedzīvo iedzīvotāju skaita pieaugumu, bet pēdējos divos posmos – samazinājumu. Suburbanizāciju raksturo iedzīvotāju skaita samazināšanās pilsētas centrā un palielināšanās piepilsētā, bet reurbanizāciju – pretēja tendence. Pētījumi Eiropā liecina, ka reurbanizācija var noritēt vienlaikus ar suburbanizāciju (Kabisch & Haase, 2011), un sarūkošās pilsētās, kur pilsētas centrā nav novērojams izteikts iedzīvotāju skaita pieaugums, tās iezīmes var noteikt, analizējot izmaiņas iedzīvotāju sastāvā un mājokļu tirgū (Haase et al., 2008).

Ģentrifikācija ir reurbanizācijas forma, ko 1964. gadā definēja Rūta Glāsa kā procesu, kurā strādnieku apdzīvotās teritorijas tiek pakāpeniski pārveidotas, tos izspiežot vidusslānim (Smith, 2012). Mūsdienās ģentrifikāciju izprot plašāk, ietverot arī starpvalstu kapitāla plūsmu ietekmi un pilsētas telpas komercializāciju, tādējādi ģentrifikācijai kļūstot par globālu pilsētvides attīstības stratēģiju (Smith, 2002). Ģentrifikācijas lomas pāraugšanu globālā fenomenā atspoguļo "planetārās ģentrifikācijas" koncepta (Lees et al., 2022) ieviešana, kas uzsver šī procesa augošo ietekmi planētas mērogā. Patēriņa modeļu maiņa un iekšpilsētas kā dzīvesvietas pievilcības pieaugums veicina ģentrifikāciju (Zukin, 1987). Tā ietver netradicionālu mājsaimniecību pieaugumu, kas ietekmē mājokļu tirgus pieprasījumu un, ņemot vērā vietējo kopienu atšķirīgās vērtības un pieaugošo sociāli telpisko nevienlīdzību, apdraud šo kopienu stabilitāti (Fabula et al., 2017). Pētījumi arvien biežāk norāda arī uz saikni starp imigrāciju un ģentrifikāciju (Hwang, 2015). Imigrantu pieplūdums var stimulēt pieprasījumu pēc mājokļiem un pakalpojumiem, izraisot cenu kāpumu, kam seko turīgāku iedzīvotāju ienākšana, tādējādi jaunās etniskās grupas var kļūt ne tikai par pilsētvides pārmaiņu aģentiem, bet arī to upuriem (Haase et al., 2020; Huse, 2018; Malmberg & Clark, 2021).

Sociāli telpiskās diferenciācijas procesi Eiropā ir atkarīgi no vēsturiskā, institucionālā un politiskā konteksta (Arbaci, 2007). Līdz ar to dominējošās teorijas, kas balstītas rietumvalstu pieredzē, ne vienmēr spēj pilnvērtīgi izskaidrot līdzīgus procesus postsociālisma pilsētvidē. Sociālisma periodā centralizētas plānošanas, industrializācijas un valsts kontrolētas kolektīvas masveida apbūves ietekmē veidojās kompaktas pilsētu struktūras ar relatīvi zemu sociāli telpiskās nošķiršanās līmeni (Marcińczak et al., 2015). Savukārt postsociālisma periodam raksturīgā plašā mājokļu privatizācija, mājokļu tirgus liberalizācija, privāto investīciju pieplūdums (Sechi et al., 2022) un labklājības valsts mazināšanās izraisīja ienākumu nevienlīdzības palielināšanos (Musterd et al., 2017), tomēr pārmaiņas pilsētu sociāli telpiskajā struktūrā noritēja lēnāk (Marcińczak, 2015). 21. gadsimtā reģionu raksturo demogrāfiskā pāreja, kuras rezultātā iedzīvotāju skaits samazinās ģeogrāfiski nevienmērīgi. Paralēli notiekošo reurbanizācijas un suburbanizācijas procesu rezultātā (Haase et al., 2010; Horňáková & Sýkora, 2021) biežāk novērojams iedzīvotāju skaita pieaugums metropoļu areālos (Borén & Gentile, 2007; Ouředníček et al., 2015), tomēr novecošanās tendences reģionā ir atšķirīgas, un daļā pilsētu tās liecina par novecošanās tempa palielināšanos (Vaishar et al., 2020), bet citās – samazināšanos (Kurek et al., 2021). Novecošanās dinamikā būtiska loma ir jaunajām imigrācijas tendencēm (Křížková & Šimon, 2022). Lai gan migrācijas politiku reģiona valstīs ietekmē Eiropas Savienības direktīvas, tomēr, ņemot vērā to migrācijas vēsturi, atšķirīgos vēsturiskos kontekstus, globālo pozicionēšanos un strukturālās sociālekonomiskās īpatnības, ir maz ticams, ka CAE valstis atkārtos Rietumeiropas pieredzi (Arango, 2012). Šīs tendences rada bažas par iespējamu etniskās telpiskās

nošķiršanās pieaugumu šo pilsētu apkaimēs, kā arī nepieciešamību atkārtoti izvērtēt situāciju, ņemot vērā ne tikai tradicionāli dominējošās mazākumtautību grupas.

Latvijas galvaspilsētas un galvenā ekonomikas centra, Rīgas, attīstību ir ietekmējuši aprakstītie vēsturiskie posmi. Padomju laikā Rīga piedzīvoja masveida industrializāciju un imigrāciju, kas mainīja tās demogrāfisko sastāvu, tomēr neveidojot izteiktu etnisko vai sociālo hierarhiju, jo imigrantu sociālekonomiskais stāvoklis bija līdzīgs (Bolt et al., 2010). Pēc neatkarības atgūšanas Rīgā ievērojami samazinājās iedzīvotāju skaits, un pāreja uz tirgus ekonomiku, mājokļu privatizācija un nepietiekami attīstītais sociālo mājokļu sektors (Krišjāne et al., 2019) izraisīja uz ienākumiem un tirgus mehānismiem balstītu (Zhitin et al., 2020) jaunu sociāli telpiskās diferenciācijas formu rašanos.

2. jautājums. **Kā pilsētvides pārmaiņas ietekmē sociāli telpisko diferenciāciju iekšpilsētā?**

Globālo, reģionālo un lokālo procesu mijiedarbības rezultātā pilsētās, mainoties to iedzīvotāju skaitam, sastāvam un izvietojumam, noris sociāli telpiskas pārmaiņas, kas mēdz būt īpaši izteiktas tieši iekšpilsētās (Kährik et al., 2015; Kovács, 2009). Šāda tendence ir raksturīga vairumam Eiropas galvaspilsētu (Musterd et al., 2017), tostarp CAE reģionā (Lichter et al., 2020; Marcińczak et al., 2015), un ir saistīta ar to, ka dažādās sociālekonomiskajās grupās novērojamas atšķirīgas iedzīvotāju dzīvesvietas maiņas iezīmes (Tammaru et al., 2020). Lai gan CAE reģiona pilsētās suburbanizācijas intensitāte joprojām ir augstāka nekā reurbanizācijas (Hesse & Siedentop, 2018), tomēr to iekšpilsētās novērota revitalizācija, augošs vai stabils iedzīvotāju skaits un tā sastāva maiņa, tostarp imigrantu un gados jaunu un augsti izglītotu speciālistu ienākšana (Haase et al., 2010; Horňáková & Sýkora, 2021; Kubeš & Kovács, 2020; Špačková et al., 2016), kā arī ģentrifikācija un no tās izrietošā iedzīvotāju izspiešana (Pastak & Kährik, 2021).

Ģentrifikācija CAE iekšpilsētās izpaužas fragmentētās, fasādes un marginālās formās (Kubeš & Kovács, 2020), kas ir saistīts ar reģionam specifisko kontekstu – īres tirgus īpatnībām, nelielo vidusslāņa, mazākumtautību vai radošu kopienu pārstāvniecību. Šādas fragmentētas pilsētvides pārmaiņas var pastiprināt sociālās plaisas (Malheiros et al., 2013), tādējādi veicinot telpiskās nevienlīdzības pieaugumu.

Arī Baltijas valstīs identificētas sociāli telpiskas pārmaiņas to galvaspilsētu centra apkaimēs, piemēram, Tallinas iekšpilsētā novērota iedzīvotāju sociālekonomiskā stāvokļa uzlabošanās un vidējā vecuma samazināšanās (Temelová et al., 2016), bet Viļņas iekšpilsētā līdzīgas tendences konstatētas tieši teritorijās, kuras iepriekš raksturoja zemāki sociālekonomiskie rādītāji (Valatka et al., 2017). Šādu procesu rezultātā apkaimēs var veidoties specifisku sociālo grupu lokalizēta koncentrācija (Tammaru et al., 2020). Rīgas kontekstā līdzšinējie pētījumi biežāk koncentrēti uz metropoles areālu, ņemot vērā intensīvo suburbanizāciju (Skadiņš, 2018), kas apvienojumā ar nelabvēlīgu sociālo vidi atsevišķās iekšpilsētas apkaimēs kavējušas reurbanizāciju (Šolks, 2010). Tomēr tieši Rīgas iekšpilsētā novērots izteikts sociāli telpisko atšķirību pieaugums, veidojoties iedzīvotāju koncentrācijai, kam raksturīgs augsts sociālekonomiskais stāvoklis un bieža dzīvesvietas maiņa (Krišjāne & Bērziņš, 2014). Turklāt iekšpilsētas relatīvais pievilcīgums ir pieaudzis, ņemot vērā tās pirmskara apbūvi, ārtelpas kvalitāti, drošību, kā arī kultūras un izklaides nozaru pieejamību, kas sevišķi piesaista gados jaunus iedzīvotājus, kuru apmierinātībā sociālekonomiskie faktori ir mazāk nozīmīgi

(Krūmiņš et al., 2018). Vienlaikus iekšpilsētas iedzīvotāji ir neapmierināti ar mājokļu kvalitāti un izmaksām (Treija et al., 2020), un mazāks attālums līdz pilsētas centram ir saistīts ar zemāku apmierinātību ar apkaimi (Šolks, 2013). Šie novērojumi ir skaidrojami ne tikai ar pakāpenisku attieksmes maiņu, bet arī apkaimju iekšējo sociāli telpisko neviendabīgumu (Ušča, 2010), kā to apliecina sociālās noslāņošanās iezīmes Daugavas kreisā krasta iekšpilsētas apkaimēs (Bauls et al., 2003). Iekšpilsētai raksturīgā selektīvā dzīvojamā fonda uzlabošana, jaunu, iedzīvotājiem ar augstiem ienākumiem paredzētu mājokļu būvniecība un vienlaicīga pirmskara ēku stāvokļa pasliktināšanās (Krišjāne & Bērziņš, 2014; Sechi et al., 2022; Treija et al., 2020) veido telpu, kurā pastāv augsts telpiskās nošķiršanās risks.

Eiropas pilsētās etniskās telpiskās nošķiršanās izpausmes atšķiras no Ziemeļamerikas pieredzes, kuras pamatā ir rasu dihotomija un diskriminējoša politika (Massey et al., 2009), un to nosaka atšķirības migrācijas vēsturē un mājokļu politikā, kas mijiedarbojas ar individuālām izvēlēm un strukturāliem faktoriem (Boterman et al., 2021; Krišjāne et al., 2019). Lai gan vēsturiski Eiropā apdzīvojuma modeļu veidošanā nozīmīgāka loma ir bijusi sociālekonomiskajam stāvoklim nekā etniskajai piederībai (Arbaci, 2007), tomēr, palielinoties globālo migrācijas plūsmu intensitātei, pilsētu apkaimēs pieaug etniskā dažādība (Catney et al., 2023; Steele & Abdelaaty, 2019), kas savukārt veicina telpiskas pārmaiņas (Tammaru et al., 2020). Augstākā imigrantu koncentrācija bieži novērojama tieši iekšpilsētās, tostarp teritorijās ar zemāku sociālekonomisko stāvokli, paaugstinot telpisko izolāciju (Costa & de Valk, 2018) un sociālekonomisko polarizāciju (Marcińczak & Bernt, 2021). Šīs izmaiņas iedzīvotāju etniskajā sastāvā padara šo aspektu par vienu no būtiskākajiem iekšpilsētu sociāli telpiskās diferenciācijas pētījumos.

Imigrantu dzīvesvietas izvēle bieži izriet no brīvprātīgas telpiskas nošķiršanās, kas, pirmkārt, saistīta ar sociālekonomisko atbalstu, kultūras tuvumu un uztverto drošību, ko nodrošina dzīvošana līdzās tautiešiem (Bolt, 2009; Imeraj et al., 2018; Malmberg & Clark, 2021; Stillwell & Phillips, 2006). Otrkārt, priekšroku dzīvesvietas izvēlē imigranti drīzāk dod tuvumā pamatiedzīvotājiem nekā citām imigrantu grupām (Ibraimovic & Hess, 2018); treškārt, šo izvēli nosaka strukturāli un ekonomiski ierobežojumi, piemēram, diskriminācija mājokļu tirgū, finansiāla nepieejamība un informācijas barjeras (Bolt et al., 2010; Johnston et al., 2007).

Tā rezultātā telpiskā nošķiršanās starp dažādām migrantu grupām atšķiras, un Eiropas pilsētās migrantiem no trešajām valstīm raksturīga augstāka koncentrācijas pakāpe (Lichter et al., 2020; Malmberg et al., 2018; Stonawski et al., 2022), kas var veicināt galējas telpiskās nošķiršanās formas – etniska anklāva – veidošanos. Sākotnēji anklāvs nodrošina sociālo kapitālu un aizsardzību pret diskrimināciju (Catney, 2016; Harris, 2023), bet ilgtermiņā tas var ierobežot imigrantu sociālekonomisko mobilitāti (Hack-Polay, 2019) un ietekmēt pamatiedzīvotāju dzīvesvietas izvēli, ņemot vērā aizspriedumus, vēlmi pēc sociālas viendabības un uztvertā apkaimes statusa izmaiņas (Bolt, 2009; Hårsman, 2006; Malmberg & Clark, 2021; Stonawski et al., 2022). Šādas pārmaiņas iedzīvotāju sastāvā savukārt ietekmē nodarbinātības, izglītības un veselības aprūpes pieejamību, var veicināt apkaimes stigmatizāciju un ar noziedzību saistītus riskus (Malmberg et al., 2018), kā arī mazināt sabiedrības saliedētību (Kaplan & Douzet, 2011). Tādējādi telpiskās nošķiršanās procesi palielina sociāli telpisko nevienlīdzību dažādos līmeņos, ietekmējot ne tikai apkaimju un atsevišķu to daļu, bet arī pilsētas kopējo attīstības trajektoriju.

3. jautājums. **Kā ģeotelpiskās analīzes metodes ļauj atklāt jaunas sociāli telpiskās diferenciācijas iezīmes un intensitāti pilsētas apkaimēs?**

Modificējamas apvidus vienības problēma (MAUP) ir būtisks izaicinājums sociāli telpiskās diferenciācijas pētījumos, jo tā var izraisīt neprecīzus telpiskās analīzes rezultātus mēroga efekta (saistīts ar analīzē izmantoto vienību lielumu) vai zonējuma efekta (saistīts ar vienību formu) dēļ (Openshaw, 1996). MAUP mazināšana, pirmkārt, palīdz precīzāk novērtēt sociāli telpisko procesu ietekmi dažādos mērogos un, otrkārt, uzlabo novērojumu salīdzināmību.

Aizvien vairāk pētījumu apliecina to, ka telpiskā nošķiršanās pēc dzīvesvietas ir atkarīga ne tikai no pilsētvides konteksta un konkrētajām analizētajām grupām, bet, jo īpaši, no novērojumu mēroga (Lichter et al., 2020; Rogne et al., 2020; Sleutjes et al., 2018). No vienas puses, telpisko nošķiršanos ietekmē dažāda mēroga procesi – globāli, reģionāli un lokāli, kā apskatīts iepriekš. No otras puses, telpiskās nošķiršanās izpausmes dažādos mērogos – mikro, mezo un makro līmenī – atšķiras, īpaši uzsverot to, ka detalizētāka analīze palīdz atklāt lokalizētas parādības, kas plašāka mēroga analīzē bieži var tikt apslēptas (Malmberg et al., 2018; Marcińczak et al., 2023; Nielsen & Hennerdal, 2017; Sleutjes et al., 2018), ierobežojot niansētu iedzīvotāju izvietojuma un koncentrācijas iezīmju noteikšanu.

Tradicionālās telpiskās analīzes metodes, kuru pamatā ir fiksētas administratīvās robežas, apgrūtina salīdzinošo analīzi un nespēj atspoguļot telpiskās nošķiršanās dinamisko, no konteksta atkarīgo raksturu. Šo metodoloģisko ierobežojumu pārvarēšana, izmantojot progresīvas metodes, kuras kļuvušas pieejamas, pateicoties mūsdienu augstas izšķirtspējas datiem un programmatūras attīstībai, ir izšķiroši nozīmīga, lai veicinātu izpratni par sociāli telpiskās diferenciācijas procesiem pilsētās dažādos mērogos, kā arī pētot jaunas, salīdzinoši nelielas sociālās grupas.

Egocentrisko apkaimju metode ir viena no pieejām, kas vienlaikus palīdz risināt MAUP un veikt analīzi dažādos mērogos, nodrošinot, ka tiek atspoguļota dažāda mēroga sociāli telpisko kontekstu ietekme uz indivīdu, ņemot vērā ģeogrāfiskā konteksta no mēroga atkarīgo raksturu (Petrović et al., 2018). Ļaujot telpiskās nošķiršanās iezīmes noteikt dažādos mērogos, piemēram, no kvartāla līdz apkaimes vai pilsētas līmenim, tiek sniegta daudz detalizētāka izpratne, nekā to pieļauj tradicionālās metodes. Līdzšinējie empīriskie novērojumi liecina, ka etniskā telpiskā nošķiršanās pēc dzīvesvietas vienlaikus var pieaugt vienā mērogā, bet samazināties citā (Šimon et al., 2022). Šādu iezīmju noteikšana ir kritiski svarīga ne tikai pētniecībā, bet arī pilsētplānošanas un integrācijas politikas veidošanā.

Tomēr, lai gan mērogjutīgu metožu izmantošana sniedz būtiskas priekšrocības, ir svarīgi ņemt vērā arī to ierobežojumus. Pētījumos secināts, ka šādas metodes neaptver visas potenciālās priekšrocības un MAUP ierobežo tikai daļēji. Tas saistīts ar to, ka šāda analīze, kuras pamatā ir nepārtraukts režģa pārklājums, neņem vērā pilsētvides fiziskos aspektus, kas darbojas kā barjeras (Amcoff, 2025). Tādējādi pārvietošanās un sociālās saskarsmes barjeras var ietekmēt indeksu precizitāti, it īpaši mezo līmenī (Östh & Türk, 2020), kas ir svarīgi pētāmās teritorijas kontekstā.

Ņemot vērā šos trūkumus, mērogjutīgas metodes ir efektīvs instruments iedzīvotāju izvietojuma analīzei pilsētā dažādos mērogos, ko apliecina to aizvien plašāka

izmantošana pētījumos par iedzīvotāju izvietojumu pēc etniskās piederības. Šīs metodes nodrošina daudzslāņainu skatījumu uz sociāli telpiskās diferenciācijas procesiem pilsētā un var kalpot kā būtisks atbalsts pilsētpolitikas plānošanā un lēmumu pieņemšanā.

2. MATERIĀLI UN METODES

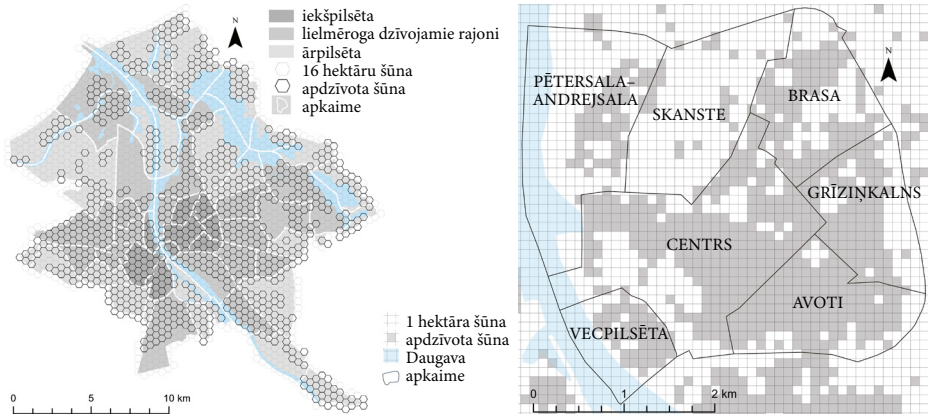
2.1. Pētījuma teritorija

Strukturāli Rīgu veido iekšpilsēta, lielmēroga dzīvojamie rajoni un ārpilsēta (1. attēls), ko nošķir vēsturiskie attīstības ceļi, tostarp migrācijas plūsmas, un apbūves specifika, kas joprojām ietekmē iedzīvotāju skaita, sastāva un izvietojuma īpatnības šajās teritorijās.

Pētījuma teritorija ietver septiņas Rīgas iekšpilsētas apkaimes – Vecpilsētu, Centru, Avotus, Grīziņkalnu, Brasu, Skansti un Pētersalu–Andrejsalu, kas ir daļa no Rīgas vēsturiskā centra un tā aizsardzības zonas. Šīs apkaimes pilsētā veido nošķirtu ģeogrāfisku un sociālu vienību, kuras izvēli pamato:

1. Iepriekšējie pētījumi un tautas skaitīšanas dati, kuri norāda uz to, ka šai teritorijai ir raksturīga augoša sociāli telpiskā diferenciācija gan pilsētas līmenī, gan iekšēji, kā arī augsta jauno imigrantu koncentrēšanās pakāpe.
2. Teritoriju no pārējās pilsētas ģeogrāfiski atdala dzelzceļa loks un Daugava, veidojot telpisku noslēgtību, kas ierobežo sociālu saskarsmi un padara to piemērotu analīzei kā diskrētu analītisko vienību.
3. Teritorijas morfoloģiskās atšķirības, ko pamatā nosaka 19. un 20. gadsimta sākuma apbūve.

Šai teritorijai raksturīgs regulārs ielu tīkls, kas arīdzan veido apkaimju administratīvās robežas. Teritorijas dienvidos un austrumos atrodas bijušie strādnieku dzīvojamie rajoni un kādreizējās rūpnīcas, bet ziemeļos bijušās ostas, rūpniecības un dzelzceļa teritorijas. Administratīvo apkaimju izmērs svārstās no 94 līdz 373 hektāriem, bet to iedzīvotāju skaits no 1.9 līdz 30.7 tūkstošiem (2021. gadā). Attiecīgi iedzīvotāju blīvums svārstās no 8,7 līdz 98,4 iedz./ha, apgrūtinot precīzu analīzi apkaimju līmenī.



1. attēls. **Rīga pēc morfoloģiskā dalījuma (pa kreisi) un Rīgas centra apkaimes – pētījuma teritorija (pa labi).**

Avots: autores veidots

2. tabulā apkopotie iedzīvotāju sastāva un migrācijas dati atklāj atšķirības starp centra un pārējām pilsētas apkaimēm, iezīmējot izteiktu sociāli telpiskās diferenciācijas procesu. Centra apkaimes, kurās 2021. gadā dzīvoja 13,3 % no pilsētas iedzīvotājiem, izceļas kā galvenais piesaistes punkts gan iedzīvotājiem no ārvalstīm, gan citām Rīgas daļām un Latvijas reģioniem, uzrādot vairākkārt augstāku starpvalstu un iekšzemes migrācijas saldo rādītāju.

2. tabula. **Rīgas iedzīvotāju sastāvs 2021. gadā, dzimstības un mirstības vispārīgie koeficienti un migrācijas saldo rādītājs.**

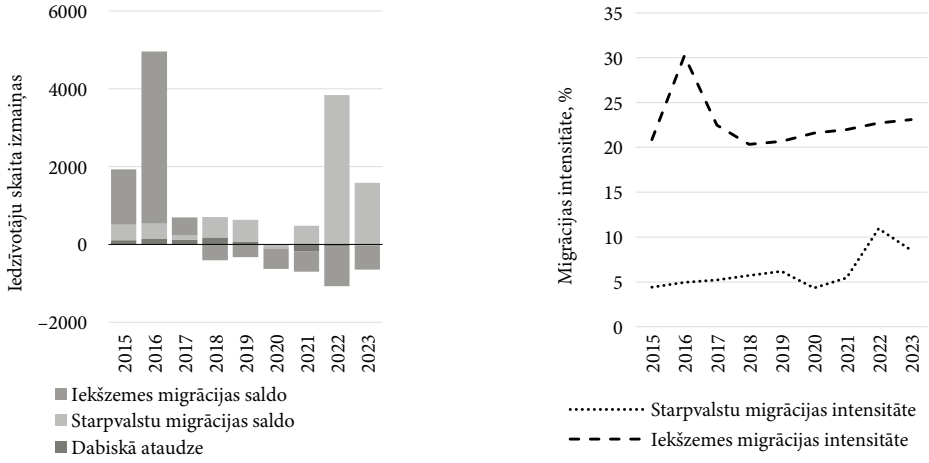
Teritorija	Iedzīvotāju sastāvs						Dzimst. un mirst. visp. koeficients[3]		Migrācijas saldo rādītājs[4]	
	vecuma struktūra (grupas īpatsv., %)			latvieši (īpatsvars, %)	relatīvie ienākumi[1]	augstākā izglītība[2]	dzimstības	mirstības	starpvalstu	iekšzemes
	0–14 gadi	15–64 gadi	65+ gadi							
Centra apkaimes	17,2	66,6	16,2	64,9	121,5	50,5	11,4	10,8	10,8	4,2
Pārējās apkaimes	15,1	62,7	22,1	44,5	97,1	37,2	9,4	15,3	0,5	–2,2
Rīga	15,4	63,3	21,4	47,2	100,0	38,9	9,7	14,7	1,8	–1,4

[1]mēneša vidējā neto darba samaksa pret Rīgas vidējo rādītāju, [2]iedzīvotāju īpatsvars 15 un vairāk gadu vecumā, kuri ieguvuši augstāko izglītību, [3]dzīvi dzimušo bērnu un mirušo skaita attiecība pret vidējo iedzīvotāju skaitu, uz 1000 iedzīvotājiem; datu pieejamības ierobežojumu dēļ izmantoti 2015.–2023. gada dati, [4]starpība starp teritorijā uz pastāvīgu dzīvi ieradušos un no tās uz citu pastāvīgo dzīvesvietu izbraukušo iedzīvotāju skaitu pret vidējo iedzīvotāju skaitu, uz 1000 iedzīvotājiem; datu pieejamības ierobežojumu dēļ izmantoti 2015.–2023. gada dati

Avots: autores aprēķini, izmantojot Centrālās statistikas pārvaldes datus

Šie migrācijas procesi uztur specifisku iedzīvotāju sociāli demogrāfisko profilu centra apkaimēs – augstāks bērnu un darbspējas vecuma iedzīvotāju īpatsvars un zemāks gados veco iedzīvotāju īpatsvars, attiecīgi veidojot nedaudz augstāku dzimstības vispārīgo koeficientu un ievērojami zemāku mirstības vispārīgo koeficientu nekā pārējā pilsētā. Pētījuma teritorijai arī raksturīgs gandrīz 1,5 reizes augstāks latviešu īpatsvars, kā arī iedzīvotāju vidējais ienākumu un izglītības līmenis centra apkaimēs ir aptuveni 1,3 reižu augstāks nekā pārējā pilsētā.

Detalizētāk analizējot iedzīvotāju skaita izmaiņu cēloņus Rīgas centra apkaimēs (2. attēls), novērojams pakāpenisks starpvalstu migrācijas saldo pieaugums, izņemot 2020. gadu, kas saistīts ar Covid-19 pandēmijas ierobežojumiem, bet straujo lēcienu 2022. gadā izraisīja Ukrainas bēgļu pieplūdums. Vienlaikus iekšzemes migrācijas saldo tendence kopš 2018. gada ir negatīva, bet pozitīvie rādītāji 2015. un 2016. gadā saistīti ar pašvaldības politiku attiecībā uz nekustamā īpašuma nodokli un iedzīvotāju atlaižu programmām. Dabiskās ataudzes ietekme šajā periodā bijusi neliela, taču lielākoties pozitīva. Vienlaikus gan starpvalstu, gan iekšzemes migrācijas intensitāte pakāpeniski pieaugusi.



2. attēls. **Iekšzemes un starpvalstu migrācijas saldo un intensitāte un dabiskā ataudze Rīgas centra apkaimēs 2015.–2023. gadā.**

Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

Kopumā šie dati liecina par izteiktu sociālekonomisko polarizāciju pilsētā, kur centra apkaimēm raksturīgs augstāks sociālekonomiskais stāvoklis, kā arī lielāka iekšzemes un, jo īpaši, starpvalstu migrācijas ietekme. Jaunās imigrantu grupas straujāk paplašinās tieši centra apkaimēs, salīdzinot ar pārējo pilsētu un valsti, padarot šo teritoriju par sociālo un telpisko pārmaiņu centru, kas palielina nevienlīdzīgas sociāli telpiskās attīstības riskus.

2.2. Dati

Rīgas centra apkaimju sociāli telpiskās diferenciācijas izpētes nolūkā tika izmantoti Centrālās statistikas pārvaldes (CSP) 2021. gada tautas skaitīšanas dati. Individuālie jeb mikrodati izmantoti anonimizētā veidā, tos ģeoreferencējot pēc dzīvesvietas kvadrāta vai sešstūra šūnu režģī, kurā katras šūnas izmērs ir attiecīgi viens vai 16 hektāri (1. attēls). Šādā veidā nodrošināts fiksētu, telpiski konsekventu vienību pārklājums, kas novērš ar administratīvo vienību izmantošanu saistītos metodoloģiskos izaicinājumus.

Pirmkārt, lai gūtu priekšstatu par iedzīvotāju izvietojumu pēc sociālekonomiskā stāvokļa, analizētas divas profesiju kategorijas – 1. kategorija (vadītāji) un 9. kategorija (vienkāršās profesijas). Šī profesiju klasifikatora pamatā ir Starptautiskā standartizētā profesiju klasifikācija (ISCO-08).

Otrkārt, lai noteiktu visaptverošas iedzīvotāju izvietojuma iezīmes pēc etniskās piederības, tautības tika apkopotas piecās grupās – latvieši, krievi, citas tradicionālās mazākumtautības (baltkrievi, ukraiņi, poļi, lietuvieši, igauņi, ebreji, romi, armēņi, tatāri un moldāvi), eiropieši un pārējās tautības. Analīžu veikšanai tika izmantots sešstūra šūnu režģis, kas aptver visu pilsētu.

Treškārt, lai noteiktu niansētas jauno etnisko grupu izvietojuma iezīmes pilsētas centra apkaimēs, tika izmantots kvadrāta šūnu režģis. Analīzei izvēlētas trīs visstraujāk augošās tautības – indieši, uzbeki un vjetnamieši, kuru pieaugums teritorijā no 2011.

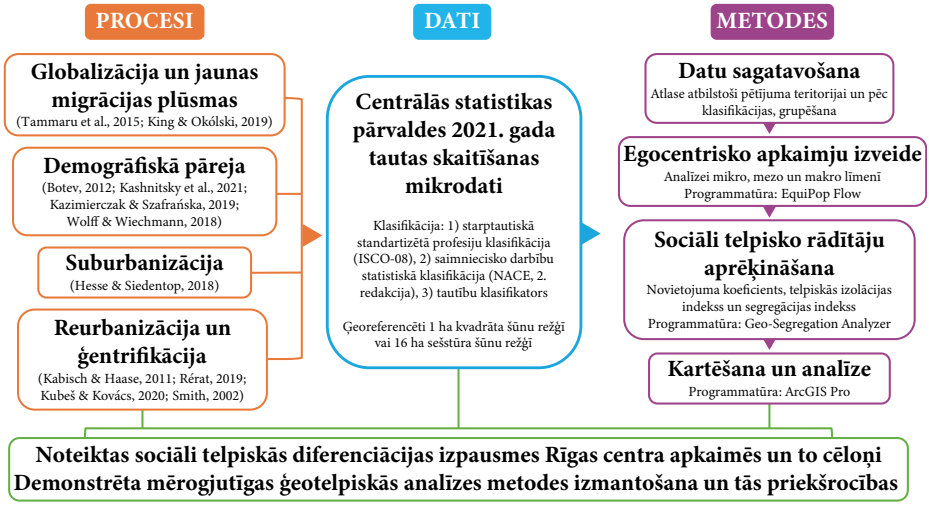
līdz 2021. gadam bija attiecīgi 95,7 %, 89,8 % un 99,1 % (Central Statistical Bureau of Latvia, 2025), kā arī latvieši un krievi.

Tautību klasifikatorā ir identificētas 330 tautības, kas galvenokārt balstītas uz etnisko piederību, norādītu personu apliecinošā dokumentā vai izvēlētu saskaņā ar augšupējo radinieku tautību divu paaudžu ietvaros (Central Statistical Bureau of Latvia, 2025). Tautas skaitīšanas datu galvenais ierobežojums ir jauktas etniskās piederības kategoriju neesamība un kategoriju "neizvēlēta" un "nezināma" iekļaušana. 2021. gadā personu īpatsvars, kuras nav norādījušas savu tautību, sasniedza 4,4 % no Rīgas iedzīvotājiem, izslēdzot no tālākas analīzes būtisku iedzīvotāju daļu.

Ceturtkārt, papildus paplašinot šajā pētījumā izmantotās metodes pielietojumu ārpus ierastās iedzīvotāju izvietojuma pēc etniskās piederības analīzes, veikta radošajās industrijās nodarbināto iedzīvotāju izvietojuma analīze. Šīs grupas definīcija balstīta iepriekšminētajā ISCO-08 un Saimniecisko darbību statistiskajā klasifikācijā (NACE, 2. redakcija). Analīze veikta, izmantojot kvadrāta šūnu režģi, kas aptver visu pilsētu.

2.3. Metodes

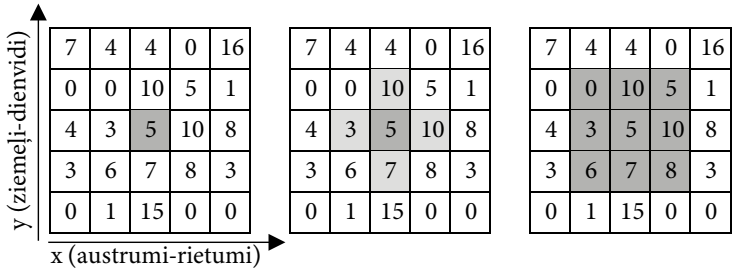
Lai pētītu iedzīvotāju grupu koncentrācijas, telpiskās izolācijas un nošķiršanās pakāpi dažādos mērogos un ierobežotu fiksētām administratīvām vienībām raksturīgo modificējamās apvidus vienības problēmu (MAUP), pētījumā izmantota egocentrisko apkaimju metode (3. attēls), kas ir multiskalāra analītiska pieeja, kuras pamatā ir *k* tuvāko kaimiņu (*k-nearest neighbors*, k-NN) algoritms.



3. attēls. **Sociāli telpiskās diferenciācijas analīze pilsētvidē.**
Avots: Autores veidots

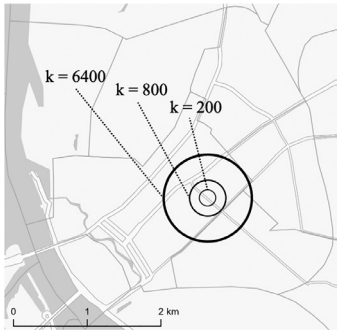
Izmantojot egocentrisko apkaimju metodi, mērogs tika noteikts dinamiski kā individuāla apkaime ap šūnu, pamatojoties uz apkārtējo iedzīvotāju skaitu, ko apzīmē k. Individuālā apkaime tiek noteikta, katru režģa šūnu paplašinot uz āru, līdz tiek

aptverts noteikts tuvāko iedzīvotāju skaits. 4. attēlā redzams piemērs, kā šī metode tiek izmantota, ja *k* vērtība ir 50. Tādējādi tiek veidotas individuālas apkaimes, kas savstarpēji pārklājas, efektīvi mazinot MAUP un ļaujot veikt detalizētu analīzi dažādos mērogos, kā arī uzlabojot rezultātu salīdzināmību (Marcińczak et al., 2023).



4. attēls. **Individuālas apkaimes izveide ar 50 tuvākajiem kaimiņiem.**
Avots: Sleutjes et al. (2018)

Egocentrisko apkaimju noteikšanā tika izmantota programmatūra *EquiPop Flow* (Östh, 2024), veicot aprēķinus astoņām dažādām *k* vērtībām: 50, 100, 200, 400, 800, 1600, 3200 un 6400. Šis diapazons ļāva izpētīt iezīmes no lokalizēta mikro līmeņa līdz plašākam makro līmenim. Rīgas centra apkaimēs izvēlētās *k* vērtības atbilst egocentriskām apkaimēm ar vidējo rādiusu no aptuveni 36 metriem, ja *k* ir 50, līdz 607 metriem, ja *k* ir 6400, un attiecīgi teritorijām no 0,4 hektāru līdz 115,8 hektāru platībai (5. attēls).



5. attēls. **Egocentrisko apkaimju vidējie izmēri pētījuma teritorijā (mikro, ja *k* = 200; mezo, ja *k* = 800; un makro, ja *k* = 6400).**
Avots: autores veidots

Lai noteiktu iedzīvotāju izvietojuma dažādās izpausmes, katrai iedzīvotāju grupai un atbilstoši katrai *k* vērtībai tika aprēķināti trīs indeksi – novietojuma koeficients (*location quotient*, LQ), telpiskās izolācijas indekss (*spatial isolation index*, SII*)* un segregācijas indekss (*segregation index*, SI) saskaņā ar *Tammaru et al. (2015)* un *van Ham et al. (2021)* metodoloģiju, kas pielāgota k-NN algoritma izmantošanai saskaņā ar *Imeraj et al. (2018)*.

Novietojuma koeficients (LQ) (Apparicio et al., 2014) mēra grupas relatīvo koncentrāciju noteiktajā k-NN apkaimē, salīdzinot to ar grupas kopējo pārstāvību pētījuma teritorijā.

$$LQ_{i,k} = \frac{x_{i,k}}{k} \div \frac{X}{T} \quad (1)$$

$x_{i,k}$ ir grupas lielums apkaimē i ar *k* tuvākajiem kaimiņiem; *k* ir tuvāko kaimiņu skaits; X ir kopējais grupas lielums pētījuma teritorijā; T ir kopējais iedzīvotāju skaits pētījuma teritorijā. Saskaņā ar Brown & Chung (2006) LQ diapazons tika definēts no 0,85 līdz 1,20, kur vērtība virs 1,20 norāda uz grupas augstu koncentrāciju, bet vērtība zem 0,85 – uz grupas zemu koncentrāciju.

Telpiskās izolācijas indekss (SII) (Apparicio et al., 2014) mēra varbūtību, ka grupas pārstāvis saskarsies ar citu indivīdu no tās pašas grupas k-NN apkaimē.

$$SII_k = \frac{\sum_{i=1}\left(x_{i,k} \times \frac{x_{i,k}}{k}\right)}{\sum_{i=1}\left(x_{i,k}\right)} \quad (2)$$

papildus iepriekš minētajiem mainīgajiem $\frac{x_{i,k}}{k}$ ir grupas proporcija apkaimē i ar *k* tuvākajiem kaimiņiem. SII vērtības svārstās no 0, kas atbilst 0 % varbūtībai sastapt savas grupas pārstāvi, līdz 1, kas atbilst 100 % varbūtībai sastapt savas grupas pārstāvi.

Segregācijas indekss (SI) (Apparicio et al., 2014) mēra pakāpi, kādā grupas izvietojums k-NN apkaimēs atšķiras no visu pārējo iedzīvotāju izvietojuma.

$$SI_k = 0{,}5 \sum_{i=1}\left|\frac{x_{i,k}}{X} - \frac{k - x_{i,k}}{T - X}\right| \quad (3)$$

SI vērtības svārstās no 0, kas norāda uz pilnīgu integrāciju, kad grupas izvietojums atbilst pārējo iedzīvotāju izvietojumam, līdz 1, kas atbilst pilnīgai segregācijai.

Indeksi tika aprēķināti, izmantojot Geo-Segregation Analyzer v.1.2. (Apparicio et al., 2014), bet telpiskā analīze un kartēšana veikta, izmantojot ArcGIS Pro.

3. REZULTĀTI UN DISKUSIJA

3.1. Pilsētvides pārmaiņas iekšpilsētā globālo, reģionālo un lokālo procesu ietekmē

Latviju raksturo izteikta un pieaugoša demogrāfiska polarizācija, kas izpaužas ģeogrāfiski nevienmērīgi. No 2011. līdz 2021. gadam Latvijā iedzīvotāju skaits samazinājās par 177,1 tūkstoti jeb 8,6 %, un procentuāli lielākais sarukums, pārsniedzot 10 %, vērojams ārpus Rīgas reģiona (3. tabula). Šī vispārējā lejupslīde kontrastēja ar tendencēm teritorijās ap Rīgu – Jūrmalā, Ādažu, Ķekavas, Mārupes, Olaines, Ropažu, Salaspils un Siguldas novadā iedzīvotāju skaits kopumā pieauga 17,4 tūkstošu jeb 7,9 % apmērā, kas apliecina suburbanizācijas augsto intensitāti. Lai gan arī Rīgā iedzīvotāju skaits šajā desmitgadē samazinājās, tomēr lēnāk nekā vidēji valstī, turklāt starp pilsētas apkaimēm šī dinamika bija atšķirīga. Rīgas centra apkaimēs iedzīvotāju skaits samazinājās tikai par 1,1 %, kas ir gandrīz sešas reizes zemāks rādītājs nekā pārējās pilsētas apkaimēs un liecina par relatīvu stabilitāti.

3. tabula. **Iedzīvotāju skaita absolūtās un relatīvās izmaiņas Latvijā no 2011. līdz 2021. gadam.**

Teritorija	Iedzīvotāju skaita izmaiņas, tūkst.	Iedzīvotāju skaita izmaiņas, %
Latvija	–177,1	–8,6
Vidzemes statistiskais reģions	–35,4	–11,3
Kurzemes statistiskais reģions	–40,9	–12,8
Zemgales statistiskais reģions	–28,1	–11,0
Latgales statistiskais reģions	–52,5	–17,3
Rīgas statistiskais reģions, izņemot Rīgu	17,4	7,9
Rīga	–37,7	–5,7
Rīgas centra apkaimes	–0,9	–1,1
Pārējās Rīgas apkaimes	–36,7	–6,4

Avots: autores aprēķini, izmantojot Centrālās statistikas pārvaldes datus

Demogrāfisko polarizāciju pastiprināja iedzīvotāju novecošanās zemu dzimstības rādītāju un emigrācijas ietekmē, vidējam vecumam valstī 2020. gadā sasniedzot 43 gadus. Ārpus Rīgas metropoles areāla vidējais vecums sasniedza 44 gadus, bet Rīgas metropoles areālā saglabājās nedaudz jaunāks iedzīvotāju profils – 42 gadi, kur arī novērota augsta bērnu (0–14 gadi) koncentrācijas pakāpe, īpaši piepilsētā. Visstraujāk augošā grupa valstī, tostarp Rīgā, bija iedzīvotāji vecumā virs 75 gadiem, tomēr šīs grupas koncentrācija Rīgā un tās apkārtnē bija zemāka nekā citviet valstī.

Šīs tendences liecina, ka suburbanizācijas procesi ir piesaistījuši jaunas ģimenes ar bērniem galvaspilsētas apkārtnei, turklāt galvenokārt selektīvi piesaistot latviešu ģimenes ar augstu sociālekonomisko stāvokli. Lai gan suburbanizācijas intensitāte piepilsētā un arī atsevišķās Rīgas ārpilsētas apkaimēs bija izteiktāka nekā recentralizācijas

tendences, tomēr šī telpiskā pārkārtošanās tieši ietekmēja Rīgas centra apkaimes un kalpoja kā priekšnoteikums jaunu sociāli telpiskās diferenciācijas iezīmju veidošanai pētījuma teritorijā, kas kļuvusi par galveno jauno starpvalstu migrācijas plūsmu galamērķi.

Pētījuma rezultāti, atklājot vienlaicīgu suburbanizācijas procesu un reurbanizācijas iezīmju pastāvēšanu Rīgas metropoles areālā, arīdzan izaicina pilsētas attīstības modeļa tradicionālo priekšstatu par attīstības ciklu secīgumu un apstiprina, ka postsociālisma pilsētu attīstības cikli ir sarežģītāki un atšķirīgi no rietumvalstu pieredzes (Haase et al., 2017; Hesse & Siedentop, 2018; Sýkora, 2009). Turklāt sarūkošas un novecojošas postsociālisma pilsētu centrālās apkaimes var radīt vidi specifiskiem procesiem, tostarp jaunu sociālo grupu ienākšanai (Haase et al., 2020), kas maina šo apkaimju attīstības trajektoriju. Izpratne par globālu, reģionālu un lokālu procesu ietekmi uz dzīvesvietas izvēli ir būtiska ne tikai Rīgai, bet arī citām reģiona pilsētām, kurās novērota bieža iedzīvotāju dzīvesvietas maiņa (Temelová et al., 2016; Valatka et al., 2017), īpaši ņemot vērā šo procesu selektīvo raksturu, kas paaugstina sociāli telpiskās nevienlīdzības riskus.

3.2. Pilsētvides pārmaiņu ietekme uz sociāli telpisko diferenciāciju iekšpilsētā

Iepriekš aprakstītie procesi veicināja izmaiņas Rīgas centra apkaimju iedzīvotāju skaitā un sastāvā, un apkopotie sociāli demogrāfiskie dati atklāja neviendabīgu teritorijas attīstību (4. tabula). Skanstei bija raksturīga jaunbūvju ģentrifikācija (*new-build gentrification*), radot izteikti selektīvu iedzīvotāju koncentrāciju – gados jauni iedzīvotāji, tostarp liels bērnu un jauniešu īpatsvars, ar augstiem sociālekonomiskajiem rādītājiem, vidējiem mēneša ienākumiem pat divkārt pārsniedzot citu centra apkaimju līmeni.

4. tabula. **Rīgas centra apkaimju iedzīvotāju sociāli demogrāfiskie rādītāji 2021. gadā un rādītāju relatīvās izmaiņas 2011.–2021. gadā, % (iekavās).**

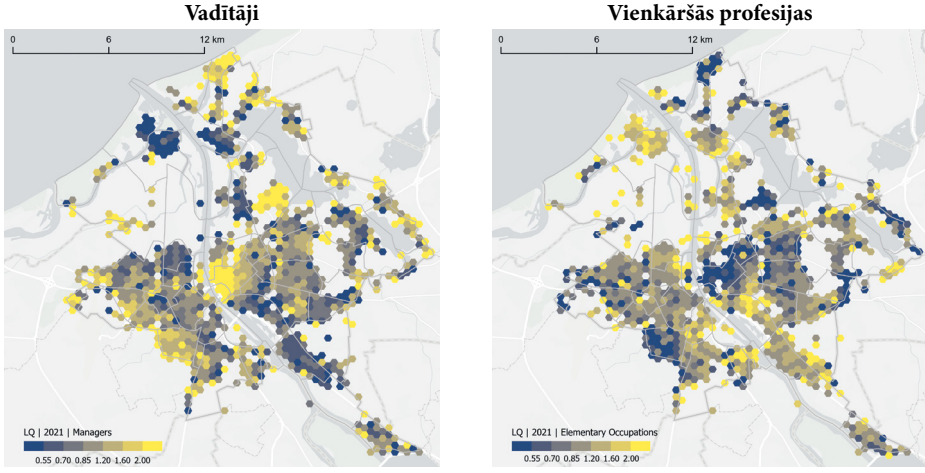
	Avoti	Brasa	Centrs	Grīziņ-kalns	Pētersala–Andrejsala	Skanste	Vecpilsēta
Iedz. skaits, tūkst.	17,9 (–3,8)	12,7 (–3,8)	30,7 (–0,2)	12,1 (–5,4)	5,1 (–1,8)	1,9 (133,5)	2,0 (3,0)
Vidējais iedz. vecums, gados	39 (0,0)	40 (–2,4)	38 (–2,6)	40 (–2,4)	41 (0,0)	33 (–10,8)	36 (–10,0)
0–17 īpatsv., %	17,4 (1,6)	19,9 (5,4)	22,6 (6,4)	17,9 (2,4)	18,6 (3,1)	30,2 (11,0)	24,8 (11,5)
18–44 īpatsv., %	43,1 (–0,6)	39,5 (–3,9)	40,1 (–3,5)	41,0 (0,1)	38,2 (–2,4)	42,1 (–3,7)	38,6 (–8,3)
65+ īpatsv., %	15,1 (0,2)	18,4 (–0,1)	15,0 (–0,5)	17,2 (–0,8)	17,9 (0,5)	9,1 (–3,4)	12,8 (–0,3)
Augstākā izglītība[1]	42,5 (9,2)	55,3 (10,7)	59,8 (9,3)	45,7 (11,6)	47,9 (13,1)	62,8 (17,7)	62,1 (12,1)
Mēneša vid. neto darba samaksa (EUR)	976 (105,9)	1130 (100,0)	1268 (91,5)	998 (105,3)	1210 (119,6)	2014 (147,7)	1335 (65,4)

[1]iedzīvotāju īpatsvars 15 un vairāk gadu vecumā, kuri ieguvuši augstāko izglītību
Avots: autores aprēķini, izmantojot Centrālās statistikas pārvaldes datus

Līdzīgas, taču mērenākas tendences vērojamas Vecpilsētā un Centrā. Kā teritorijas apdzīvotākā apkaime, Centrs uzrādīja demogrāfisku stabilitāti un saglabāja augstu sociālekonomisko statusu. Pārējās apkaimes piedzīvoja nelielu iedzīvotāju skaita samazinājumu, kā arī novērojams augstāks iedzīvotāju vidējais vecums. Lai gan Avotos bija augstākais 18–44 gadus veco iedzīvotāju īpatsvars – vecuma grupa, kas saistīta ar ģentrifikācijas procesiem – iedzīvotāju īpatsvars ar augstāko izglītību un vidējie mēneša ienākumi bija zemāki nekā pārējās apkaimēs. Attiecībā uz iedzīvotāju skaita dinamiku šajā periodā jāņem vērā Covid-19 pandēmijas ietekme, kas samazināja centra apkaimju kā dzīvesvietas pievilcību tās sniegto priekšrocību ierobežošanas dēļ.

Salīdzinot ar 2011. gadu, vidējais iedzīvotāju vecums visās apkaimēs saglabājās stabils vai samazinājās, kamēr bērnu un jauniešu īpatsvars pieauga. Vienlaikus gados vecāko iedzīvotāju īpatsvars samazinājās visās apkaimēs, izņemot Avotus un Pētersalu–Andrejsalu. Iedzīvotāju ar augstāko izglītību īpatsvars un vidējie mēneša ienākumi palielinājās visās apkaimēs, visstraujāk – Skanstē un Pētersalā-Andrejsalā.

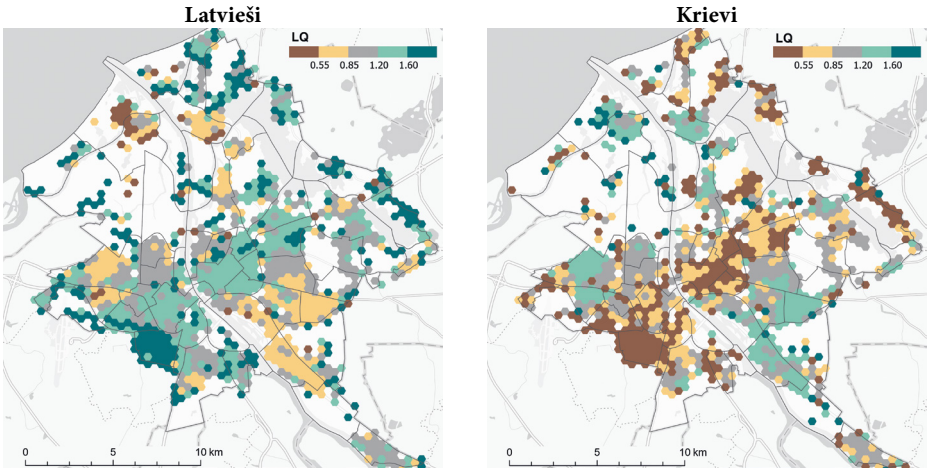
Atbilstoši centra apkaimju relatīvi augstajam sociālekonomiskajam statusam kopumā pētījuma teritorijā novērota augsta vadītāju koncentrācija un zema vienkāršo profesiju pārstāvju koncentrācija (6. attēls). Apkaimju līmenī augstākā vadītāju koncentrācija bija Vecrīgā, Centra rietumdaļā, Pētersalas–Andrejsalas dienviddaļā un Skanstē, pārējā teritorijā vadītāju koncentrācija bija lielākoties vidēja, bet Avotu un Grīziņkalna perifērijā – zema. Vienkāršo profesiju pārstāvju dzīvesvietu izvietojumā redzama izteikti zema koncentrācija vietās, kur ir augsta vadītāju koncentrācija, liecinot par telpisko nošķiršanos. Augstākā šīs grupas koncentrācija bija novērojama teritorijas ziemeļdaļā un dienviddaļā, tostarp Avotu un Vecpilsētas perifērijā.



6. attēls. **Rīgas iedzīvotāju izvietojums un koncentrācijas pakāpe pēc profesijas 2021. gadā.**
Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

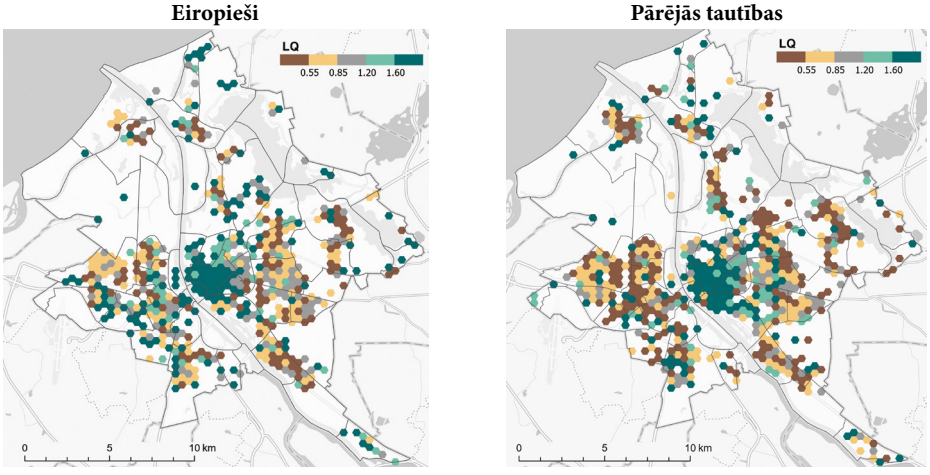
No 2011. līdz 2021. gadam Rīgā piecu vēsturiski lielāko tautību (latvieši, krievi, baltkrievi, ukraiņi, poļi) kopējais īpatsvars samazinājās no 96 % līdz 92 %. 2021. gadā latviešu koncentrācijas pakāpe saglabājās augsta gan iekšpilsētā, gan ārpilsētā, savukārt krievu koncentrācija bija augstāka lielmēroga dzīvojamajos rajonos (7. attēls). Centra apkaimēs latviešu koncentrācija bija augsta visā teritorijā, izņemot

ziemeļdaļu – Pētersalu–Andrejsalu un daļu Skanstes, kur tā bija vidēja. Krievu koncentrācija visā pētījuma teritorijā bija zema, izņemot Pētersalu–Andrejsalu un Skansti, kur tā biežāk sasniedza vidēju līmeni.



7. attēls. **Rīgas iedzīvotāju izvietojums un koncentrācijas pakāpe pēc tautības 2021. gadā.**
Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

Eiropieši un pārējās tautības bija izteikti un gandrīz ekskluzīvi koncentrētas pētījuma teritorijā (8. attēls), tomēr vidēja un zema eiropiešu koncentrācijas pakāpe lokalizēti novērota Avotu austrumdaļā, Grīziņkalnā un Brasā. Pārējās tautības bija zemāk koncentrētas Pētersalā-Andrejsalā un Brasā, un tikai atsevišķās šūnās koncentrācija nesasniedza vidējo līmeni. Šī jauno imigrantu grupu koncentrācija centra apkaimēs saistāma ar etniskās infrastruktūras trūkumu (Křížková & Šimon, 2022) un to, ka šī teritorija nodrošina labāku piekļuvi nodarbinātībai un pakalpojumiem (Sechi et al., 2022).



8. attēls. **Rīgas iedzīvotāju izvietojums un koncentrācijas pakāpe pēc tautības 2021. gadā.**
Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

Augstākā telpiskā nošķiršanās novērota starp krieviem un eiropiešu un pārējo tautību grupām, savukārt šo jauno grupu un latviešu dzīvesvietas telpiskās iezīmes liecināja par zināmu līdzāspastāvēšanu. Šī pilsētas līmeņa analīze apstiprināja to, ka centra apkaimes ir kļuvušas par galveno etniskās dažādošanās telpu pilsētā, apliecinot detalizētākas analīzes nepieciešamību.

Šīs etniskās grupas raksturoja arī būtiskas sociāli demogrāfiskas atšķirības. Krieviem bija raksturīgs augstākais vidējais vecums, bet pārējām tautībām – zemākais, kā arī lielāks vīriešu īpatsvars un biežāka dzīvesvietas maiņa. Līdzīgi, bet mērenāki rādītāji novēroti arī eiropiešu grupā, kas atbilst novērojumiem, ka apkaimēm ar augstāku iedzīvotāju etnisko dažādību bieži raksturīgs jaunāks iedzīvotāju profils gan vietējo, gan ārvalstīs dzimušo vidū (Catney et al., 2021; Hårsman, 2006). Kopumā eiropieši un latvieši uzrādīja augstāko īpatsvaru gan augstskolu absolventu, gan augsta statusa profesijās nodarbināto vidū, bet krievi – zemāku. Pārējām tautībām turpretim raksturīgs augsts augstskolu absolventu īpatsvars, taču ierobežota pārstāvība augsta statusa profesijās, kā arī visaugstākā nodarbinātība zema statusa profesijās. Šī tendence starpvalstu migrācijas kontekstā atspoguļo sociālekonomisko polarizāciju, vienlaikus demonstrējot gan globālu konkurenci par augsti kvalificētiem speciālistiem, gan migrantu koncentrēšanos zemas kvalifikācijas nozarēs (Hamnett, 2021). Šīs atšķirības liecina ne vien par potenciāli atšķirīgiem integrācijas ceļiem pilsētas sistēmā starp dažādām tautībām, bet arī sociālekonomiskās mobilitātes lomas nozīmību.

Mājokļu pieejamība ir noteicošs faktors dzīvesvietas izvēlē. Privatizācijas rezultātā dominējošais īpašnieku apdzīvotais mājokļu fonds ierobežo dzīvesvietas izvēli Rīgā, kā arī ēku komercializāciju (Olt & Csizmady, 2020). Tādējādi ievērojami augstākais īres mājokļu īpatsvars centra apkaimēs (5. tabula) nodrošināja labvēlīgāku vidi jaunu iedzīvotāju piesaistē, īpaši Avotos un Grīziņkalnā. Arī jaunbūvju ģentrifikācija centra apkaimēs bija nozīmīga, bet telpiski koncentrēta; tikai Skanstē un Pētersalā–Andrejsalā iedzīvotāju īpatsvars jaunos mājokļos pārsniedza pilsētas vidējo rādītāju, turklāt šajās apkaimēs vienlaikus bija zemākais īres mājokļu īpatsvars. Tādēļ būtiski ņemt vērā, ka nekustamā īpašuma attīstība var veicināt telpisko nošķiršanos pēc etniskās piederības un sociālekonomiskā stāvokļa (van Gent & Hochstenbach, 2020), selektīvi piesaistot noteiktas sociālās grupas.

5. tabula. **Īres mājokļu un iedzīvotāju jaunās ēkās īpatsvars Rīgas centra apkaimēs 2021. gadā un rādītāju relatīvās izmaiņas 2011.–2021. gadā, % (iekavās).**

	Avoti	Brasa	Centrs	Grīziņ-kalns	Pētersala-Andrej-sala	Skanste	Vecpilsēta
Īres mājokļi	48,0 (–3,2)	27,4 (–3,2)	37,8 (–2,6)	44,7 (–1,2)	20,8 (1,2)	18,3 (10,1)	33,7 (13,8)
Iedzīvotāji jaunās ēkās[1]	0,3	2,2	1,7	0,5	8,6	50,3	0,0

[1]ēkās, kas uzceltas kopš 2011. gada
Avots: autores aprēķini, izmantojot Centrālās statistikas pārvaldes datus

Lai gan jaunbūvju ģentrifikācija bija galvenokārt raksturīga Skanstei un Pētersalai–Andrejsalai, pārējās centra apkaimēs bija novērojamas citas marginālas ģentrifikācijas formas, piemēram, fasāžu ģentrifikācija, kas paaugstina riskus iedzīvotāju ar zemāku ienākumu līmeni izspiešanai (Walks et al., 2021). Kopumā šis izteikti neviendabīgais

mājokļu fonds noteica gan iespējas, gan ierobežojumus dažādām pastāvošajām sociālajām grupām un jaunienācējiem, kuru atšķirīgais sociāli demogrāfiskais profils bija svarīgs faktors dzīvesvietas izvēlē.

3.3. Sociāli telpiskās diferenciācijas iezīmes un intensitāte iekšpilsētā, izmantojot egocentrisko apkaimju metodi

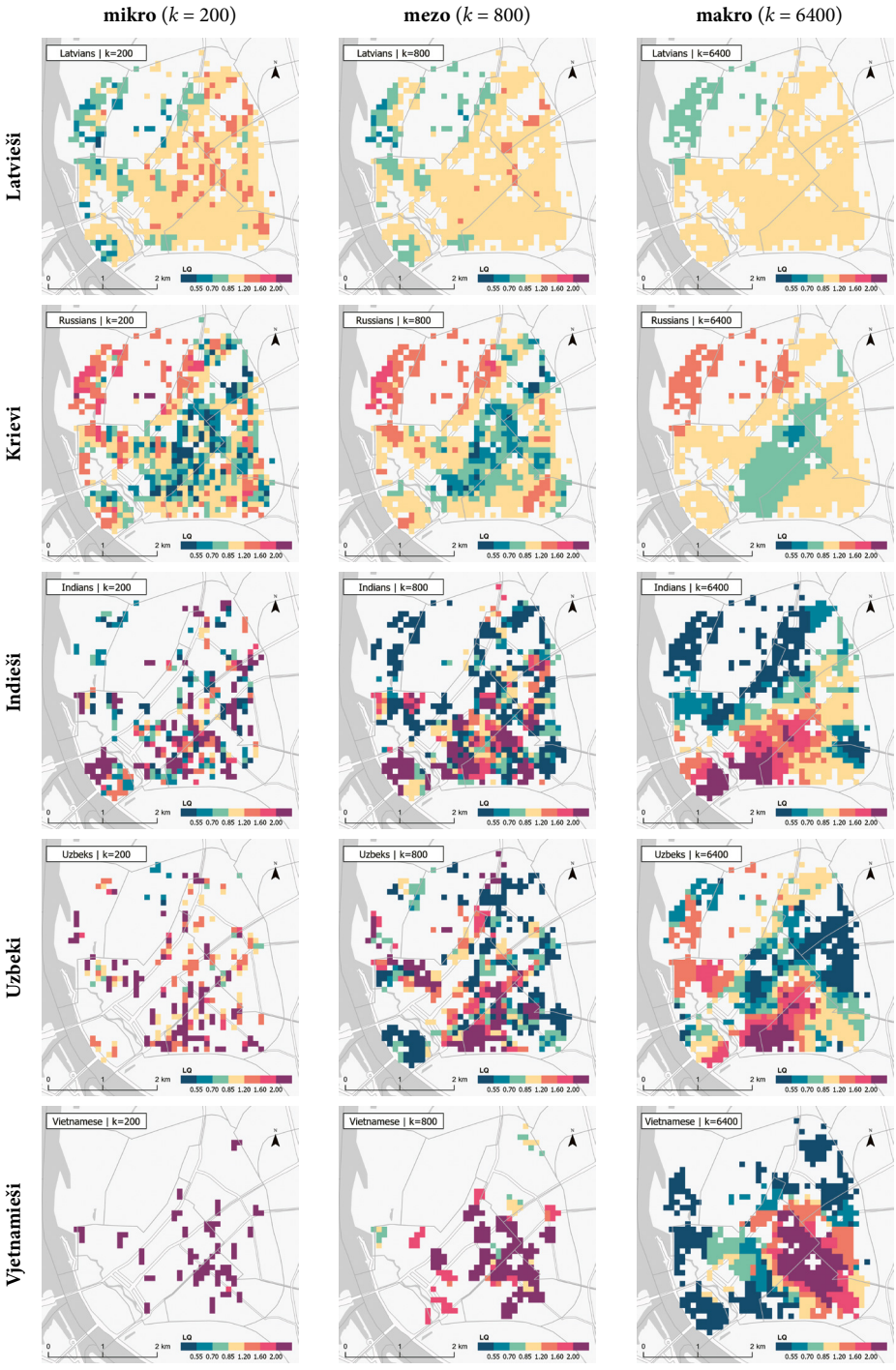
Ņemot vērā augsto jauno migrantu grupu koncentrāciju un pieaugošo sociālekonomisko polarizāciju Rīgas centra apkaimēs, ar egocentrisko apkaimju metodi tika veikta padziļināta teritorijas telpiskā analīze dažādos mērogos. Rezultāti atklāja, ka, lai gan Rīgai vēsturiski ir bijis raksturīgs zems etniskās un sociālekonomiskās telpiskās nošķiršanās līmenis, kas joprojām atspoguļojas latviešu un krievu izvietojumā un salīdzinoši noturīgajās novietojuma koeficienta (LQ) vērtībās dažādos mērogos, jauno imigrantu grupās veidojas hiperlokālas telpiskās nošķiršanās iezīmes (9. attēls).

Indiešu, uzbeku un vjetnamiešu dzīvesvietas iezīmes atspoguļoja jaunām migrantu grupām raksturīgu augstu koncentrācijas pakāpi, kā arī izteiktu jutību pret analīzes mērogu. Pētīto grupu ārkārtīgi augstās LQ vērtības mikro un mezo līmenī liecināja par intensīvu koncentrācijas punktu veidošanos, vienlaikus apliecinot metodes lietderību mazu sociālo grupu analīzē nelielā teritorijā.

Lai gan visas jaunās imigrantu grupas uzrādīja augstu koncentrācijas pakāpi, to specifiskās ģeogrāfiskās iezīmes atšķīrās, norādot uz sarežģītu dzīvesvietas izvēļu un ierobežojumu mijiedarbību. Makro līmeņa analīze atklāja visu pētīto grupu konverģences zonu pētījuma teritorijas dienviddaļā, kas funkcionē kā "pilsētas ienākšanas telpa" (*urban arrival space*) – teritorija pilsētā, kam raksturīgs augsts apdzīvotības blīvums, bieža dzīvesvietas maiņa un augsts īres mājokļu īpatsvars ar zemākām īres izmaksām (Haase et al., 2020; Hans et al., 2019), kas veicina mājokļu pieejamību un atvieglo jauno imigrantu grupu apmešanos pilsētā. Liberāls mājokļu tirgus bieži pastiprina etnisko grupu koncentrēšanos (Imeraj et al., 2018), uzsverot mājokļu tirgus kritisko lomu telpiskās nošķiršanās procesos. Tas ir sarežģīts izaicinājums politikas veidotājiem, jo ietver sistēmisku šķēršļu, piemēram, diskriminācijas, mazināšanu un var veicināt ģentrifikācijas procesus vai pastiprināt telpisko nošķiršanos (Bolt et al., 2010).

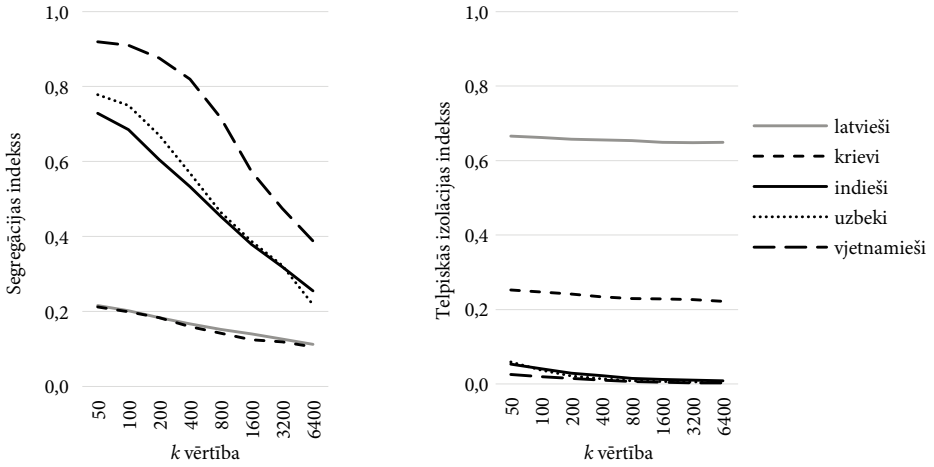
Vienlaikus mikro un mezo līmeņa analīze atklāja, ka indiešu kopiena bija izkliedētāka, uzbeki daļēji apmetušies krievu kopienu apdzīvotās teritorijās, kas liecina par pastāvošās etniskās infrastruktūras nozīmi (Křížková & Šimon, 2022), savukārt vjetnamieši bija telpiski viskoncentrētākie. Novērojamas arī sociāli telpiskas izvairīšanās iezīmes starp grupām, piemēram, zema latviešu pārstāvniecība krievu apdzīvotās vietās un zema krievu pārstāvniecība jauno grupu koncentrācijas vietās.

Jauno etnisko grupu segregācijas indekss (SI) bija ārkārtīgi augsts, īpaši mikro līmenī, 3–4 reizes pārsniedzot latviešu un krievu SI vērtības (10. attēls). Lai gan makro līmenī šo grupu SI vērtības samazinājās, tās joprojām bija ievērojami augstākas nekā pamatiedzīvotāju vidū. Turklāt atšķirīgie SI sarukuma tempi starp jaunajām grupām liecināja, ka telpiskās nošķiršanās intensitāti ietekmē dažādu faktoru kopums – ne tikai grupas lielums (Forrest & Johnston, 2001; Johnston et al., 2007), bet arī kultūras atšķirības un sociālekonomiskā neaizsargātība, kas atbilst pētnieku novērojumiem, ka līdzīga izmēra grupas var piedzīvot atšķirīgu telpisko nošķiršanos (Stonawski et al., 2022).



9. attēls. **Latviešu, krievu un jauno etnisko grupu izvietojums un koncentrācijas pakāpe Rīgas centra apkaimēs 2021. gadā mikro, mezo un makro līmenī.**

Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus



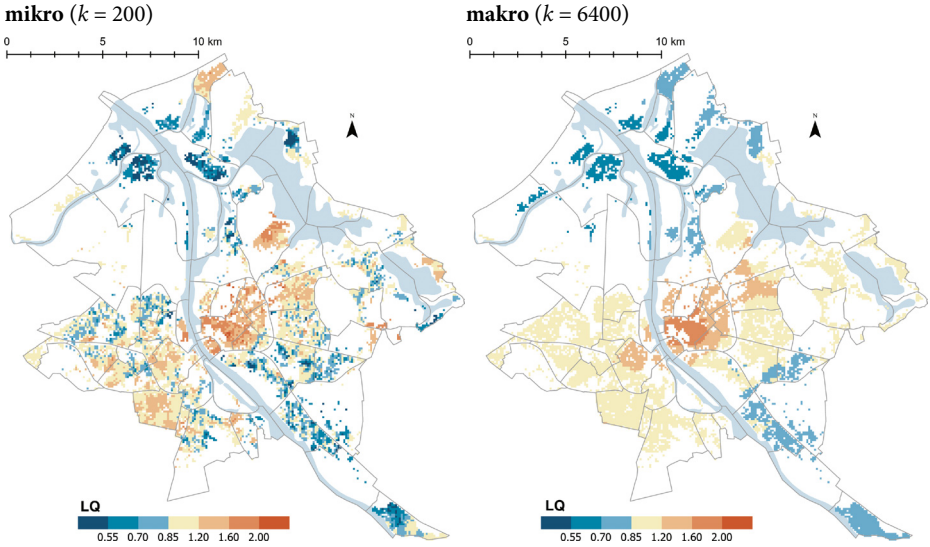
10. attēls. **Segregācijas un telpiskās izolācijas indekss Rīgas centra apkaimēs atbilstoši *k* vērtībām 2021. gadā.**

Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

Arī telpiskā izolācija (SII) jaunajām grupām bija ļoti augsta – tautiešu satikšanas varbūtība makro līmenī bija nulle, bet mikro un mezo līmenī pastāvēja neliela varbūtība (2–4 %) (10. attēls). Latviešiem un krieviem tautiešu satikšanas varbūtība bija ievērojami augstāka, attiecīgi 65–66 % un 22–25 %, kā arī kopumā novērojams, ka telpiskās izolācijas atkarība no mēroga bija daudz mazāka.

Šie rezultāti kopumā norādīja uz pilsētas ainavu, kurā jaunās kopienas veido atsevišķus, augstas koncentrācijas klasterus pilsētas centra apkaimēs. Metodoloģiski jāņem vērā, ka šie rādītāji ir jutīgi pret grupas izmēru un nelielos klasteros var radīt šķietami ļoti nevienmērīgu izvietojumu (Stonawski et al., 2022), tomēr pētījumā atklātās iezīmes izaicina telpiskās asimilācijas teorijas prognozes par pakāpenisku imigrantu izkliedi. Lai gan ir pāragri spriest par ilgtermiņa rezultātiem, pašreizējie novērojumi liecina par pieaugošu telpiskās nevienlīdzības risku. Etniskā hierarhija un ierobežota sociāli telpiskā mobilitāte ir noturīgas parādības, īpaši migrantiem no trešajām valstīm (Kadarik, 2020; Wessel et al., 2017). Lai gan etniskā telpiskā nošķiršanās ir saistīta ar sociālekonomisko stāvokli (Manley et al., 2015; Sturgis et al., 2014), un, uzlabojoties sociālekonomiskajam stāvoklim, tā var samazināties (Catney, 2016; Catney & Simpson, 2010), tomēr šis process ir lēns, aptver tikai nelielu daļu migrantu (Andersen, 2016; Vogiazides & Chihaya, 2020) un to kavē kultūras atšķirības un dzīvesvietas izvēles (Malmberg & Clark, 2021; Murayama & Nagayasu, 2021; Šimon et al., 2022). Tādējādi šie rezultāti atspoguļo ne tikai brīvprātīgu telpisku nošķiršanos, bet arī potenciālus strukturālus šķēršļus, kas var apgrūtināt šo iedzīvotāju grupu dabisku izkliedi.

Paplašinot egocentrisko apkaimju metodes pielietojumu, veikta arī radošajās industrijās nodarbināto – t. i., radošajās, zināšanu, kultūras un brīvā laika profesijās strādājošo – izvietojuma un koncentrācijas pakāpes analīze (11. attēls). Makro līmenī novērota izteikta šīs grupas koncentrācija Rīgas centra apkaimēs, turpretim mikro līmenī novērojams, ka grupai bija zemāka koncentrācija Avotu austrumdaļā un Pētersalā–Andrejsalā. Vienlaikus ārpus centra apkaimēm mikro līmeņa analīze atklāja daudz nevienmērīgāku grupas izvietojumu, kam raksturīgas lokalizētas zemas koncentrācijas pakāpes.



11. attēls. **Iedzīvotāju izvietojums un koncentrācijas pakāpe pēc profesijas (radošajās industrijās nodarbinātie) Rīgā 2021. gadā mikro un makro līmenī.**

Avots: autores veidots, izmantojot Centrālās statistikas pārvaldes datus

Šai iedzīvotāju grupai, kas veido 17 % no Rīgas nodarbinātajiem, raksturīgs augsts augstskolu absolventu īpatsvars, bieža nodarbinātība augsta statusa profesijās un iesaiste ģentrifikācijas procesos. Radošajās industrijās nodarbinātajiem dzīvesvietas un dzīvesveida izvēles, kā arī pakalpojumu izmantošanas paradumi atšķiras no citās industrijās strādājošajiem (Musterd & Murie, 2011), kas var pastiprināt sociāli telpisko nevienlīdzību.

SECINĀJUMI

Promocijas darba ietvaros izvērtētas sociāli telpiskās diferenciācijas iezīmes Rīgas centra apkaimēs, un iegūtie rezultāti ļauj izdarīt šādus secinājumus:

1. Rīgas centra apkaimēs sociāli telpiskā diferenciācija izriet no globālo, reģionālo un lokālo procesu mijiedarbības, kurā īpaši nozīmīgi ir šādi procesi:
   1.1. demogrāfiskā polarizācija, kas atspoguļo ģeogrāfiski nevienmērīgu iedzīvotāju skaita samazināšanos un novecošanos valstī, Rīgas metropoles areālam – īpaši iekšpilsētai un piepilsētai – saglabājot relatīvi augstāku demogrāfisko noturību;
   1.2. selektīva suburbanizācija Rīgas reģionā, kuras ietvaros turīgas ģimenes ar bērniem pārceļas uz piepilsētu, tādējādi mainot gan pilsētas centra, gan perifērijas sociālo sastāvu;
   1.3. fragmentēta ģentrifikācija centra apkaimēs, kas izpaužas kā selektīva turīgāku iedzīvotāju ienākšana un atsevišķu apkaimju daļu revitalizācija, vienlaikus palielinot iedzīvotāju ar zemākiem ienākumiem izspiešanas risku;
   1.4. imigrācija, kas pārvērš centra apkaimes par galveno jaunu un daudzveidīgu starpvalstu migrācijas plūsmu galamērķi, veidojot jaunas etniskās un sociālās diferenciācijas iezīmes.
2. Apkopojot un salīdzinot empīriskos pētījumus, konstatēta iedzīvotāju sastāva maiņa un sociāli telpiskās diferenciācijas palielināšanās iekšpilsētās, ko ietekmē pieaugošā etniskā daudzveidība un sociālekonomiskā polarizācija. Centrālās un Austrumeiropas pilsētu, tostarp Rīgas, iekšpilsētas piedzīvo ģentrifikāciju, tomēr šie procesi bieži ir fragmentēti un pastiprina sociālo nevienlīdzību un telpisko nošķiršanos.
3. Telpiskās nošķiršanās pētniecību apgrūtina modificējamas apvidus vienības problēma un tās no mēroga atkarīgais raksturs. Mērogjutīgu ģeotelpiskās analīzes metožu izmantošana ļauj samazināt šos ierobežojumus un atklāt jaunas, niansētas sociāli telpiskās diferenciācijas iezīmes un intensitāti dažādos mērogos – mikro, mezo un makro līmenī, tādējādi nodrošinot daudzslāņainu skatījumu uz pilsētu apkaimju iedzīvotāju izvietojumu un koncentrācijas pakāpi.
4. Sociālekonomiskā polarizācija un etniska telpiskā nošķiršanās novērota gan starp centra apkaimēm un pārējo pilsētu, gan centra apkaimju starpā, attālinoties no postsociālisma pilsētām raksturīgās zemās sociālekonomiskās un etniskās telpiskās nošķiršanās. Lai gan kopumā Rīgas centra apkaimēm bija raksturīgs stabils iedzīvotāju skaits, to attīstība bija neviendabīga, veidojoties sociāli un telpiski polarizētai ainavai, kurā vienlaikus pastāv fragmentēta ģentrifikācija un augsta netradicionālo imigrantu grupu koncentrācijas pakāpe.
5. Izmantojot egocentrisko apkaimju metodi, pierādīts, ka jauno imigrantu grupu (indiešu, uzbeku un vjetnamiešu) telpiskā nošķiršanās Rīgas centra apkaimēs ir izteikti mērogjutīga – tā ir ļoti augsta mikro līmenī (hiperlokāli), bet samazinās plašākā mērogā. Šī pieeja pierādīja savu efektivitāti, atklājot niansētas un iepriekš neidentificētas iedzīvotāju izvietojuma iezīmes, tostarp "pilsētas ienākšanas telpu" un etniskās infrastruktūras nozīmi, kas tradicionālajās, uz administratīvajām robežām balstītajās metodēs bieži tiek apslēptas.

Priekšlikumi turpmākajiem pētījumiem

1. Ņemot vērā jauno imigrantu grupu augsto koncentrācijas pakāpi, padziļināta kvalitatīva analīze par "pilsētas ienākšanas telpu" palīdzētu skaidrot jauno imigrantu grupu pieredzi dzīvesvietas izvēlē, kā arī pakalpojumu un nodarbinātības pieejamības nozīmi.
2. Lai gan pašreizējā individuālā līmeņa datu pieejamība ierobežo longitudinālas izpētes veikšanu, šāda izpēte nākotnē varētu sniegt būtisku ieguldījumu telpiskās nošķiršanās līmeņu izmaiņu novērošanā un ar to saistīto telpiskās asimilācijas iezīmju izpētē.
3. Ņemot vērā ģentrifikācijas ciešo saikni ar iedzīvotāju izspiešanu, būtiski veikt padziļinātu analīzi par fragmentētās ģentrifikācijas ietekmi uz mazāk aizsargātām grupām, piemēram, senioriem, tostarp attiecībā uz piekļuvi mājokļiem, pakalpojumiem un sociālo labklājību.
4. Ņemot vērā mērogjutīgu ģeotelpiskās analīzes metožu efektivitāti, ieteicams paplašināt to pielietojumu, analizējot citu sociālo grupu izvietojuma un koncentrācijas raksturlielumus.

UNIVERSITY OF
LATVIA

FACULTY OF SCIENCE
AND TECHNOLOGY
DEPARTMENT OF GEOGRAPHY

Sindija Balode-Kraujiņa

SOCIO-SPATIAL DIFFERENTIATION IN THE INNER CITY OF RIGA

DOCTORAL THESIS – THE SERIES OF ARTICLES

Submitted for the degree of Doctor of Science (Ph.D.)
Field of Social and Economic Geography
Subfield of Human Geography

Riga 2026

The doctoral thesis was completed between 2021 and 2025 at the Department of Geography, Faculty of Science and Technology, University of Latvia.

This research was supported by:
- the Recovery and Resilience Facility project "Internal and External Consolidation of the University of Latvia" (No. 5.2.1.1.i.0/2/24/I/CFLA/007);
- the EU ESF project "Strengthening of the Capacity of Doctoral Studies at the University of Latvia within the Framework of the New Doctoral Model" (No. 8.2.2.0/20/I/006);
- the SRP project "New Solutions for the Study of Demographic and Migration Processes for the Development of a Latvian and European Knowledge Society" (No. VPP-LETONIKA-2021/4-0002).

Scientific Supervisor

Prof. **Zaiga Krišjāne**, Ph.D.

Academic Advisor

Prof. **Māris Bērziņš**, Ph.D.

Reviewers

Prof. **Martin Ouředníček**, RNDr., Charles University, Czech Republic
Assoc. Prof. **Ženija Krūzmētra**, Ph.D., Latvia University of Life Sciences and Technologies, Latvia
Prof. **Māris Kļaviņš**, Dr. habil., University of Latvia, Latvia

Doctoral Committee

Prof. Agrita Briede, Ph.D., Chair of the Committee
Prof. Oļģerts Nikodemus, Ph.D., Deputy Chair
Prof. Zaiga Krišjāne, Ph.D.
Prof. Māris Bērziņš, Ph.D.
Assoc. Prof. Elīna Apsīte-Beriņa, Ph.D.
Doc. Jānis Brizga, Ph.D.
Prof. Māris Kļaviņš, Dr. habil.

The doctoral thesis will be defended on January 21, 2026, at 12:00, at the public session of the Doctoral Committee at the Faculty of Science and Technology, University of Latvia, located at 1 Jelgavas Street, House of Nature, Riga, Room 702.

The doctoral thesis and its summary are available at the Library of the University of Latvia, 1 Jelgavas Street, Riga.

ISBN 978-9934-36-491-4
ISBN 978-9934-36-492-1 (PDF)

ABSTRACT

Cities worldwide are experiencing demographic shifts and increasing socio-spatial differentiation, which exacerbate social inequality and threaten prospects for sustainable development. This phenomenon is especially complex in post-socialist urban areas, where development is shaped by the legacy of centrally planned economies, a systemic and rapid transition to a market economy, and integration into the European Union. The aim of this doctoral thesis is to assess the patterns of socio-spatial differentiation in Riga's inner city. Using advanced geospatial analysis and data from the 2021 census, the findings reveal that Riga's inner city develops unevenly, creating a socially and spatially polarized landscape. Within this landscape, fragmented gentrification coexists with "urban arrival space" for new immigrants, who exhibit high levels of segregation, the intensity of which varies depending on the scale of analysis. Several interacting processes influence this socio-spatial differentiation, including demographic polarization at the national level, selective suburbanization, and the concentration of new migration flows in the inner city.

Keywords: socio-spatial differentiation, inner city, immigration, multiscale analysis

TABLE OF CONTENTS

INTRODUCTION

A key factor in urban development is changes in population composition and size (Fihel & Okólski, 2019; Kulcsár & Brown, 2017). As migration intensifies, urban populations become more diverse, drawing academic attention to the processes that create and sustain socio-spatial inequality (King & Okólski, 2019). Although a socially inclusive environment is the foundation of sustainable cities and resilient local communities (United Nations, n.d.), cities are facing rising socio-spatial differentiation, which fundamentally shapes them and manifests as socio-spatial inequality. In this context, urban space is not just a passive background: it actively influences social relations, economic systems, and political dynamics, which in turn impact the space itself (Diener & Hagen, 2019). Furthermore, increasing inequality and shifts in social geography are not local phenomena but part of broader global trends characterized by the "Global Segregation Thesis", which synthesizes evidence of rising socioeconomic segregation worldwide (van Ham et al., 2021). Cities are simultaneously centers of economic growth and spaces where the greatest diversity of social groups – and the greatest inequalities – converge (Tammaru et al., 2015). Therefore, examining local phenomena within a broader regional and global context helps identify similarities and differences in socio-spatial differentiation and enhances understanding of the complex dynamics shaping today's cities.

The heterogeneity of European cities arises from interactions among economic, social, and physical dimensions, along with demographic changes and migration processes (Musterd et al., 2017). Declining natural growth rates and migration have become major influences on population size and composition across Europe, with immigration levels reaching record highs and exhibiting increased diversity in countries of origin and motivations for migration (Amran et al., 2019; Van Mol & de Valk, 2016). Additionally, European urban centers typically experience a high concentration of immigrant populations in their central districts (Martori & Apparicio, 2011; Salvati, 2017; Stillwell & Phillips, 2006), demonstrating the rising ethnic diversity within inner-city neighborhoods.

Socio-spatial processes are closely connected to stages of urban development, especially suburbanization and reurbanization, which often happen simultaneously, creating a complex interaction between urban decentralization and recentralization (Dembski et al., 2021). Suburbanization is the second stage of the urban development model, following urbanization, and is a relatively old and well-studied process in Europe. It also plays a significant role as a prerequisite for reurbanization and gentrification (Zukin, 1987). As population stability and growth are increasingly observed in European inner cities (Buzar et al., 2007; Salvati et al., 2019), the importance of studying reurbanization processes is growing. Furthermore, analyzing population size alone is insufficient; understanding the characteristics of the groups involved is equally important, as it helps uncover subtler shifts, such as new social groups in the inner city (Rérat, 2019).

The processes of socio-spatial differentiation in Europe are not uniform. Influenced by historical, economic, and political factors, they vary not only across countries but also between cities and their neighborhoods, with cities in Central and Eastern Europe

(CEE) providing a unique context. Their development reflects the legacy of centrally planned economies, a rapid systemic transition to a market economy, and integration into the European Union (Křížková & Šimon, 2022), creating social-spatial differentiation patterns that differ from those of Western European cities. Historically, CEE cities have been characterized by lower levels of socioeconomic and ethnic segregation (Hess et al., 2018; Krišjāne et al., 2015) and by a degree of spatial equality that persisted even after systemic transformations (Marcińczak et al., 2015). However, today, in addition to growing socioeconomic polarization, CEE cities are also impacted by processes such as urban shrinkage and population aging (Haase et al., 2016), as well as new selective and marginal forms of gentrification linked to specific characteristics of the housing market and population composition (Kubeš & Kovács, 2020), contributing to uneven inner-city development.

Riga, the capital of Latvia, exemplifies the interplay of these complex processes. The city's spatial configuration comprises a historic inner city, surrounded by large housing estates centrally planned during the Soviet occupation, beyond which lies the outer city that developed only after independence, reflecting the delayed suburbanization typical of CEE cities. During the Soviet occupation, Riga experienced large-scale immigration from other parts of the USSR, which significantly changed its demographic composition. Following Latvia's restoration of independence, it had the highest proportion of ethnic minorities among the Baltic States, accounting for nearly half of the population. Ethnic minorities continue to be unevenly distributed, predominantly concentrated in the largest urban centers, particularly Riga. Furthermore, the city has encountered challenges associated with population decline and aging, driven by negative natural growth and net migration. Concurrently, new migration patterns have emerged, driven by globalization, geopolitical developments, and European Union membership, transforming Latvia's migration landscape. This includes a substantial increase in immigration from third countries such as India, Uzbekistan, and Vietnam, with immigrants largely concentrated in Riga.

While the interplay of these processes, together with spatial heterogeneity, has allowed certain urban neighborhoods to experience demographic, social, and economic breakthroughs, others have faced decline (Sechi et al., 2022). This study focuses on Riga's inner-city core: an area that includes Centrs, Avoti, Grīziņkalns, Brasa, Skanste, Pētersala-Andrejsala, and Old Town. After a prolonged period of population decline, this area has been experiencing changes such as stabilization of population size, a widening socioeconomic gap relative to the rest of the city, high residential mobility (Krišjāne & Bērziņš, 2014), and the highest concentration of newly arrived ethnic groups. Because traditional spatial analysis methods are subject to the modifiable areal unit problem (MAUP) (Openshaw, 1996), particularly in terms of scale, where finer-grained analyses can reveal patterns not visible at broader scales (Ouředníček & Pospíšilová, 2016), it is essential to employ geospatial analysis methods that are robust to such limitations. Scale-sensitive methods provide detailed insights into the spatial distribution of various social groups, including smaller and less visible populations, thereby enhancing understanding of socio-spatial differentiation in cities.

Aim of the Thesis

The aim of the doctoral thesis is to assess the patterns of socio-spatial differentiation in Riga's inner city.

Research Questions

1. What global, regional, and local processes drive urban change in the inner city?
2. How does urban change impact socio-spatial differentiation within the inner city?
3. How do geospatial analysis methods assist in revealing new patterns and levels of socio-spatial differentiation in urban neighborhoods?

Hypothesis

Socio-spatial differentiation in Riga's inner city is shaped by the interplay of global, regional, and local processes, with new immigrant groups playing a significant role.

Tasks of the Thesis

The following tasks have been outlined to achieve the aim of the doctoral thesis:

1. Examine the global, regional, and local processes that drive urban change in the inner city and their interactions.
2. Review empirical studies on demographic shifts and socio-spatial differentiation in the inner city.
3. Review theoretical approaches to the modifiable areal unit problem and develop a scale-sensitive methodology.
4. Analyze urban transformations at the neighborhood level in Riga, as well as within the broader contexts of the Riga metropolitan area and Latvian regions.
5. Conduct a multiscale analysis of Riga's inner-city population by ethnicity and employment in the creative industries, using scalable individualized neighborhoods to identify patterns of socio-spatial differentiation.

Scientific Novelty

1. The impact of the city's historical development, morphological structure, and urban geography processes (e.g., gentrification, suburbanization) on inner-city social polarization has been evaluated, distinguishing among different neighborhood development paths.
2. New patterns of socio-spatial differentiation in Riga's inner city have been identified, revealing previously unexamined distribution and concentration patterns of emerging ethnic groups.
3. The EquiPop Flow spatial analysis tool has been applied and adapted to Latvian urban research, helping overcome the limitations of traditional methods and providing a precise view of socio-spatial processes across various levels, regardless of administrative and/or statistical boundaries.
4. The broader application of EquiPop Flow in the spatial analysis of other population characteristics has been demonstrated.
5. Given the focus on urban development and sustainability research in both the EU and Latvia, the findings can guide integration policies and aid municipalities' efforts.

Theses

1. The socio-spatial differentiation in Riga's inner city is determined by the interaction of demographic polarization, selective suburbanization, fragmented gentrification, and concentrated new international migration flows.

2. A heterogeneous socio-spatial landscape is emerging in the inner city of Riga, marked by ethnic and socioeconomic hierarchies, as well as the formation of "urban arrival space".
3. Applying scale-sensitive geospatial analysis demonstrates that segregation varies according to scale and is particularly significant when examining small social groups. This approach reveals exceptionally high segregation among emerging ethnic groups at the micro-level.

Approbation of the Results

The results of the doctoral thesis have been published in six scientific publications and presented at 10 international conferences.

Scientific Publications Related to the Topic of the Thesis

Balode, S., & Bērziņš, M. (2025). Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods. *Frontiers in Sustainable Cities*, 7:1612980. https://doi.org/10.3389/frsc.2025.1612980

Balode, S., & Bērziņš, M. (2025). Exploring patterns of ethnic diversification and residential intermixing in the neighborhoods of Riga, Latvia. *Urban Science, 9*(7), 274. https://doi.org/10.3390/urbansci9070274

Balode, S., & Krišjāne, Z. (2024). Divergent population dynamics: the case of the inner city of Riga. *Rozwój Regionalny i Polityka Regionalna*, *68*, 69–82. https://doi.org/10.14746/rrpr.2024.68.06

Krisjane, Z., Berzins, M., Krumins, J., Apsite-Berina, E., & **Balode, S**. (2023). Uneven geographies: ageing and population dynamics in Latvia. *Regional Science Policy and Practice*, *15*(4). https://doi.org/10.1111/rsp3.12648

Other Scientific Publications

Balode, S., & Berzins, M. (2024). Beyond the traditional dichotomies in studying ethnic residential geographies in Riga. *Folia Geographica*, *21*, 48–60. https://doi.org/10.22364/fg.21.4

Balode, S. (2023). Shifting inner-city sociodemographics: the case of Riga. *Folia Geographica*, *20*(2), 64–73. https://doi.org/10.22364/fg.20.2.7

Selected Conference Presentations

1. 12th International Conference on Population Geographies, Belfast, United Kingdom, July 2, 2024. Presentation: *"A Study of Ethnic Residential Patterns in the Inner City of Riga Using Scalable Individualised Neighbourhoods."*
2. European Population Conference 2024, Edinburgh, United Kingdom, June 14, 2024. Presentation: *"Mapping the Residential Geographies of Ethnic Diversity in Inner Riga."*
3. 9th NoRSA Conference, Vilnius, Lithuania, May 3, 2024. Presentation: *"Patterns of Socioeconomic Residential Segregation: Exploring the Intersections of Occupation and Ethnicity in Riga."*
4. 10th International Urban Geographies of Post-Communist States Conference, Riga, Latvia, September 20, 2023. Presentation: *"Ethnic Diversity in the Inner-City Core of Riga."*

5. 9th EUGEO Congress, Barcelona, Spain, September 5, 2023. Presentation: *"Patterns of Socio-spatial Distribution of the Residents of Riga, Latvia."*
6. American Association of Geographers Annual Meeting, Denver, USA (virtual), March 26, 2023. Presentation: *"Shifting Demographics in the Inner City of Riga."*
7. 8th Central European Conference in Regional Science, Poznań, Poland (virtual), November 23, 2022. Presentation: *"Divergent Population Dynamics: The Case of the Inner City of Riga."*
8. 11th International Conference on Population Geographies, Tokyo, Japan (virtual), August 25, 2022. Presentation: *"Demographic Processes in the Central Neighborhoods of Riga, Latvia."*
9. 3rd International Conference on Migration and Mobilities, St. Andrews, United Kingdom, July 6, 2022. Presentation: *"Demographic Processes in the Central Neighborhoods of Riga."*
10. 9th International Urban Geographies of Post-Communist States Conference, Budapest, Hungary, June 29, 2022. Presentation: *"Who Lives in the City Center? The Case of Riga."*

Table 1. **The author's contribution to the development of the thesis.**

Impact of the processes studied	Processes studied	Title of scientific publication	Author's contribution * minor, ** moderate, *** major				
			Research design	Methodology	Data analysis, visualization	Interpretation of results	Manuscript preparation
Socio-spatial differentiation in the inner city of Riga	Distribution and concentration of emerging ethnic groups in the inner city of Riga using scalable individualized neighborhoods	Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods	**	***	***	***	***
	Distribution and concentration dynamics of aggregate ethnic groups in Riga	Exploring patterns of ethnic diversification and residential intermixing in the neighborhoods of Riga, Latvia	**	**	***	***	***
	Population dynamics in the inner city and suburbs of Riga according to the city development model	Divergent population dynamics: The case of the inner city of Riga	***	***	***	***	***
	Population changes and ageing processes in Latvia	Uneven geographies: ageing and population dynamics in Latvia	*	*	*	**	***

Structure of the Thesis Summary

The thesis summary provides an overview of the global, regional, and local processes that shape socio-spatial differentiation in the inner city along with the related methodological challenges; it includes a description of the study area – the inner city of Riga – as well as the data and methods employed; presents the main results and discussion based on the author's scientific publications; and, offers the conclusions and suggestions for future research.

1. RESEARCH QUESTIONS

Socio-spatial differentiation is a fundamental concept in urban research. It describes how social groups are spatially separated, influenced by various social, economic, cultural, political, and institutional factors at different levels (Orum, 2019). The most common form of socio-spatial differentiation is residential segregation, which divides social groups based on characteristics such as ethnicity, socioeconomic status, or age (Andersson et al., 2018), leading to unequal access to resources, services, and opportunities and thereby reinforcing existing social inequalities (Massey & Denton, 1988). Thus, residential mobility is not only a response to structural socioeconomic forces but also acts as a driver of urban change, manifesting differently across various contexts. Socio-spatial differentiation is driven by multiple interrelated processes operating at global, regional, and local scales, including globalization, migration, and socioeconomic change. These processes tend to interact and manifest most prominently in inner cities, resulting in new forms of socio-spatial differentiation.

Question 1. **What global, regional, and local processes drive urban change in the inner city?**

Socio-spatial transformations within urban areas are intricately linked to globalization, which has precipitated extensive economic, political, and cultural processes that continuously reshape urban environments. The ensuing economic restructuring, characterized by deindustrialization and the proliferation of finance, technology, and service sectors, contributes to the formation of new elite social groups while marginalizing other populations (Tammaru et al., 2020). Thus, globalization operates as a structural mechanism that, in conjunction with welfare policies, housing systems, and employment structure, influences patterns of segregation (Tammaru et al., 2015). Furthermore, it induces new migration flows, which, alongside historical migration patterns, redefine Europe's ethnic composition (King & Okólski, 2019). Given the established link between immigration rates and the degree of ethnic segregation (Skifter Andersen et al., 2016), the risk of socio-spatial inequality is escalating (Amran et al., 2019; Dembski et al., 2021), particularly affecting urban centers with the highest migrant concentrations (Benassi et al., 2020). As Catney et al. (2023) emphasize, understanding changes in the geography of inequality in European cities requires integrating research on ethnic diversity, residential segregation, and internal migration.

European cities are experiencing an aging population and, less frequently, urban shrinkage driven by demographic transition, low birthrates, changes in household structures, and the emigration of young people (Botev, 2012; Kashnitsky et al., 2021; Kazimierczak & Szafrańska, 2019; Wolff & Wiechmann, 2018). These factors lead to increased segregation between younger and older residents (Sabater et al., 2017). The trajectory of urban development is conceptualized by van den Berg et al. (1982), who divide it into four successive stages: urbanization, suburbanization, deurbanization, and reurbanization. During the first two stages, the functional urban area experiences population growth, whereas in the last two, it undergoes a decline. Suburbanization

involves a population decrease in the city center and growth in the suburbs, while reurbanization shows the opposite trend. Studies across Europe indicate that reurbanization can occur simultaneously with suburbanization (Kabisch & Haase, 2011). In shrinking cities with no significant population growth in the city center, signs of reurbanization can be seen in shifts in population composition and the housing market (Haase et al., 2008).

Gentrification is a form of reurbanization that Ruth Glass described in 1964 as a process that transforms neighborhoods traditionally inhabited by workers, displacing them in favor of the middle class (Smith, 2012). Today, gentrification is understood more broadly to include the effects of cross-border capital flows and the commercialization of urban spaces, making it a global urban development strategy (Smith, 2002). The globally growing prominence of gentrification is reflected in the concept of "planetary gentrification" (Lees et al., 2022), which emphasizes its expanding influence worldwide. Changes in consumption habits and the increased attractiveness of inner cities as residential areas are driving gentrification (Zukin, 1987). This trend involves the rise of non-traditional households, which affect housing demand and endanger local communities due to differing values and increasing socio-spatial inequalities (Fabula et al., 2017). Research increasingly links immigration and gentrification (Hwang, 2015). An influx of immigrants can boost demand for housing and services, leading to rising prices, followed by the arrival of wealthier residents. As a result, new ethnic groups can become both agents and victims of urban change (Haase et al., 2020; Huse, 2018; Malmberg & Clark, 2021).

The processes of socio-spatial differentiation in Europe rely on the historical, institutional, and political context (Arbaci, 2007). As a result, prevailing theories grounded in Western experience may not always fully explain similar processes in post-socialist urban environments. During the socialist era, centralized planning, industrialization, and state-controlled mass construction led to the development of compact urban structures with relatively low levels of socio-spatial segregation (Marcińczak et al., 2015). Conversely, the widespread privatization of housing, housing market liberalization, influx of private investment (Sechi et al., 2022), and decline of the welfare state characteristic of the post-socialist period contributed to rising income inequality (Musterd et al., 2017). However, changes in the socio-spatial structure of cities have proceeded more slowly (Marcińczak, 2015). In the 21st century, the region is marked by demographic transition and geographically uneven population decline. Due to parallel processes of reurbanization and suburbanization (Haase et al., 2010; Horňáková & Sýkora, 2021), population growth is more common in metropolitan regions (Borén & Gentile, 2007; Ouředníček et al., 2015). Meanwhile, aging trends vary: some cities experience increases in aging rates (Vaishar et al., 2020), while others encounter decreases (Kurek et al., 2021). New migration patterns significantly influence aging dynamics **(**Křížková & Šimon, 2022). Although migration policies in the region are shaped by the European Union directives, given their migration histories, diverse historical contexts, global positioning, and structural socioeconomic factors, it is unlikely that CEE countries will mirror Western Europe's experience (Arango, 2012). These trends raise concerns about a possible increase in ethnic segregation in urban neighborhoods and emphasize the need to reassess this issue beyond the traditionally dominant ethnic groups.

The development of Riga, Latvia's capital and primary economic center, has been shaped by the historical periods described above. During the Soviet period, the city experienced large-scale industrialization and immigration, which altered its demographic composition; however, this did not result in a pronounced ethnic or social hierarchy, as immigrants possessed similar socioeconomic status (Bolt et al., 2010). Following the restoration of independence, Riga's population decreased considerably, and the transition to a market economy, privatization of housing, and an underdeveloped social housing sector (Krišjāne et al., 2019) contributed to the emergence of new types of socio-spatial disparities driven by income and market forces (Zhitin et al., 2020).

Question 2. **How does urban change affect socio-spatial differentiation within the inner city?**

Owing to the interaction of global, regional, and local dynamics, urban areas are undergoing socio-spatial transformations that are intrinsically linked to changes in population size, composition, and spatial distribution. These transformations are often particularly significant within inner-city areas (Kährik et al., 2015; Kovács, 2009). This trend is typical of most European capitals (Musterd et al., 2017), including those within the CEE region (Lichter et al., 2020; Marcińczak et al., 2015), and is associated with the fact that various socioeconomic groups display distinct patterns of residential mobility (Tammaru et al., 2020). While suburbanization in CEE cities remains stronger than reurbanization (Hesse & Siedentop, 2018), inner-city areas have seen revitalization, population growth or stabilization, and shifts in composition such as the arrival of immigrants and young, highly educated professionals (Haase et al., 2010; Horňáková & Sýkora, 2021; Kubeš & Kovács, 2020; Špačková et al., 2016), alongside gentrification and the resulting displacement of residents (Pastak & Kährik, 2021).

Gentrification in CEE inner cities occurs in fragmented, façade, and marginal forms (Kubeš & Kovács, 2020), influenced by the region-specific contexts such as the distinctive features of the rental market and the relatively low presence of middle-class, ethnic minorities, and creative communities. These fragmented urban changes can intensify social divisions (Malheiros et al., 2013), further reinforcing spatial inequalities.

Social-spatial transformations have also been observed within the inner cities of the Baltic States' capitals. For instance, in Tallinn's city center, inhabitants have experienced improved socioeconomic status and a decline in average age (Temelová et al., 2016), while in Vilnius, analogous trends have been documented in city center areas that previously exhibited lower socioeconomic indicators (Valatka et al., 2017). Consequently, these processes may lead to the emergence of localized concentrations of specific social groups (Tammaru et al., 2020). In Riga, earlier research predominantly concentrated on the metropolitan region due to extensive suburban expansion (Skadiņš, 2018), which, in conjunction with an unfavorable social environment in certain inner-city neighborhoods, has impeded reurbanization efforts (Šolks, 2010). Nonetheless, the socio-spatial disparities within Riga's inner city have increased markedly, characterized by clustering of residents of high socioeconomic status and elevated residential mobility (Krišjāne & Bērziņš, 2014). Furthermore, the relative attractiveness

of the inner city has grown due to its pre-war architecture, public space, safety, and cultural and entertainment amenities, which especially draw younger residents for whom socioeconomic factors are less decisive (Krūmiņš et al., 2018). Concurrently, inner-city residents have expressed discontent regarding housing quality and costs (Treija et al., 2020), and proximity to the city center has been associated with diminished neighborhood satisfaction (Šolks, 2013). These phenomena can be attributed not solely to shifting attitudes but also to internal socio-spatial heterogeneity within neighborhoods (Ušča, 2010), as evidenced by social stratification in the inner-city districts on the left bank of the Daugava River (Bauls et al., 2003). The selective upgrading of housing stock, the development of new residences targeting high-income individuals, and the deterioration of pre-war buildings in the inner city (Krišjāne & Bērziņš, 2014; Sechi et al., 2022; Treija et al., 2020) collectively contribute to the formation of a space with an elevated potential for segregation.

The manifestations of ethnic segregation in European cities differ from the North American experience, which is based on racial dichotomy and discriminatory policies (Massey et al., 2009). These differences are shaped by migration history and housing policies, which interact with individual choices and structural factors (Boterman et al., 2021; Krišjāne et al., 2019). Although historically, socioeconomic status has played a more significant role than ethnicity in shaping settlement patterns in Europe (Arbaci, 2007), the increase in global migration flows is leading to greater ethnic diversity in urban areas (Catney et al., 2023; Steele & Abdelaaty, 2019). This diversification, in turn, prompts spatial transformations (Tammaru et al., 2020). The highest concentration of immigrants is often found in inner-city areas, including neighborhoods with lower socioeconomic status, which reinforces spatial isolation (Costa & de Valk, 2018) and socioeconomic polarization (Marcińczak & Bernt, 2021). As a result, changes in the ethnic composition of the population are becoming a key focus in studying inner-city socio-spatial differentiation.

Immigrants' residential choices often result from voluntary segregation, driven by socioeconomic support, cultural proximity, and the perceived safety of living with co-ethnics (Bolt, 2009; Imeraj et al., 2018; Malmberg & Clark, 2021; Stillwell & Phillips, 2006). Additionally, there is a preference for living near the native population rather than other immigrant groups (Ibraimovic & Hess, 2018), and finally, the choice of residence is influenced by structural and economic constraints such as discrimination in the housing market, financial barriers, and lack of information (Bolt et al., 2010; Johnston et al., 2007).

As a result, segregation among migrant groups varies, with migrants from third countries often exhibiting higher concentrations in European cities (Lichter et al., 2020; Malmberg et al., 2018; Stonawski et al., 2022). This clustering can lead to the development of extreme forms of segregation – ethnic enclaves. Initially, enclaves offer social capital and protection from discrimination (Catney, 2016; Harris, 2023), but over time, they can restrict immigrants' socioeconomic mobility (Hack-Polay, 2019) and influence where native residents choose to live due to prejudice, a desire for social homogeneity, or perceived neighborhood status changes (Bolt, 2009; Hårsman, 2006; Malmberg & Clark, 2021; Stonawski et al., 2022). Such shifts in population composition, in turn, impact access to employment, education, and healthcare, contribute to neighborhood stigmatization and crime risks (Malmberg et al., 2018), and may weaken social cohesion (Kaplan & Douzet, 2011). Therefore, ethnic segregation intensifies

socio-spatial inequality on multiple levels, affecting not only neighborhoods or their parts but also the city as a whole.

Question 3. **How do geospatial analysis methods assist in revealing new patterns and levels of socio-spatial differentiation in urban neighborhoods?**

The modifiable areal unit problem (MAUP) is a major challenge in the study of socio-spatial differentiation. It can cause inaccurate results in spatial analysis due to scale effects related to the size of the units used or zoning effects related to their shape (Openshaw, 1996). Reducing MAUP first helps evaluate the influence of socio-spatial processes at different scales more accurately, and second, improves the comparability of observations.

An increasing number of studies confirm that residential segregation depends not only on the urban context and the specific groups studied but also, notably, on the scale of observation (Lichter et al., 2020; Rogne et al., 2020; Sleutjes et al., 2018). On one hand, segregation is shaped by processes at various levels, i.e., global, regional, and local, as previously discussed. On the other hand, manifestations of segregation vary across different scales – at micro, meso, and macro level – with more detailed analysis revealing localized phenomena that can often be overlooked in broader-scale studies (Malmberg et al., 2018; Marcińczak et al., 2023; Nielsen & Hennerdal, 2017; Sleutjes et al., 2018), thus preventing the detection of subtle patterns in population distribution.

Traditional spatial analysis methods based on fixed administrative boundaries hinder comparative analysis and do not capture the dynamic, context-dependent nature of segregation. Employing advanced methodologies, which are now feasible due to the availability of high-resolution data and sophisticated software, is essential for developing a more comprehensive understanding of socio-spatial differentiation in urban areas at different scales. Such approaches also enable the systematic investigation of emerging and smaller social groups that were previously difficult to capture.

The scalable individualized neighborhood method is an approach that helps address MAUP and analyze data across various scales. This ensures that individuals' exposure to socio-spatial contexts at different scales accurately reflects the scale-dependent nature of the geographic setting (Petrović et al., 2018). By enabling the identification of segregation features at multiple scales from block to neighborhood and city level, the method provides a more detailed understanding than traditional approaches. Empirical evidence demonstrates that ethnic residential segregation may increase at certain scales while decreasing at others (Šimon et al., 2022). The identification of these patterns is vital not only for academic research but also for urban planning and social integration policy.

While the use of scale-sensitive methodologies presents notable advantages, it is also important to acknowledge their limitations. Studies have concluded that these methods do not encompass all potential benefits and only partially mitigate MAUP. This is attributed to the fact that such analyses, which are based on continuous grid coverage, fail to consider the physical features of the urban environment that function as barriers (Amcoff, 2025). Consequently, obstacles to physical mobility and social

interaction may result in inaccurate indices, particularly at the meso level (Östh & Türk, 2020), which must be considered depending on the area's physical characteristics.

Considering these limitations, scale-sensitive methodologies serve as an effective instrument for analyzing how residents are distributed across urban areas at different scales, as evidenced by their growing use in research on ethnic residential patterns. These methods offer a layered view of socio-spatial differentiation within the city and can serve as a valuable aid in developing urban policies and making strategic decisions.

2. DATA AND METHODS

2.1. Study Area

Structurally, Riga consists of the inner city, large housing estates, and the outer city (Figure 1), which are separated by historical development paths, including migration flows, and the built environment. These factors continue to influence the population size, composition, and distribution in these areas.

The study area includes seven inner-city neighborhoods of Riga: Old Town, Centrs, Avoti, Grīziņkalns, Brasa, Skanste, and Pētersala-Andrejsala, which are part of the Riga Historical Center and its protection zone. These neighborhoods form the inner-city core, which is a distinct geographic and social unit within the city selected on the following grounds:

1. Previous studies and census data show that this area is marked by increasing socio-spatial differentiation, both at the city level and internally, as well as by a high concentration of new immigrants.
2. The area is geographically separated by the railway loop and the Daugava River, forming a spatial enclosure that limits social interaction and makes it suitable for analysis as a discrete analytical unit.
3. The area is characterized by distinctive morphology, shaped largely by late 19th- and early 20th-century development.

This area is defined by a regular street network that also serves as the neighborhood boundaries. To the south and east, former workers' residential areas and old factories are located, while to the north, former port, industrial, and railway zones are found. The neighborhoods range in size from 94 to 373 hectares, with populations ranging from 1.9 to 30.7 thousand (as of 2021). Consequently, population density varies from 8.7 to 98.4 residents per hectare, complicating precise analysis at the neighborhood level.

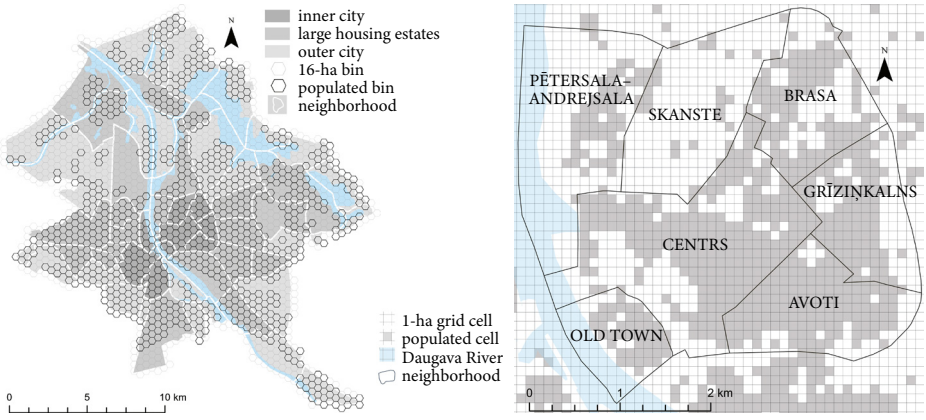


Figure 1. **Riga by morphological structure (left) and Riga's inner-city core – the study area (right).**

Source: Created by the author

Table 2. **Composition of Riga's population in 2021, crude birth and death rates, and net migration rate from 2015 to 2023.**

Area	Population composition						Crude birth and death rates[3]		Net migration rate[4]	
	Age structure (group proportion, %)			Latvians (proportion, %)	Relative income[1]	Higher education[2]	Birth	Death	International	Internal
	0–14 years	15–64 years	65+ years							
Inner-city core	17.2	66.6	16.2	64.9	121.5	50.5	11.4	10.8	10.8	4.2
Rest of the city	15.1	62.7	22.1	44.5	97.1	37.2	9.4	15.3	0.5	–2.2
Riga	15.4	63.3	21.4	47.2	100.0	38.9	9.7	14.7	1.8	–1.4

[1] Average monthly net wage compared to the average for Riga; [2] Share of residents aged 15 and over who have obtained higher education; [3] Ratio of live births and deaths to average population, per 1,000 inhabitants; due to data availability constraints, data for 2015–2023 were used; [4] The difference between the number of residents who arrived in the area for permanent residence and those who left for another permanent place of residence to average population, per 1,000 inhabitants; due to data availability constraints, data for 2015–2023 were used.

Source: Author's calculations using data from the Central Statistical Bureau.

The data on population composition and migration summarized in Table 2 reveal differences between the inner-city core neighborhoods and the rest of the city, highlighting a pronounced process of socio-spatial differentiation. The inner-city core neighborhoods, where 13.3 % of the city's population lived in 2021, stood out as the primary destination for both foreign residents and residents from other parts of Riga and regions of Latvia, with a significantly higher net international and internal migration rate.

These migration processes maintain a specific socio-demographic profile in the inner-city core neighborhoods characterized by a higher proportion of children and working-age residents and a lower proportion of elderly residents. This results in a slightly higher crude birth rate and a significantly lower crude death rate compared to the rest of the city. The study area also had a nearly 1.5 times higher proportion of Latvians and approximately 1.3 times higher average income and education levels among its residents than the rest of the city.

A more detailed analysis of the causes of population change in the inner-city core of Riga (Figure 2) reveals a gradual increase in net international migration, except in 2020, when COVID-19 pandemic restrictions affected the city. The sharp increase in 2022 exhibits the influx of Ukrainian refugees. Simultaneously, the trend in net internal migration has been negative since 2018, while the positive figures in 2015 and 2016 reflect municipal policies on property taxes and resident discount programs. The effect of natural growth during this period was small but mostly positive. Additionally, both international and internal migration intensities have gradually risen.

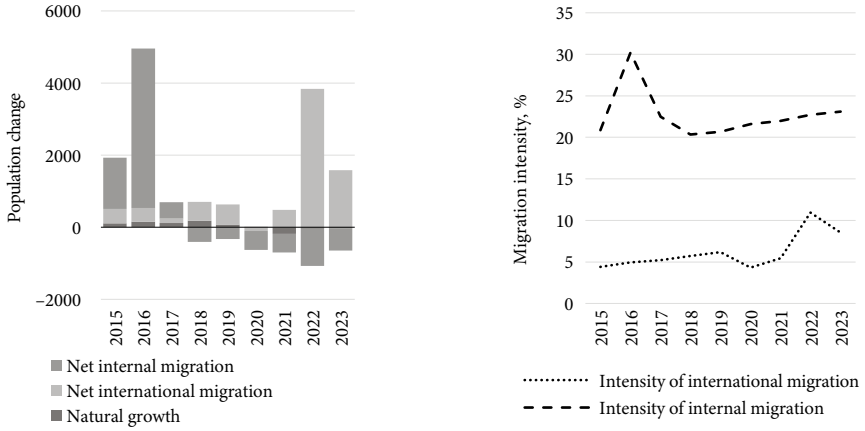


Figure 2. **Net internal and international migration, migration intensities, and natural growth in Riga's inner-city core between 2015 and 2023.**
Source: Created by the author using data from the Central Statistical Bureau

Overall, these data highlight a distinct socioeconomic divide within the city, with inner-city neighborhoods demonstrating higher socioeconomic status and being more affected by internal and, notably, international migration. This area is experiencing the fastest growth in new immigrant groups relative to other parts of the city and the country, positioning it as the key hub of social and spatial transformation. This dynamic increases the likelihood of uneven socio-spatial development.

2.2. Data

The 2021 census data from the Central Statistical Bureau (CSB) were used to analyze the socio-spatial differentiation of Riga's inner-city core. The individual, or micro-level, data were used in anonymized form and georeferenced to residential location in grid cells – either square or hexagonal – where each cell measures, respectively, 1 or 16 hectares (Figure 1). This approach ensures a consistent, spatially fixed unit coverage that avoids the methodological challenges associated with using administrative units.

Firstly, to get a broad understanding of population distribution by socioeconomic status, two occupational categories were analyzed: Category 1 (managers) and Category 9 (elementary occupations). This classification follows the International Standard Classification of Occupations (ISCO-08).

Secondly, to identify broad patterns of population distribution by ethnicity, five aggregated groups were formed: Latvians; Russians; other traditional minorities (including Belarusians, Ukrainians, Poles, Lithuanians, Estonians, Jews, Roma, Armenians, Tatars, and Moldovans); Europeans; and non-Europeans. For the analyses, a hexagonal grid covering the entire city was used.

Thirdly, to identify the nuanced spatial patterns in the distribution of emerging ethnic groups, a square-cell grid covering the inner-city core was applied. Within this framework, three of the fastest-growing ethnic groups in the area, i.e., Indians, Uzbeks, and Vietnamese, were selected, whose populations increased by 95.7 %, 89.8 %,

and 99.1 %, respectively, between 2011 and 2021 (Central Statistical Bureau of Latvia, 2025), along with Latvians and Russians.

The Classification of Nationalities recognizes 330 nationalities, primarily based on ethnic affiliation as indicated in personal identification documents or the individual's choice, aligned with the nationality of their ancestors within two generations (Central Statistical Bureau of Latvia, 2025). A key limitation of the census data is the lack of mixed ethnicity categories and the inclusion of the categories "not selected" and "unknown". In 2021, 4.4 % of Riga's population did not specify their ethnicity, excluding a significant portion of the population from further analysis.

Fourthly, to expand the methodological approach used in this study beyond the conventional analysis of population distribution by ethnicity, the spatial distribution of residents employed in the creative industries was examined. This demographic was defined according to ISCO-08 and the Statistical Classification of Economic Activities (NACE, 2nd edition). The analysis used a square-cell grid covering the entire city.

2.3. Methods

To examine the concentration, spatial isolation, and segregation of various population groups across different scales and to address the modifiable areal unit problem (MAUP) associated with fixed administrative units, the study employed the scalable individualized neighborhood method (Figure 3). This multiscale analytical approach is based on the k-nearest neighbors (k-NN) algorithm.

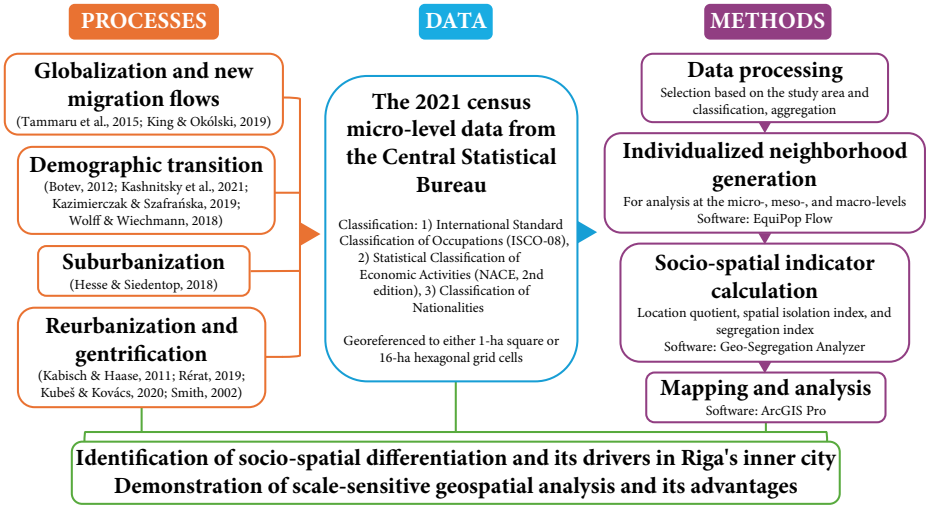


Figure 3. **Analysis of socio-spatial differentiation in the urban environment.**
Source: Created by the author

Using the scalable individualized neighborhood method, the scale was dynamically determined for each cell as an individualized neighborhood around it, based on the number of surrounding residents (*k*). The individualized neighborhood is

defined by expanding outward from a grid cell until a specified number of the nearest residents is included. Figure 4 illustrates how this method is applied when k = 50. This creates overlapping, individualized neighborhoods, effectively reducing MAUP, enabling detailed analysis across scales, and improving the comparability of results (Marcińczak et al., 2023).

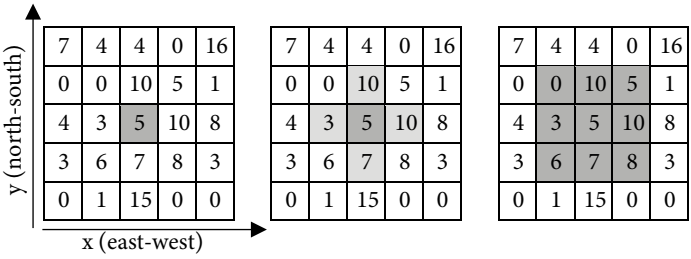


Figure 4. **Creation of an individualized neighborhood with the 50 nearest neighbors.**
Source: Sleutjes et al. (2018)

The EquiPop Flow software (Östh, 2024) was used to identify individualized neighborhoods by calculating across eight k values: 50, 100, 200, 400, 800, 1,600, 3,200, and 6,400. This range enabled the analysis of patterns from the local micro level to the broader macro level. The selected k values for Riga's inner-city core corresponded to individualized neighborhoods with an average radius of approximately 36 meters when k = 50 and 607 meters when k = 6,400, covering areas of 0.4 hectares and 115.8 hectares, respectively (Figure 5).

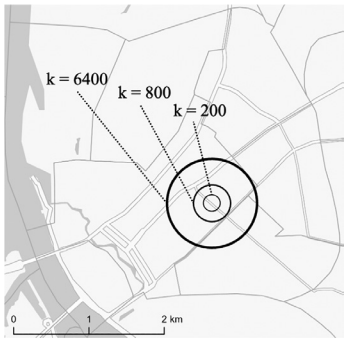


Figure 5. **Average sizes of individualized neighborhoods in the study area (micro if k = 200; meso if k = 800; and macro if k = 6,400).**
Source: Created by the author

To determine the different manifestations of population distribution, three indices were calculated for each population group and according to each k value: location quotient (LQ), spatial isolation index (SII), and segregation index (SI) according to the methodology of Tammaru et al. (2015) and van Ham et al. (2021), adapted for use with the k-NN algorithm (Imeraj et al., 2018).

The location quotient (LQ) (Apparicio et al., 2014) measures the relative concentration of a group in each individualized neighborhood compared to its overall representation in the study area.

$$LQ_{i,k} = \frac{x_{i,k}}{k} \div \frac{X}{T} \quad (1)$$

where: $x_{i,k}$ is the size of the group in neighborhood i with *k* nearest neighbors; *k* is the number of nearest neighbors; X is the total size of the group in the study area; and T is the total population in the study area. According to Brown & Chung (2006), the LQ range was defined as 0.85–1.20, with values above 1.20 indicating high group concentration and those below 0.85 indicating low group concentration.

The spatial isolation index (SII) (Apparicio et al., 2014) measures the likelihood that a group member will encounter another member of the same group within the individualized neighborhood.

$$SII_k = \frac{\sum_{i=1}\left(x_{i,k} \times \frac{x_{i,k}}{k}\right)}{\sum_{i=1}\left(x_{i,k}\right)} \quad (2)$$

In addition to the variables mentioned above, $\frac{x_{i,k}}{k}$ represents the group proportion in neighborhood i with *k* nearest neighbors. SII values range from 0, indicating a 0 % probability of meeting a member of one's own group, to 1, indicating a 100 % probability.

The segregation index (SI) (Apparicio et al., 2014) quantifies the extent to which the distribution of a specific group within individualized neighborhoods differs from that of the rest of the population.

$$SI_k = 0.5 \sum_{i=1}\left|\frac{x_{i,k}}{X} - \frac{k - x_{i,k}}{T - X}\right| \quad (3)$$

SI values range from 0, indicating complete integration with the group's distribution mirroring that of the rest of the population, to 1, indicating complete segregation.

The indices were calculated using Geo-Segregation Analyzer v.1.2. (Apparicio et al., 2014), while spatial analysis and mapping were performed using ArcGIS Pro.

3. RESULTS AND DISCUSSION

3.1. Urban Changes in the Inner City Driven by Global, Regional, and Local Processes

Latvia exhibits pronounced and increasing demographic polarization, with uneven effects across the country. From 2011 to 2021, Latvia's population decreased by 177.1 thousand people, or 8.6 %, with the most significant percentage decline exceeding 10 % outside the Riga region (Table 3). This overall decline contrasted with trends in areas surrounding Riga, i.e., in Jūrmala, Ādaži, Ķekava, Mārupe, Olaine, Ropaži, Salaspils, and Sigulda municipalities, where the population grew by 17.4 thousand, or 7.9 %, highlighting the strong impact of suburbanization. Although Riga's population also declined during this period, the decline was slightly lower than the national average, and different neighborhoods experienced varying changes. In the inner-city core of Riga, the population declined by only 1.1 %, nearly six times less than in other parts of the city, indicating relative stability.

Table 3. **Absolute and relative population change in Latvia from 2011 to 2021.**

Area	Population change, thousands	Population change, %
Latvia	–177.1	–8.6
Vidzeme statistical region	–35.4	–11.3
Kurzeme statistical region	–40.9	–12.8
Zemgale statistical region	–28.1	–11.0
Latgale statistical region	–52.5	–17.3
Riga statistical region, excluding Riga	17.4	7.9
Riga	–37.7	–5.7
Inner-city core of Riga	–0.9	–1.1
Rest of the city	–36.7	–6.4

Source: Author's calculations using data from the Central Statistical Bureau

Demographic polarization was exacerbated by population aging, driven by low birth rates and emigration, with the nation's average age reaching 43 in 2020. Outside the Riga metropolitan area, the average age was 44 years. In contrast, in the Riga metropolitan area, the population remained slightly younger, at 42, with a high concentration of children (0–14 years), especially in the suburbs. The fastest-growing group in the country, including Riga, was people over 75 years of age, but their concentration was lower in Riga and its surroundings than in the rest of the country.

The observed trends suggest that suburbanization processes have drawn young families with children to the outskirts of the capital, predominantly Latvian families with comparatively high socioeconomic standing. Although suburbanization was more pronounced than recentralization, this spatial shift directly affected Riga's inner city. Furthermore, it served as a prerequisite for emerging patterns of socio-spatial differentiation in the study area, which has also evolved into the primary destination for new international migration flows.

The study's results show the simultaneous occurrence of suburbanization and signs of reurbanization in the Riga metropolitan area and challenge the traditional view of urban development stages as a sequential process. They confirm that post-socialist urban development cycles are more complex and differ from those in Western countries (Haase et al., 2017; Hesse & Siedentop, 2018; Sýkora, 2009). Moreover, the shrinking and aging inner neighborhoods of post-socialist cities may create conditions favorable to specific processes, including the influx of new social groups (Haase et al., 2020), thereby altering the development paths of these neighborhoods. Understanding how global, regional, and local factors influence residential choice is important not just for Riga but also for other regional capitals with high residential mobility (Temelová et al., 2016; Valatka et al., 2017). This is especially important given the selective nature of these processes, which increase the risks of socio-spatial inequality.

3.2. The Impact of Urban Changes on Socio-Spatial Differentiation in the Inner City

The processes described above contributed to changes in the size and composition of Riga's inner-city population. Furthermore, neighborhood-level socio-demographic data indicate uneven development within the area (Table 4). Skanste was characterized by new-build gentrification, which has resulted in a highly selective concentration of residents – predominantly young individuals, including a significant proportion of children and adolescents – with elevated socioeconomic indicators and average monthly incomes that can be twice as high as those in other inner neighborhoods.

Table 4. **Socio-demographic indicators of residents in Riga's inner-city core in 2021, with percentage changes from 2011 to 2021 (in brackets).**

	Avoti	Brasa	Centrs	Grīziņ-kalns	Pētersala-Andrejsala	Skanste	Old Town
Population, thousands	17.9 (–3.8)	12.7 (–3.8)	30.7 (–0.2)	12.1 (–5.4)	5.1 (–1.8)	1.9 (133.5)	2.0 (3.0)
Average age, years	39 (0.0)	40 (–2.4)	38 (–2.6)	40 (–2.4)	41 (0.0)	33 (–10.8)	36 (–10.0)
0–17 proportion, %	17.4 (1.6)	19.9 (5.4)	22.6 (6.4)	17.9 (2.4)	18.6 (3.1)	30.2 (11.0)	24.8 (11.5)
18–44 proportion, %	43.1 (–0.6)	39.5 (–3.9)	40.1 (–3.5)	41.0 (0.1)	38.2 (–2.4)	42.1 (–3.7)	38.6 (–8.3)
65 proportion, %	15 (0.2)	18.4 (–0.1)	15.0 (–0.5)	17.2 (–0.8)	17.9 (0.5)	9.1 (–3.4)	12.8 (–0.3)
Higher education[1]	42.5 (9.2)	55.3 (10.7)	59.8 (9.3)	45.7 (11.6)	47.9 (13.1)	62.8 (17.7)	62.1 (12.1)
Avg. monthly net salary (EUR)	976 (105.9)	1130 (100.0)	1268 (91.5)	998 (105.3)	1210 (119.6)	2014 (147.7)	1335 (65.4)

[1] Proportion of population aged 15 and over who have attained higher education
Source: Author's calculations using data from the Central Statistical Bureau

Similar but more moderate trends can be observed in Old Town and Centrs. As the most populous neighborhood in the study area, Centrs demonstrated demographic stability and preserved a high socioeconomic status. The other neighborhoods experienced a slight population decline and had a higher average resident age. Although Avoti had the highest proportion of residents aged 18–44, a demographic group linked to gentrification, the proportion of residents with higher education and the average monthly income were lower compared to other neighborhoods. Regarding population fluctuations during this period, it is essential to acknowledge the influence of the COVID-19 pandemic, which diminished the attractiveness of inner-city neighborhoods as residential areas due to restrictions on the benefits they offer.

Compared to 2011, the average age of the population remained stable or decreased across all neighborhoods, while the proportion of children and adolescents increased. Concurrently, the proportion of elderly residents declined in all neighborhoods except Avoti and Pētersala-Andrejsala. The percentages of residents with higher education and the average monthly income increased in all neighborhoods, with the most rapid growth in Skanste and Pētersala-Andrejsala.

In accordance with the relatively high socioeconomic status of the inner neighborhoods, in general, the study area showed overrepresentation of managers and underrepresentation of workers in elementary occupations (Figure 6). At the neighborhood level, the highest concentration of managers was in Old Town, the western part of Centrs, the southern part of Pētersala-Andrejsala, and Skanste. In the rest of the study area, the concentration of managers was mostly moderate but low in the outskirts of Avoti and Grīziņkalns. The residential patterns of workers in elementary occupations showed a low concentration in areas with high concentrations of managers, indicating a degree of segregation. The highest concentration of this group was found in the northern and southern parts of the study area, including the outskirts of Avoti and Old Town.

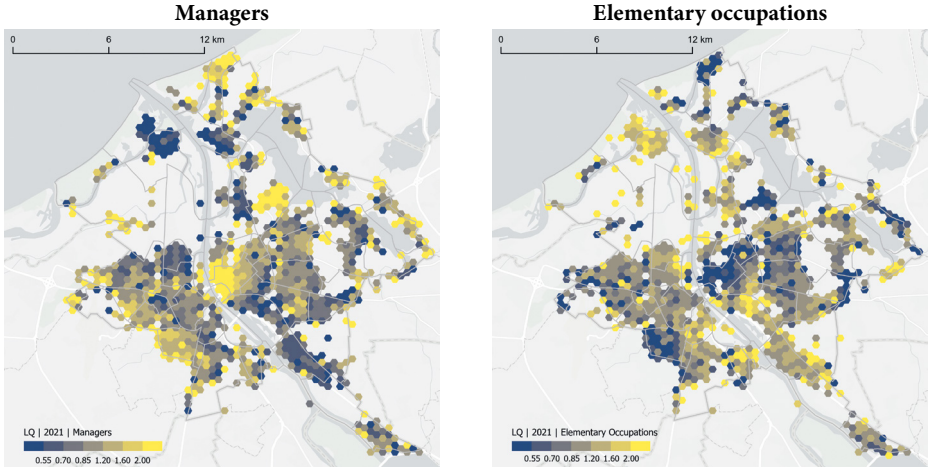


Figure 6. **Location quotient by occupation in Riga in 2021 – managers (left) and elementary occupations (right).**

Source: Created by the author using data from the Central Statistical Bureau

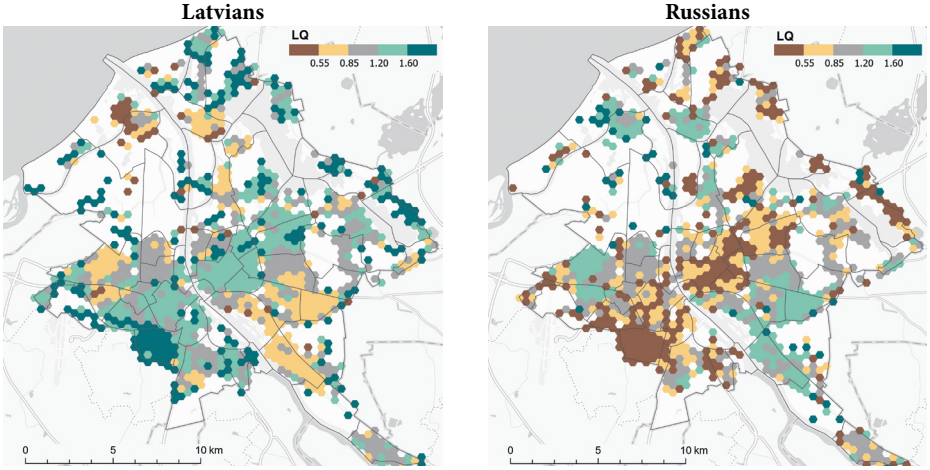


Figure 7. **Location quotient by ethnicity in Riga in 2021 – Latvians (left) and Russians (right).**

Source: Created by the author using data from the Central Statistical Bureau

From 2011 to 2021, the combined share of the five largest ethnic groups in Riga (Latvians, Russians, Belarusians, Ukrainians, Poles) declined from 96 % to 92 %. In 2021, Latvians remained highly concentrated in the inner and outer city, while Russians were mainly found in large housing estates (Figure 7). In inner-city neighborhoods, Latvians were overrepresented across most study area, except for the northern sections, i.e., Pētersala-Andrejsala and part of Skanste, where their presence was moderate. Conversely, Russians were generally underrepresented throughout the study area, except for Pētersala-Andrejsala and Skanste, where their presence was more often moderate.

European and non-European populations were predominantly and almost exclusively concentrated within the study area (Figure 8). Moderate to low representation of Europeans was observed locally in the eastern part of Avoti, as well as in Grīziņkalns and Brasa. Non-Europeans were less concentrated in Pētersala-Andrejsala and Brasa; however, only a few locations had concentrations below the moderate level. The clustering of new immigrant groups in the inner city can be linked to the lack of ethnic infrastructure (Křížková & Šimon, 2022) and the area's better access to employment opportunities and services (Sechi et al., 2022).

Accordingly, the most significant segregation was identified between Russians and both Europeans and non-Europeans. In contrast, the residential patterns of these newer immigrant groups and Latvians indicated a degree of coexistence. This city-wide analysis demonstrated that the inner-city core has become the predominant area of ethnic diversity, thereby confirming the necessity for further detailed investigation.

These ethnic groups also exhibited significant socio-demographic differences. Russians had the highest average age, while non-Europeans had the lowest one, along with a higher proportion of males and greater residential mobility. Similar patterns, though less pronounced, were observed among Europeans, consistent with the observation that neighborhoods with higher ethnic diversity often have a younger population profile, both among locals and foreign-born residents (Catney et al., 2021; Hårsman, 2006).

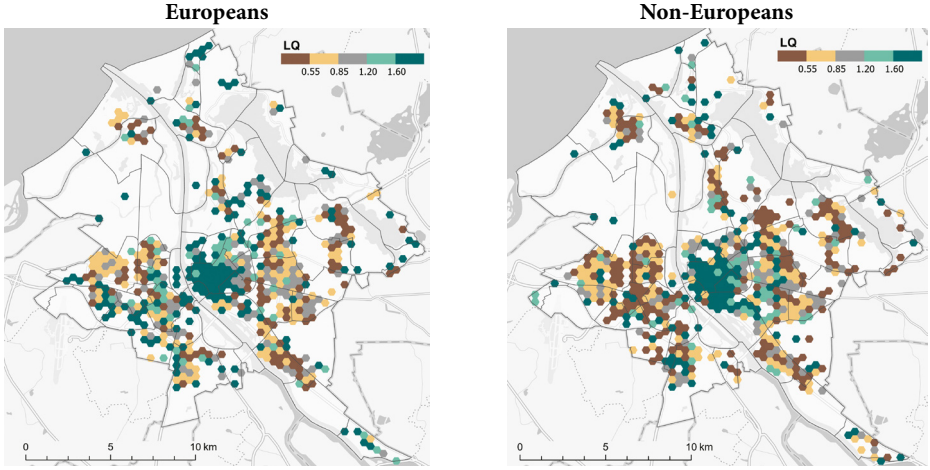


Figure 8. **Location quotient by ethnicity in Riga in 2021 – Europeans (left) and non-Europeans (right).**

Source: Created by the author using data from the Central Statistical Bureau

Overall, Europeans and Latvians had the highest proportions of university graduates and those employed in high-status jobs, whereas Russians demonstrated lower proportions. Non-Europeans, on the other hand, were characterized by a high proportion of university graduates but limited representation in high-status careers, as well as the highest employment rates in low-status jobs. In the context of international migration, this reflects socioeconomic polarization: while there is global competition for highly skilled professionals, many migrants are concentrated in low-skilled sectors (Hamnett, 2021). These differences highlight not only potentially different pathways of integration into the urban system among various ethnic groups but also the significance of socioeconomic mobility.

Housing availability plays a vital role in residential choice. Due to privatization, the dominant owner-occupied housing stock restricts residential choice in Riga and further limits the commercialization of buildings (Olt & Csizmady, 2020). Consequently, a significantly higher proportion of rental housing in inner neighborhoods (Table 5) has fostered a more favorable environment for new residents, particularly in Avoti and Grīziņkalns. The phenomenon of new-build gentrification in inner neighborhoods was also notable; however, it was spatially concentrated.

Table 5. **Proportion of rental housing and residents in new buildings in Riga's inner-city core in 2021, with percentage changes between 2011 and 2021 (in brackets).**

	Avoti	Brasa	Centrs	Grīziņ-kalns	Pētersala–Andrejsala	Skanste	Old Town
Rental housing	48.0 (–3.2)	27.4 (–3.2)	37.8 (–2.6)	44.7 (–1.2)	20.8 (1.2)	18.3 (10.1)	33.7 (13.8)
Residents in new buildings[1]	0.3	2.2	1.7	0.5	8.6	50.3	0.0

[1] Buildings constructed since 2011

Source: Author's calculations using data from the Central Statistical Bureau

Only in Skanste and Pētersala-Andrejsala did the proportion of residents residing in new housing exceed the city average, and these neighborhoods also exhibited the lowest proportion of rental housing. Hence, it is crucial to acknowledge that real estate development may contribute to ethnic and socioeconomic segregation (van Gent & Hochstenbach, 2020) by selectively attracting particular social groups.

While new-build gentrification mainly affected Skanste and Pētersala-Andrejsala, other inner neighborhoods exhibited different forms of marginal gentrification, such as façade gentrification, which increases the risk of displacing lower-income residents (Walks et al., 2021). Overall, this highly diverse housing stock created both opportunities and constraints for existing social groups and newcomers alike, whose varying socio-demographic profiles played a key role in residential choices.

3.3. Patterns and Levels of Socio-Spatial Differentiation in the Inner City Using the Scalable Individualized Neighborhood Method

Given the high concentration of new migrant groups and the increasing socioeconomic polarization in Riga's inner-city neighborhoods, a detailed spatial analysis of the area was conducted at multiple scales using the scalable individualized neighborhood method. The results showed that, even though Riga has historically had low levels of ethnic and socioeconomic segregation, which is still evident in the distribution of Latvians and Russians and in their relatively stable location quotient (LQ) values across different scales, hyperlocal segregation patterns are now emerging among new immigrant groups (Figure 9).

The residential patterns of Indians, Uzbeks, and Vietnamese reflected the high degree of concentration characteristic of emerging ethnic groups, as well as a pronounced sensitivity to the scale of analysis. The exceptionally high LQ values observed for these groups at the micro and meso levels indicate the formation of strongly localized concentration hotspots. These findings underscore the utility of this method for analyzing relatively small social groups within a confined geographic area.

Although all new immigrant groups demonstrated high levels of concentration, their specific geographical patterns varied, indicating complex interactions between residential choice and barriers. The macro-level analysis identified a convergence zone in the southern part of the study area for all groups examined, serving as an "urban arrival space". An "urban arrival space" is characterized by high population density, high residential mobility, and a significant proportion of rental housing at lower rents (Haase et al., 2020; Hans et al., 2019), which helps maintain housing affordability and facilitates the settlement of new immigrant groups. A liberal housing market often reinforces the concentration of ethnic groups (Imeraj et al., 2018), underscoring the critical role of the housing market in segregation processes. This presents a complex challenge for policymakers, involving systemic barriers such as discrimination, and can facilitate gentrification or segregation (Bolt et al., 2010).

Simultaneously, micro- and meso-level analysis revealed that the Indian community was more dispersed, whereas Uzbeks partially settled in areas inhabited by the Russian population, underscoring the role of existing ethnic infrastructures (Křížková & Šimon, 2022), while the Vietnamese remained the most spatially concentrated.

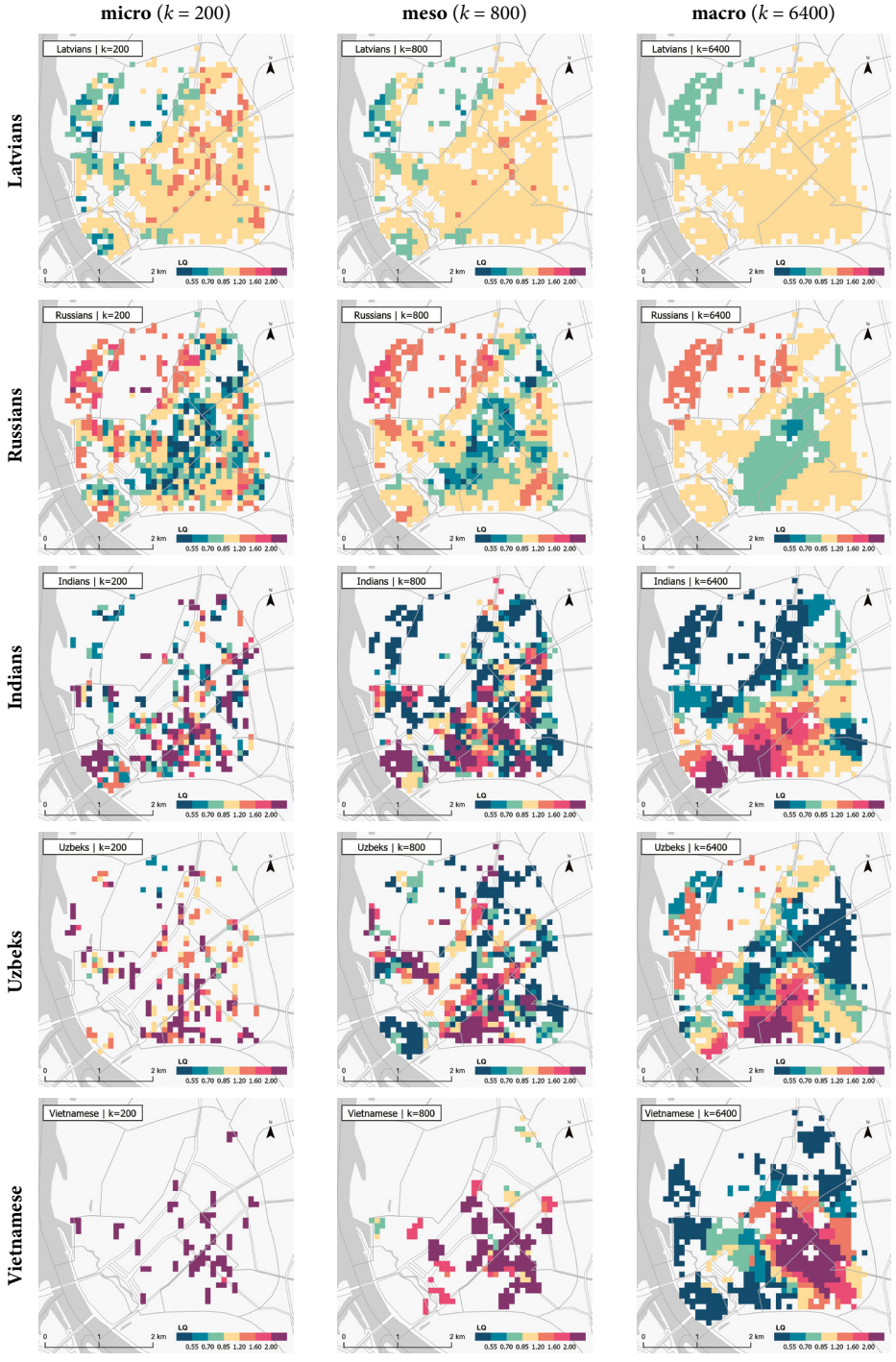


Figure 9. **Location quotient by ethnicity in Riga's inner-city core in 2021 at the micro, meso, and macro levels.**

Source: Created by the author using data from the Central Statistical Bureau

There are also indications of socio-spatial avoidance between groups, such as the underrepresentation of Latvians in Russian-populated areas and the underrepresentation of Russians in areas where emerging ethnic groups are concentrated.

The segregation index (SI) for emerging ethnic groups was very high, particularly at the micro level, exceeding the SI values for Latvians and Russians by 3–4 times (Figure 10). Although SI values decreased at the macro level, they remained significantly higher than those of Latvians and Russians.

Additionally, the differing rates of SI decline among emerging ethnic groups suggest that segregation is influenced not only by group size but also by cultural differences and socioeconomic vulnerability (Forrest & Johnston, 2001; Johnston et al., 2007). This is consistent with research showing that groups of comparable size may nonetheless exhibit different levels of segregation (Stonawski et al., 2022).

Spatial isolation (SII) was also pronounced among the emerging ethnic groups. Their likelihood of encountering co-ethnics was effectively zero at the macro level and only 2–4 % at the micro and meso levels (Figure 10). In contrast, Latvians and Russians exhibited substantially higher probabilities of co-ethnic contact, at 65–66 % and 22–25 %, respectively. Overall, spatial isolation demonstrated considerably lower sensitivity to scale.

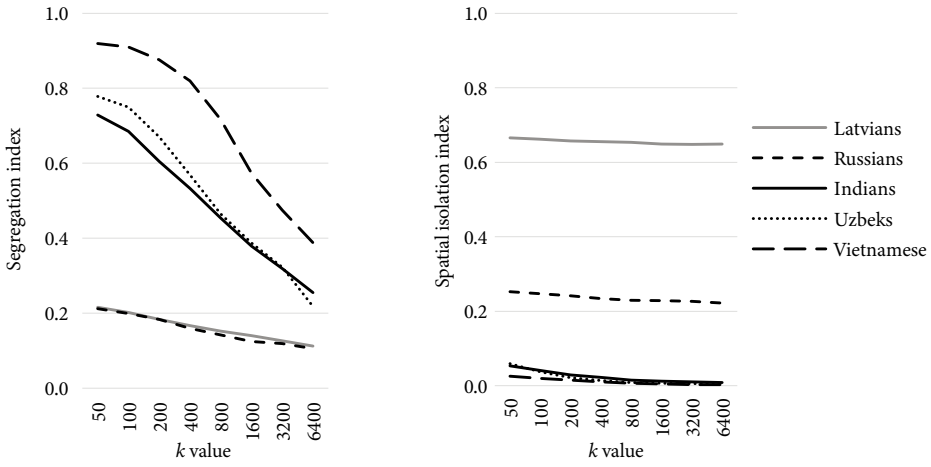


Figure 10. **Segregation index and spatial isolation index in the inner-city core of Riga, by ethnic group and k-nearest neighbors in 2021.**

Source: Created by the author using data from the Central Statistical Bureau

These findings illustrate an urban landscape where new communities form distinct, highly concentrated clusters in the inner city. Methodologically, it should be noted that these indicators are sensitive to group size and may appear highly uneven in small clusters (Stonawski et al., 2022). Nevertheless, the patterns identified in this study challenge spatial assimilation theories, which anticipate a gradual dispersal of immigrants. Although long-term outcomes remain uncertain, current observations suggest an increasing risk of spatial inequality. Ethnic hierarchy and limited socio-spatial mobility are persistent phenomena, particularly among immigrants from

third countries (Kadarik, 2020; Wessel et al., 2017). Although ethnic segregation is linked to socioeconomic status (Manley et al., 2015; Sturgis et al., 2014) and may diminish as socioeconomic conditions improve (Catney, 2016; Catney & Simpson, 2010), this process is slow, affects only a small portion of migrants (Andersen, 2016; Vogiazides & Chihaya, 2020), and is further constrained by cultural differences and residential preferences (Malmberg & Clark, 2021; Murayama & Nagayasu, 2021; Šimon et al., 2022). Consequently, these results reflect not only voluntary segregation but also potential structural barriers that may impede the natural dispersal of these population groups.

Extending the application of the scalable individualized neighborhood method, an analysis was conducted on the residential patterns of people employed in creative industries, including creative, knowledge, cultural, and leisure professions (Figure 11). At the macro level, this group was predominantly overrepresented in Riga's inner city. However, on a micro level, areas of underrepresentation in the eastern parts of Avoti and Pētersala-Andrejsala could be identified. Additionally, outside the inner-city neighborhoods, micro-level analysis revealed significantly more uneven distribution of the group, with localized clusters of underrepresentation across most neighborhoods.

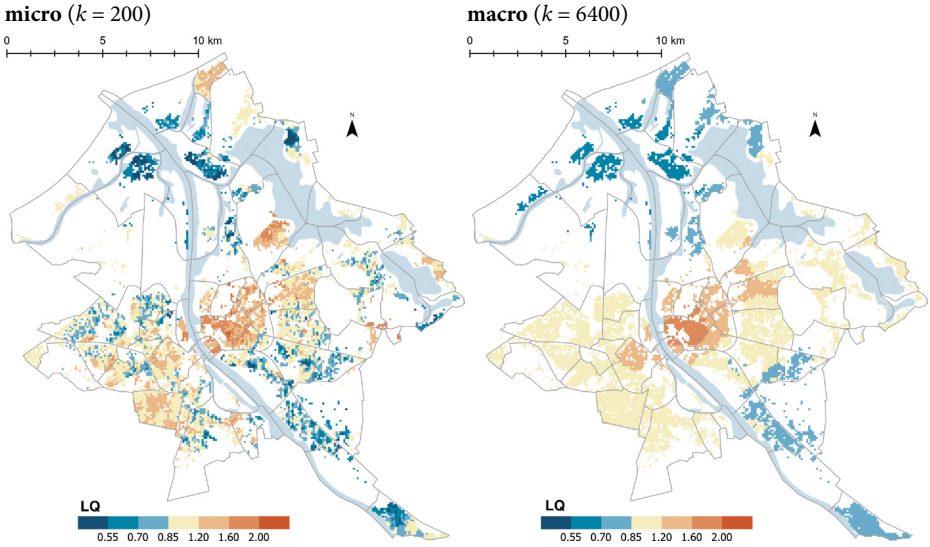


Figure 11. **Location quotient by occupation (employment in creative industries) in Riga in 2021 at the micro and macro levels.**

Source: Created by the author using data from the Central Statistical Bureau

This population group, which accounts for 17 % of Riga's employed residents, is characterized by a high proportion of university graduates and professionals in high-status occupations, as well as active participation in gentrification processes. Those employed in the creative industries exhibit distinct residential preferences, lifestyles, and patterns of service use compared with individuals employed in other industries (Musterd & Murie, 2011), which can, in turn, reinforce socio-spatial inequality.

CONCLUSIONS

The doctoral thesis assessed the patterns of socio-spatial differentiation in Riga's inner city. The findings support the following key conclusions:

1. Socio-spatial differentiation in Riga's inner city is shaped by the interplay of global, regional, and local processes. The most influential processes include:
   1.1. Demographic polarization: Characterized by geographically uneven population decline and aging nationwide, contrasted with the relative demographic resilience of the Riga metropolitan area, particularly its inner-city and suburban zones.
   1.2. Selective suburbanization: The relocation of wealthier families with children to suburban areas within the Riga metropolitan region alters population structures in both inner-city and peripheral areas.
   1.3. Fragmented gentrification: The selective influx of higher-income residents and targeted revitalization of specific inner-city areas, accompanied by heightened risks of displacement among lower-income groups.
   1.4. Immigration: The inner city functions as the primary destination for increasingly diverse international migration flows, generating new forms of ethnic and social differentiation.
2. Empirical evidence demonstrates that changes in population composition have intensified socio-spatial differentiation within inner cities, driven by rising ethnic diversity and socioeconomic polarization. Gentrification in Central and Eastern European inner cities, including Riga, is typically fragmented and often reinforces pre-existing social inequalities.
3. Research on segregation is constrained by the modifiable areal unit problem (MAUP) and the scale-dependent nature of socio-spatial patterns. Applying scale-sensitive geospatial methods helps mitigate these limitations, enabling the identification of detailed differentiation patterns at micro, meso, and macro levels, offering a more nuanced understanding of residential configurations across urban neighborhoods.
4. Socioeconomic polarization and ethnic segregation are evident both between Riga's inner city and the rest of the city and within the inner city itself, departing from the historically low social and ethnic segregation characteristic of post-socialist cities. Although Riga's inner neighborhoods have generally maintained stable populations, uneven development has produced a socially and spatially polarized landscape in which fragmented gentrification coexists with high concentrations of non-traditional immigrant groups.
5. Using the scalable individualized neighborhood method, segregation among new immigrant groups (Indian, Uzbek, and Vietnamese) in Riga's inner city is shown to be highly scale-dependent: extremely pronounced at the micro (hyperlocal) level, yet diminishing at broader scales. This approach effectively reveals granular, previously unidentified residential patterns, including "urban arrival space" and the role of ethnic infrastructure, which are often obscured by methods relying on administrative units.

Future Research

1. Given the high concentration of new immigrant groups, a comprehensive qualitative analysis of the "urban arrival space" would help elucidate residential choices of emerging ethnic groups and the significance of access to services and employment.
2. While the limited availability of individual-level data currently restricts longitudinal research, in the future, such analysis would substantially advance understanding of changes in segregation levels and the dynamics of spatial assimilation.
3. Given the strong link between gentrification and displacement, it is crucial to examine the effects of fragmented gentrification on vulnerable populations, such as seniors, in terms of access to housing, services, and social welfare.
4. Given the demonstrated effectiveness of scale-sensitive geospatial analysis methods, their broader application is recommended to investigate the distribution and concentration levels of other social groups.

ACKNOWLEDGMENTS

I am deeply grateful to Prof. Zaiga Krišjāne, my supervisor, whose guidance and calm reassurance – always reminding me that every challenge has a solution – have shaped and made this journey possible. I also want to thank Prof. Māris Bērziņš, my academic advisor, for his tireless support and our close collaboration on publications; his insight and readiness to help at any hour have greatly strengthened this work. I am equally grateful to Assoc. Prof. Elīna Apsīte-Beriņa, whose thoughtful feedback, friendship, and constant emotional support have been a cornerstone throughout.

I would like to express special appreciation to my master's thesis supervisor, Sarmīte Barvika of Riga Technical University, whose encouragement and confidence in my abilities were the spark that led me toward doctoral research.

Most of all, I want to thank my family. To my wife, Marta Balode-Kraujiņa –thank you for your endless patience, love, and for listening to more of my research ideas than anyone ever should. Your support made this possible. And to my best friend, Agnese Čikule, thank you for your unwavering belief in me, your constant presence, and your friendship every step of the way.

ATSAUCES / REFERENCES

Amcoff, J. (2025). Reflections on the Use of k-Nearest-Neighbours Bespoke Neighbourhoods in Urban Studies. *Tijdschrift Voor Economische En Sociale Geografie*, *116*(4). https://doi.org/10.1111/tesg.70001

Amran, G., Bélanger, A., Conte, A., Gailey, N., Ghio, D., Grapsa, E., Jensen, K., Loichinger, E., Marois, G., Muttarak, R., Potančoková, M., Sabourin, P., & Stonawski, M. (2019). *Demographic Scenarios for the EU – Migration, Population and Education* (W. Lutz, Ed.). Publications Office. https://doi.org/10.2760/751889

Andersen, H. S. (2016). Spatial assimilation? The development in immigrants' residential career with duration of stay in Denmark. *Journal of Housing and the Built Environment*, *31*(2). https://doi.org/10.1007/s10901-015-9459-0

Andersson, E. K., Lyngstad, T. H., & Sleutjes, B. (2018). Comparing Patterns of Segregation in North-Western Europe: A Multiscalar Approach. *European Journal of Population*, *34*(2). https://doi.org/10.1007/s10680-018-9477-1

Apparicio, P., Martori, J. C., Pearson, A. L., Fournier, É., & Apparicio, D. (2014). An Open-Source Software for Calculating Indices of Urban Residential Segregation. *Social Science Computer Review*, *32*(1). https://doi.org/10.1177/0894439313504539

Arango, J. (2012). Early Starters and Latecomers: Comparing Countries of Immigration and Immigration Regimes in Europe. In M. Okolski (Ed.), *European Immigrations: Trends, Structures and Policy Implications* (pp. 45–64). Amsterdam University Press. https://doi.org/10.1017/9789048517275.003

Arbaci, S. (2007). Ethnic segregation, housing systems and welfare regimes in Europe. *European Journal of Housing Policy*, *7*(4). https://doi.org/10.1080/14616710701650443

Bauls, A., Krišjāne, Z., & Mežciema, G. (2003). Evaluation of the Urban Environment in Different Parts of Riga. *Folia Geographica*, *11*.

Benassi, F., Bonifazi, C., Heins, F., Lipizzi, F., & Strozza, S. (2020). Comparing Residential Segregation of Migrant Populations in Selected European Urban and Metropolitan Areas. *Spatial Demography*, *8*(3). https://doi.org/10.1007/s40980-020-00064-5

Bolt, G. (2009). Combating residential segregation of ethnic minorities in European cities. *Journal of Housing and the Built Environment*, *24*(4). https://doi.org/10.1007/s10901-009-9163-z

Bolt, G., Phillips, D., & Van Ronald, K. (2010). Housing policy, (De)segregation and social mixing: An international perspective. *Housing Studies*, *25*(2). https://doi.org/10.1080/02673030903564838

Borén, T., & Gentile, M. (2007). Metropolitan processes in post-communist states: An introduction. *Geografiska Annaler, Series B: Human Geography*, *89*(2). https://doi.org/10.1111/j.1468-0467.2007.00242.x

Boterman, W. R., Musterd, S., & Manting, D. (2021). Multiple dimensions of residential segregation. The case of the metropolitan area of Amsterdam. *Urban Geography*, *42*(4). https://doi.org/10.1080/02723638.2020.1724439

Botev, N. (2012). Population ageing in Central and Eastern Europe and its demographic and social context. *European Journal of Ageing*, *9*(1). https://doi.org/10.1007/s10433-012-0217-9

Brown, L. A., & Chung, S. Y. (2006). Spatial segregation, segregation indices and the geographical perspective. *Population, Space and Place*, *12*(2). https://doi.org/10.1002/psp.403

Buzar, S., Ogden, P., Hall, R., Haase, A., Kabisch, S., & Steinführer, A. (2007). Splintering urban populations: Emergent landscapes of reurbanisation in four European cities. *Urban Studies*, *44*(4). https://doi.org/10.1080/00420980601185544

Catney, G. (2016). Exploring a decade of small area ethnic (de-)segregation in England and Wales. *Urban Studies*, *53*(8). https://doi.org/10.1177/0042098015576855

Catney, G., Lloyd, C. D., Ellis, M., Wright, R., Finney, N., Jivraj, S., & Manley, D. (2023). Ethnic diversification and neighbourhood mixing: A rapid response analysis of the 2021 Census of England and Wales. *Geographical Journal*, *189*(1). https://doi.org/10.1111/geoj.12507

Catney, G., & Simpson, L. (2010). Settlement area migration in England and Wales: Assessing evidence for a social gradient. *Transactions of the Institute of British Geographers*, *35*(4). https://doi.org/10.1111/j.1475-5661.2010.00400.x

Catney, G., Wright, R., & Ellis, M. (2021). The evolution and stability of multi-ethnic residential neighbourhoods in England. *Transactions of the Institute of British Geographers*, *46*(2). https://doi.org/10.1111/tran.12416

Central Statistical Bureau of Latvia. (2025). *Population statistics [Database]*. https://stat.gov.lv/en

Costa, R., & de Valk, H. A. G. (2018). Ethnic and Socioeconomic Segregation in Belgium: A Multiscalar Approach Using Individualised Neighbourhoods. *European Journal of Population*, *34*(2). https://doi.org/10.1007/s10680-018-9480-6

Dembski, S., Sykes, O., Couch, C., Desjardins, X., Evers, D., Osterhage, F., Siedentop, S., & Zimmermann, K. (2021). Reurbanisation and suburbia in Northwest Europe: A comparative perspective on spatial trends and policy approaches. *Progress in Planning*, *150*. https://doi.org/10.1016/j.progress.2019.100462

Diener, A. C., & Hagen, J. (2019). *The City as Power: Urban Space, Place, and National Identity*. Rowman & Littlefield.

Fabula, S., Boros, L., Kovács, Z., Horváth, D., & Pál, V. (2017). Studentification, diversity and social cohesion in post-socialist Budapest. *Hungarian Geographical Bulletin*, *66*(2). https://doi.org/10.15201/hungeobull.66.2.5

Fihel, A., & Okólski, M. (2019). Demographic change and challenge. In G. Gorzelak (Ed.), *Social and Economic Development in Central and Eastern Europe: Stability and Change after 1990* (pp. 101–132). Routledge. https://doi.org/10.4324/9780429450969-6

Forrest, J., & Johnston, R. (2001). The geography of the new ethnicity: Ethnic residential segregation in Metropolitan Sydney 1996. *Tijdschrift Voor Economische En Sociale Geografie*, *92*(1). https://doi.org/10.1111/1467-9663.00138

Haase, A., Kabisch, S., Steinführer, A., Bouzarovski, S., Hall, R., & Ogden, P. (2010). Emergent spaces of reurbanisation: Exploring the demographic dimension of inner-city residential change in a European setting. *Population, Space and Place*, *16*(5). https://doi.org/10.1002/psp.603

Haase, A., Rink, D., & Grossmann, K. (2016). Shrinking Cities in Post-Socialist Europe: What Can We Learn from Their Analysis for Theory Building Today? *Geografiska Annaler, Series B: Human Geography*, *98*(4). https://doi.org/10.1111/geob.12106

Haase, A., Schmidt, A., Rink, D., & Kabisch, S. (2020). Leipzig's inner east as an arrival space? Exploring the trajectory of a diversifying neighbourhood. *Urban Planning*, *5*(3). https://doi.org/10.17645/up.v5i3.2902

Haase, A., Wolff, M., Špačková, P., & Radzimski, A. (2017). Reurbanisation in postsocialist europe – A comparative view of eastern Germany, Poland, and the Czech Republic. *Comparative Population Studies*, *42*. https://doi.org/10.12765/CPoS-2018-02en

Haase, D., Haase, A., Kabisch, S., & Bischoff, P. (2008). Guidelines for the "perfect inner city". Discussing the appropriateness of monitoring approaches for reurbanization. *European Planning Studies*, *16*(8). https://doi.org/10.1080/09654310802315765

Hack-Polay, D. (2019). Migrant enclaves: disempowering economic ghettos or sanctuaries of opportunities for migrants?: A double lens dialectic analysis. *Journal of Enterprising Communities*, *13*(4). https://doi.org/10.1108/JEC-01-2019-0008

Hamnett, C. (2021). The changing social structure of global cities: Professionalisation, proletarianisation or polarisation. *Urban Studies*, *58*(5). https://doi.org/10.1177/0042098020940556

Hans, N., Hanhörster, H., Polívka, J., & Beißwenger, S. (2019). The role of arrival spaces in integrating immigrants. A critical literature review. *Raumforschung Und Raumordnung*, *77*(5). https://doi.org/10.2478/rara-2019-0019

Harris, R. (2023). A tale of four cities: Neighbourhood diversification and residential desegregation in and around England's 'no majority' cities. *Geographical Journal*. https://doi.org/10.1111/geoj.12561

Hårsman, B. (2006). Ethnic diversity and spatial segregation in the Stockholm region. *Urban Studies*, *43*(8). https://doi.org/10.1080/00420980600776434

Hess, D. B., Tammaru, T., & van Ham, M. (2018). Housing Estates in Europe: Poverty, Ethnic Segregation and Policy Challenges. In *Urban Book Series*. Springer Cham. https://doi.org/10.1007/978-3-319-92813-5

Hesse, M., & Siedentop, S. (2018). Suburbanisation and Suburbanisms – Making Sense of Continental European Developments. *Raumforschung Und Raumordnung*, *76*(2). https://doi.org/10.1007/s13147-018-0526-3

Horňáková, M., & Sýkora, J. (2021). From suburbanization to reurbanization? Changing residential mobility flows of families with young children in the Prague Metropolitan Area. *Norsk Geografisk Tidsskrift*, *75*(4). https://doi.org/10.1080/00291951.2021.1970014

Huse, T. (2018). Gentrification and ethnicity. In L. Lees & M. Phillips (Eds.), *Handbook of Gentrification Studies* (pp. 186–204). Edward Elgar Publishing Limited. https://doi.org/10.4337/9781785361746.00022

Hwang, J. (2015). Gentrification in Changing Cities: Immigration, New Diversity, and Racial Inequality in Neighborhood Renewal. *Annals of the American Academy of Political and Social Science*, *660*(1). https://doi.org/10.1177/0002716215579823

Ibraimovic, T., & Hess, S. (2018). A latent class model of residential choice behaviour and ethnic segregation preferences. *Housing Studies*, *33*(4). https://doi.org/10.1080/02673037.2017.1373749

Imeraj, L., Willaert, D., & de Valk, H. A. G. (2018). A comparative approach towards ethnic segregation patterns in Belgian cities using multiscalar individualized neighborhoods. *Urban Geography*, *39*(8). https://doi.org/10.1080/02723638.2018.1446584

Johnston, R., Poulsen, M., & Forrest, J. (2007). The geography of ethnic residential segregation: A comparative study of five countries. *Annals of the Association of American Geographers*, *97*(4). https://doi.org/10.1111/j.1467-8306.2007.00579.x

Kabisch, N., & Haase, D. (2011). Diversifying European agglomerations: Evidence of urban population trends for the 21st century. *Population, Space and Place*, *17*(3). https://doi.org/10.1002/psp.600

Kadarik, K. (2020). Immigrants' mobility towards native-dominated neighbourhoods: the role of individual resources, country of origin, and settlement context. *Geografiska Annaler, Series B: Human Geography*, *102*(2). https://doi.org/10.1080/04353684.2019.1697939

Kährik, A., Novák, J., Temelová, J., Kadarik, K., & Tammaru, T. (2015). Patterns and drivers of inner city social differentiation in Prague and Tallinn. *Geografie-Sbornik CGS*, *120*(2). https://doi.org/10.37040/geografie2015120020275

Kaplan, D., & Douzet, F. (2011). Research in ethnic segregation III: Segregation outcomes. *Urban Geography*, *32*(4). https://doi.org/10.2747/0272-3638.32.4.589

Kashnitsky, I., De Beer, J., & Van Wissen, L. (2021). Unequally ageing regions of Europe: Exploring the role of urbanization. *Population Studies*, *75*(2). https://doi.org/10.1080/00324728.2020.1788130

Kazimierczak, J., & Szafrańska, E. (2019). Demographic and morphological shrinkage of urban neighbourhoods in a post-socialist city: the case of Łódź, Poland. *Geografiska Annaler, Series B: Human Geography*, *101*(2). https://doi.org/10.1080/04353684.2019.1582304

King, R., & Okólski, M. (2019). Diverse, Fragile and Fragmented: The New Map of European Migration. *Central and Eastern European Migration Review*, *8*(1). https://doi.org/10.17467/ceemr.2018.18

Kovács, Z. (2009). Social and economic transformation of historical neighbourhoods in Budapest. *Tijdschrift Voor Economische En Sociale Geografie*, *100*(4). https://doi.org/10.1111/j.1467-9663.2009.00549.x

Krišjāne, Z., & Bērziņš, M. (2014). Intra-urban residential differentiation in the post-Soviet city: The case of Riga, Latvia. *Hungarian Geographical Bulletin*, *63*(3). https://doi.org/10.15201/hungeobull.63.3.1

Krišjāne, Z., Bērziņš, M., & Kratovits, K. (2015). Occupation and ethnicity: Patterns of residential segregation in Riga two decades after socialism. In T. Tammaru, S. Marcinczak, M. van Ham, & S. Musterd (Eds.), *Socio-Economic Segregation in European Capital Cities: East Meets West* (pp. 287–312). Routledge.

Krišjāne, Z., Bērziņš, M., Sechi, G., & Krūmiņš, J. (2019). Residential Change and Socio-demographic Challenges for Large Housing Estates in Riga, Latvia. In D. B. Hess & T. Tammaru (Eds.), *Housing Estates in the Baltic Countries. The Urban Book Series.* (pp. 225–245). Springer, Cham. https://doi.org/10.1007/978-3-030-23392-1_11

Křížková, I., & Šimon, M. (2022). Measuring residential segregation of non-European migrants using the individualised neighbourhood method: How does Czechia fit to the European landscape? *Applied Geography*, *144*. https://doi.org/10.1016/j.apgeog.2022.102730

Krūmiņš, J., Sechi, G., & Bērziņš, M. (2018). Residential satisfaction and mobility behaviour among the young: Insights from the post-Soviet city of Riga. *BELGEO*, *3*. https://doi.org/10.4000/belgeo.28347

Kubeš, J., & Kovács, Z. (2020). The kaleidoscope of gentrification in post-socialist cities. *Urban Studies*, *57*(13). https://doi.org/10.1177/0042098019889257

Kulcsár, L. J., & Brown, D. L. (2017). Population ageing in eastern Europe: Toward a coupled micro-macro framework. *Regional Statistics*, *7*(1). https://doi.org/10.15196/RS07107

Kurek, S., Wójtowicz, M., & Gałka, J. (2021). Using Spatial Autocorrelation for identification of demographic patterns of Functional Urban Areas in Poland. *Bulletin of Geography. Socio-Economic Series*, *52*(52). https://doi.org/10.2478/bog-2021-0018

Lees, L., Slater, T., & Wyly, E. (2022). The Planetary Gentrification Reader. In *The Planetary Gentrification Reader*. Routledge. https://doi.org/10.4324/9781003341239

Lichter, D. T., Parisi, D., & Ambinakudige, S. (2020). The Spatial Integration of Immigrants in Europe: A Cross-National Study. *Population Research and Policy Review*, *39*(3). https://doi.org/10.1007/s11113-019-09540-3

Malheiros, J., Carvalho, R., & Mendes, L. (2013). Gentrification, residential ethnicization and the social production of fragmented space in two multi-ethnic neighbouroods of Lisbon and Bilbao. *Finisterra*, *48*(96). https://doi.org/10.18055/finis3619

Malmberg, B., Andersson, E. K., Nielsen, M. M., & Haandrikman, K. (2018). Residential Segregation of European and Non-European Migrants in Sweden: 1990–2012. *European Journal of Population*, *34*(2). https://doi.org/10.1007/s10680-018-9478-0

Malmberg, B., & Clark, W. A. V. (2021). Migration and Neighborhood Change in Sweden: The Interaction of Ethnic Choice and Income Constraints. *Geographical Analysis*, *53*(2). https://doi.org/10.1111/gean.12250

Manley, D., Johnston, R., Jones, K., & Owen, D. (2015). Macro-, Meso- and Microscale Segregation: Modeling Changing Ethnic Residential Patterns in Auckland, New Zealand, 2001–2013. *Annals of the Association of American Geographers*, *105*(5). https://doi.org/10.1080/00045608.2015.1066739

Marcińczak, S., & Bernt, M. (2021). Immigration, segregation and neighborhood change in Berlin. *Cities*, *119*. https://doi.org/10.1016/j.cities.2021.103417

Marcińczak, S., Mooses, V., Strömgren, M., & Tammaru, T. (2023). A comparative study of immigrant-native segregation at multiple spatial scales in urban Europe. *Journal of Ethnic and Migration Studies*, *49*(1). https://doi.org/10.1080/1369183X.2021.2008887

Marcińczak, S., Musterd, S., van Ham, M., & Tammaru, T. (2015). Inequality and rising levels of socio-economic segregation: Lessons from a pan-European comparative study. In T. Tammaru, S. Marcinczak, M. van Ham, & S. Musterd (Eds.), *Socio-Economic Segregation in European Capital Cities: East Meets West* (pp. 357–382). Routledge.

Marcińczak, S., Tammaru, T., Novák, J., Gentile, M., Kovács, Z., Temelová, J., Valatka, V., Kährik, A., & Szabó, B. (2015). Patterns of Socioeconomic Segregation in the Capital Cities of Fast-Track Reforming Postsocialist Countries. *Annals of the Association of American Geographers*, *105*(1). https://doi.org/10.1080/00045608.2014.968977

Martori, J. C., & Apparicio, P. (2011). Changes in spatial patterns of the immigrant population of a southern european metropolis: The case of the barcelona metropolitan area (2001–2008). *Tijdschrift Voor Economische En Sociale Geografie*, *102*(5). https://doi.org/10.1111/j.1467-9663.2011.00658.x

Massey, D. S., & Denton, N. A. (1988). The Dimensions of Residential Segregation. *Social Forces*, *67*(2). https://doi.org/10.1093/sf/67.2.281

Massey, D. S., Rothwell, J., & Domina, T. (2009). The changing bases of segregation in the United States. *Annals of the American Academy of Political and Social Science*, *626*(1). https://doi.org/10.1177/0002716209343558

Murayama, K., & Nagayasu, J. (2021). Toward coexistence of immigrants and local people in Japan: Implications from spatial assimilation theory. *Sustainability (Switzerland)*, *13*(7). https://doi.org/10.3390/su13073849

Musterd, S., Marcińczak, S., van Ham, M., & Tammaru, T. (2017). Socioeconomic segregation in European capital cities. Increasing separation between poor and rich. *Urban Geography*, *38*(7). https://doi.org/10.1080/02723638.2016.1228371

Musterd, S., & Murie, A. (2011). *Making Competitive Cities*. Wiley-Blackwell.

Nielsen, M. M., & Hennerdal, P. (2017). Changes in the residential segregation of immigrants in Sweden from 1990 to 2012: Using a multi-scalar segregation measure that accounts for the modifiable areal unit problem. *Applied Geography*, *87*. https://doi.org/10.1016/j.apgeog.2017.08.004

Olt, G., & Csizmady, A. (2020). Gentrification and functional change in Budapest – 'ruin bars' and the commodification of housing in a post-socialist context. *Urban Development Issues*, *65*(1). https://doi.org/10.2478/udi-2020-0002

Openshaw, S. (1996). Developing GIS relevant zone based spatial analysis methods. In P. A. Longley & M. Batty (Eds.), *Spatial Analysis: Modelling in a GIS Environment* (pp. 55–73). John Wiley & Sons.

Orum, A. M. (2019). The Wiley Blackwell Encyclopedia of Urban and Regional Studies. In *The Wiley Blackwell Encyclopedia of Urban and Regional Studies*. John Wiley & Sons. https://doi.org/10.1002/9781118568446

Östh, J. (2024). *EquiPop Flow*. Uppsala Universitet. https://www.uu.se/en/department/human-geography/research/equipop

Östh, J., & Türk, U. (2020). Integrating infrastructure and accessibility in measures of bespoke neighbourhoods. In S. Musterd (Ed.), *Handbook of Urban Segregation* (pp. 378–394). Edward Elgar Publishing Limited. https://doi.org/10.4337/9781788115605.00031

Ouředníček, M., & Pospíšilová, L. (2016). Editorial: Urban Dynamics and Neighbourhood Change in Cities after Transition. *Czech Sociological Review*, *52*(6).

Ouředníček, M., Šimon, M., & Kopečná, M. (2015). The reurbanisation concept and its utility for contemporary research on post-socialist cities: The case of the Czech Republic. *Moravian Geographical Reports*, *23*(4). https://doi.org/10.1515/mgr-2015-0022

Pastak, I., & Kährik, A. (2021). Symbolic displacement revisited: Place-making Narratives in Gentrifying Neighbourhoods of Tallinn. *International Journal of Urban and Regional Research*, *45*(5). https://doi.org/10.1111/1468-2427.13054

Petrović, A., van Ham, M., & Manley, D. (2018). Multiscale measures of population: Within- and between-city variation in exposure to the sociospatial context. *Annals of the American Association of Geographers*, *108*(4). https://doi.org/10.1080/24694452.2017.1411245

Rérat, P. (2019). The return of cities: the trajectory of Swiss cities from demographic loss to reurbanization. *European Planning Studies*, *27*(2). https://doi.org/10.1080/09654313.2018.1546832

Rogne, A. F., Andersson, E. K., Malmberg, B., & Lyngstad, T. H. (2020). Neighbourhood Concentration and Representation of Non-European Migrants: New Results from Norway. *European Journal of Population*, *36*(1). https://doi.org/10.1007/s10680-019-09522-3

Sabater, A., Graham, E., & Finney, N. (2017). The spatialities of ageing: Evidencing increasing spatial polarisation between older and younger adults in England and Wales. *Demographic Research*, *36*(1). https://doi.org/10.4054/DemRes.2017.36.25

Salvati, L. (2017). Demographic transition, immigration, gentrification: Unravelling early signs of re-urbanisation in a European city. *International Social Science Journal*, *66*(219–220). https://doi.org/10.1111/issj.12120

Salvati, L., Serra, P., Bencardino, M., & Carlucci, M. (2019). Re-urbanizing the European City: A Multivariate Analysis of Population Dynamics During Expansion and Recession Times. *European Journal of Population*, *35*(1). https://doi.org/10.1007/s10680-017-9462-0

Sechi, G., Zhitin, D., Krisjane, Z., & Berzins, M. (2022). Post-Soviet Suburbanization as Part of Broader Metropolitan Change: A Comparative Analysis of Saint Petersburg and Riga. *Sustainability (Switzerland)*, *14*(13). https://doi.org/10.3390/su14138201

Šimon, M., Křížková, I., & Klsák, A. (2022). Residential Segregation in Prague and the Central Bohemian Region in 2012–2018: A Multiscalar Approach Using Individualised Neighbourhoods. In M. Ouředníček (Ed.), *Prague and Central Bohemia: Current Population Processes and Socio-spatial Differentiation* (pp. 73–90). Karolinum Press. https://doi.org/10.2307/jj.5699273.9

Skadiņš, T. (2018). Rīgas aglomerācijas apdzīvojums un tā pārmaiņas. *Folia Geographica*, *16*. https://doi.org/10.22364/fg.16.9

Skifter Andersen, H., Andersson, R., Wessel, T., & Vilkama, K. (2016). The impact of housing policies and housing markets on ethnic spatial segregation: comparing the capital cities of four Nordic welfare states. *International Journal of Housing Policy*, *16*(1). https://doi.org/10.1080/14616718.2015.1110375

Sleutjes, B., de Valk, H. A. G., & Ooijevaar, J. (2018). The Measurement of Ethnic Segregation in the Netherlands: Differences Between Administrative and Individualized Neighbourhoods. *European Journal of Population*, *34*(2). https://doi.org/10.1007/s10680-018-9479-z

Smith, N. (2002). New Globalism, New Urbanism: Gentrification as Global Urban Strategy. *Antipode*, *34*(3). https://doi.org/10.1111/1467-8330.00249

Smith, S. J. (2012). International Encyclopedia of Housing and Home. In *International Encyclopedia of Housing and Home*. Elsevier Science. https://doi.org/10.1016/C2009-1-28377-8

Šolks, G. (2010). Reurbanizācijas procesi Rīgā. *Latvijas Universitātes Raksti*, *752*.

Šolks, G. (2013). *Pilsētas revitalizācijas procesi Rīgā* [Dissertation]. Latvijas Universitāte.

Špačková, P., Pospíšilová, L., & Ouředníček, M. (2016). The long-term development of socio-spatial differentiation in socialist and post-socialist Prague. *Sociologicky Casopis*, *52*(6). https://doi.org/10.13060/00380288.2016.52.6.288

Steele, L. G., & Abdelaaty, L. (2019). Ethnic diversity and attitudes towards refugees. *Journal of Ethnic and Migration Studies*, *45*(11). https://doi.org/10.1080/1369183X.2018.1513785

Stillwell, J., & Phillips, D. (2006). Diversity and Change: Understanding the Ethnic Geographies of Leeds. *Journal of Ethnic and Migration Studies*, *32*(7). https://doi.org/10.1080/13691830600821851

Stonawski, M., Brzozowski, J., Pędziwiatr, K., & Georgati, M. (2022). Investigating neighbourhood concentration of immigrants in Poland: explorative evidence from Kraków. *Bulletin of Geography. Socio-Economic Series*, *56*. https://doi.org/10.12775/bgss-2022-0019

Sturgis, P., Brunton-Smith, I., Kuha, J., & Jackson, J. (2014). Ethnic diversity, segregation and the social cohesion of neighbourhoods in London. *Ethnic and Racial Studies*, *37*(8). https://doi.org/10.1080/01419870.2013.831932

Sýkora, L. (2009). Post-Socialist Cities. In *International Encyclopedia of Human Geography* (pp. 387–395). Elsevier. https://doi.org/10.1016/B978-008044910-4.01072-5

Tammaru, T., Marcińczak, S., Aunap, R., van Ham, M., & Janssen, H. (2020). Relationship between income inequality and residential segregation of socioeconomic groups. *Regional Studies*, *54*(4). https://doi.org/10.1080/00343404.2018.1540035

Tammaru, T., Marcińczak, S., van Ham, M., & Musterd, S. (2015). Socio-economic segregation in European capital cities: East meets West. In *Socio-Economic Segregation in European Capital Cities: East Meets West*. Routledge. https://doi.org/10.4324/9781315758879

Temelová, J., Novák, J., Kährik, A., & Tammaru, T. (2016). Neighbourhood Trajectories in the Inner Cities of Prague and Tallinn: What Affects the Speed of Social and Demographic Change? *Geografiska Annaler, Series B: Human Geography*, *98*(4). https://doi.org/10.1111/geob.12109

Treija, S., Bratuškins, U., Barvika, S., & Bondars, E. (2020). The liveability of historical cities: Current state and prospects for habitation. *WIT Transactions on the Built Environment*, *193*. https://doi.org/10.2495/GD170021

United Nations. (n.d.). *Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.* United Nations Sustainable Development Goals.

Ušča, M. (2010). Urban activity spaces: The case of a post-Soviet neighbourhood in Riga. *WIT Transactions on Ecology and the Environment*, *129*. https://doi.org/10.2495/SC100491

Vaishar, A., Šťastná, M., Zapletalová, J., & Nováková, E. (2020). Is the European countryside depopulating? Case study Moravia. *Journal of Rural Studies*, *80*. https://doi.org/10.1016/j.jrurstud.2020.10.044

Valatka, V., Burneika, D., & Ubarevičiene, R. (2017). Large social inequalities and low levels of socio-economic segregation in Vilnius. *A+BE Architecture and the Built Environment*, *9*. https://doi.org/10.59490/abe.2017.9.3626

van den Berg, L., Drewett, R., Klaassen, L. H., Rossi, A., & Vijverberg, C. H. T. (1982). Urban Europe: A Study of Growth and Decline. In *A Study of Growth and Decline*. Elsevier. https://doi.org/https://doi.org/10.1016/C2013-0-03056-3

van Gent, W., & Hochstenbach, C. (2020). The impact of gentrification on social and ethnic segregation. In S. Musterd (Ed.), *Handbook of Urban Segregation* (pp. 306–324). Elgar Publishing Limited. https://doi.org/10.4337/9781788115605.00026

van Ham, M., Tammaru, T., Ubarevičienė, R., & Janssen, H. (2021). Urban Socio-Economic Segregation and Income Inequality: A Global Perspective. In *Urban Book Series*. Springer Cham. https://doi.org/https://doi.org/10.1007/978-3-030-64569-4

Van Mol, C., & de Valk, H. (2016). Migration and Immigrants in Europe: A Historical and Demographic Perspective. In B. Garcés-Mascareñas & R. Penninx (Eds.), *Integration Processes and Policies in Europe* (pp. 31–55). https://doi.org/10.1007/978-3-319-21674-4_3

Vogiazides, L., & Chihaya, G. K. (2020). Migrants' long-term residential trajectories in Sweden: persistent neighbourhood deprivation or spatial assimilation? *Housing Studies*, *35*(5). https://doi.org/10.1080/02673037.2019.1636937

Walks, A., Hawes, E., & Simone, D. (2021). Gentrification in large Canadian cities: tenure, age, and exclusionary displacement 1991–2011. *Urban Geography*, *42*(5). https://doi.org/10.1080/02723638.2020.1832376

Wessel, T., Andersson, R., Kauppinen, T., & Andersen, H. S. (2017). Spatial Integration of Immigrants in Nordic Cities: The Relevance of Spatial Assimilation Theory in a Welfare State Context. *Urban Affairs Review*, *53*(5). https://doi.org/10.1177/1078087416638448

Wolff, M., & Wiechmann, T. (2018). Urban growth and decline: Europe's shrinking cities in a comparative perspective 1990–2010. *European Urban and Regional Studies*, *25*(2). https://doi.org/10.1177/0969776417694680

Zhitin, D. V., Krisjane, Z., Sechi, G., & Berzins, M. (2020). Socio-spatial differentiation in transition: a preliminary comparative analysis of post-soviet St Petersburg and Riga. *Baltic Region*, *12*(1). https://doi.org/10.5922/10.5922/2079-8555-2020-1-6

Zukin, S. (1987). Gentrification: Culture and Capital in the Urban Core. *Annual Review of Sociology*, *13*. https://doi.org/10.1146/annurev.so.13.080187.001021

PUBLIKĀCIJAS / PUBLICATIONS

Balode, S., & Bērziņš, M. (2025).
Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods. *Frontiers in Sustainable Cities*, 7:1612980.
https://doi.org/10.3389/frsc.2025.1612980

frontiers | Frontiers in Sustainable Cities

TYPE Original Research
PUBLISHED 14 July 2025
DOI 10.3389/frsc.2025.1612980

OPEN ACCESS

EDITED BY
Remus Cretan,
West University of Timişoara, Romania

REVIEWED BY
Carlos Aguirre-Nuñez,
San Sebastián University, Chile
Martin Šimon,
Institute of Sociology Czech Academy of Sciences, Czechia
Francesca Bitonti,
University of Catania, Italy

*CORRESPONDENCE
Sindija Balode
✉ sindija.balode@lu.lv

RECEIVED 16 April 2025
ACCEPTED 20 June 2025
PUBLISHED 14 July 2025

CITATION
Balode S and Bērziņš M (2025) Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods.
Front. Sustain. Cities 7:1612980.
doi: 10.3389/frsc.2025.1612980

Ethnic residential patterns in the inner-city core of Riga, Latvia using scalable individualized neighborhoods

Sindija Balode* and Māris Bērziņš

Department of Geography, University of Latvia, Riga, Latvia

Urban residential segregation of immigrant populations is a key research area. Riga, Latvia, offers a unique context due to its Soviet-era migration legacy and increasing diversity from new immigration flows amidst demographic decline of established minorities. Analyzing the spatial patterns of emerging ethnic groups, who often exhibit residential clustering, is key to understanding potential spatial inequalities. This study investigated the residential concentration, isolation, and segregation of emerging ethnic groups in Riga's inner-city core using a multi-scalar geographic approach. Analyzing anonymized individual-level 2021 census data processed with EquiPop, we found that residential distribution and concentration varies significantly by spatial scale. Individualized neighborhoods effectively revealed multi-scalar patterns and intra-neighborhood heterogeneity. Results identified a concentration of new ethnic groups in the southern inner-city core, functioning as an "arrival space", alongside an influence of existing ethnic infrastructure on shaping residential patterns. This research provides crucial insights into the fine-scale spatial organization of new immigrant communities, informing the understanding and addressing of spatial inequalities, particularly those faced by non-European groups within the complex European context.

KEYWORDS

ethnic segregation, urban geography, k-nearest neighbor, immigration, Riga

1 Introduction

The escalating ethnic diversification of urban populations, driven by international migration, is a defining global trend of the twenty-first century. Within the European Union, this phenomenon has been particularly pronounced over the past decade, prompting urgent scholarly and policy attention toward understanding the complex relationship between immigration, shifting demographics, and spatial inequalities related to residential segregation. As Křížková and Šimon (2022) highlight, European nations display considerable heterogeneity in their ethnic neighborhood structures and associated inequalities, shaped by distinct welfare regimes, economic pathways, historical trajectories, and migration histories (Marcińczak et al., 2015). This inherent variability underscores the necessity for context-specific research into the dynamics of urban ethnic residential segregation.

Historically, research on ethnic segregation has been heavily influenced by the North American experience, which focused on deprived inner-city areas shaped by a sharp Black-White racial dichotomy and fueled by discriminatory federal policies (Massey et al., 2009). Although this paradigm is evolving with the rapid diversification of US suburbs (Walker, 2018), it provides a key point of contrast to Europe. The manifestation of ethnic

spatial inequalities across European cities is contingent upon varied migration histories (e.g., post-colonial, Soviet-era, intra-European) and different urban-political dynamics, including policies regarding social housing and privatization. In these European contexts, socioeconomic class has often played a more dominant role than race in shaping settlement patterns, resulting in different spatial patterns and lower levels of ethnic segregation (Arbaci, 2007).

Nevertheless, many European cities still exhibit significant ethnic minority concentrations within their central cores. Cities such as Berlin, Barcelona, Leeds, Brussels, and Rome exemplify this trend, with high levels of immigrant settlement and increasing multi-ethnicity in inner-city districts (Stillwell and Phillips, 2006; Martori and Apparicio, 2011; Salvati, 2016), alongside neighborhood polarization (Marcińczak and Bernt, 2021). Although European inner cities typically present more mixed socioeconomic profiles and more recent migrant populations than their American counterparts (Marcińczak et al., 2015; Stonawski et al., 2022b), they are not immune to pockets of deprivation where vulnerable immigrant groups in lower-quality housing face heightened risks of spatial isolation (Costa and de Valk, 2018).

Compounding the substantive analysis of these trends is the growing recognition of the methodological complexities inherent in measuring and comparing segregation. Residential segregation is a fundamentally multi-scalar phenomenon, contingent on context, the specific groups being analyzed, and the spatial scale of observation (Sleutjes et al., 2018; Lichter et al., 2020; Rogne et al., 2020). Consequently, conventional approaches relying on fixed, often arbitrarily defined administrative boundaries present significant challenges for comparative analysis and fail to capture the granular, dynamic nature of residential concentration. Addressing these methodological limitations is crucial for advancing our understanding of contemporary urban ethnic geographies.

This study directs its focus toward Riga, the capital of Latvia, situated on the eastern periphery of the European Union. Riga offers a unique socio-historical context for examining ethnic residential dynamics. Shaped significantly by Soviet-era migration policies, Latvia historically maintained a high proportion of foreign-born residents (14.0% in 2012, compared to the OECD average of 8.9%). However, recent demographic shifts indicate a decline in the long-established ethnic minority population (down to 11.9% by 2022) (Society at a Glance 2024, 2024), concurrent with new migration flows stimulated by globalization, geopolitical realignments, and European Union accession in 2004. These emerging flows, encompassing a greater diversity of origin countries and migration motivations and including a notable increase in immigrants from outside Europe, are reshaping Latvia's migration landscape.

Responding to these developments, this paper investigates the multi-scalar residential geographies of emerging ethnic groups within Riga's inner-city core. We seek to understand how spatial patterns of ethnic concentration, isolation, and segregation manifest and transform across different spatial scales. Specifically, we pose two central research questions: (1) What are the levels of residential concentration for emerging ethnic groups in Riga's inner-city core, and how do they vary with the scale of analysis? (2) How do indices of spatial isolation and segregation for these groups change across scales, and what do these variations reveal about the evolving dynamics of intra-urban ethnic diversity?

This research offers several distinct contributions. Methodologically, it introduces a novel multi-scalar approach to the Latvian context using fine-grained spatial units. It represents an early application of the 2021 census data to map the distribution of emerging immigrant communities in Riga's inner-city core across micro-, meso-, and macro-scales. Empirically, the study illuminates the changing migration dynamics within a post-socialist urban environment, leveraging Riga's distinctive demographic profile. By providing a fine-grained, scale-sensitive perspective on contemporary ethnic residential patterns, this analysis addresses a significant gap in the literature, particularly concerning newer immigrant populations in post-socialist cities. Furthermore, the findings contribute to a more nuanced understanding of ethnic community spatial organization—a subject of increasing public and political concern in Latvia—and hold important policy implications for anticipating and mitigating spatial inequalities as these emerging communities grow.

This paper is structured as follows. Section 2 reviews the literature on immigration and ethnic residential segregation. Section 3 introduces the study area, providing its historical and contemporary context. Section 4 details our methodology. Section 5 presents the empirical results. Finally, Section 6 discusses the implications of these findings, and Section 7 concludes the paper.

2 Immigration and ethnic residential segregation

As a persistent form of spatial inequality with profound social implications, ethnic residential segregation remains a central theme in urban studies. Residential segregation, broadly defined as the spatial separation of social groups along dimensions such as ethnicity, socioeconomic status, and age (Andersson et al., 2018), is intrinsically linked to shifts in urban residential configurations driven by international migration. Consequently, there is a link between a city's level of immigration and its degree of ethnic segregation (Skifter Andersen et al., 2016).

Although the discourse on ethnic residential segregation in European contexts is scarce, a key debate concerns the relative weight of its causal factors. Evidence points toward the significance of residential preferences and voluntary self-segregation, where individuals choose to live near co-ethnics for social support, cultural familiarity, or perceived safety (Bolt, 2009; Malmberg and Clark, 2021). However, structural and economic constraints, including housing market discrimination, affordability issues, and information barriers (Bolt et al., 2010), are also acknowledged as significant contributing factors, particularly shaping the residential outcomes of more vulnerable populations.

The intersection of socioeconomic status and ethnicity is crucial in reinforcing spatial segregation, as a lower socioeconomic status can significantly limit housing choices (Imeraj et al., 2018). This dynamic is particularly relevant in contexts with rising socioeconomic disparities, as observed across parts of Europe, including Eastern Europe (Marcińczak et al., 2015;

Lichter et al., 2020), even where overall urban ethnic residential segregation was comparatively low in the early 21st century (Musterd, 2005). The complexity of this intersection is evident in Southern European cities, where low spatial segregation often paradoxically reflects high social segregation due to an exclusionary, owner-dominated housing system (Arbaci, 2007). Consequently, the degree of socioeconomic integration represents an important set of constraints and opportunities that influence the initial and subsequent residential patterns of emerging immigrant populations.

Furthermore, empirical research consistently reveals differentiated segregation experiences across migrant groups. Notably, migrants of non-European origin often exhibit higher levels of spatial concentration in European cities compared to their European counterparts (Malmberg et al., 2018; Lichter et al., 2020), a trend also observed among smaller non-European groups in Krakow (Stonawski et al., 2022a). This is frequently attributed to initial settlement patterns, where newcomers facing precarious socioeconomic circumstances settle in established areas with existing co-ethnic support networks (Imeraj et al., 2018). The combination of socioeconomic vulnerability and greater cultural distance can thus foster distinct concentration patterns. Understanding these dynamics is vital for analyzing the residential geographies of diverse migration flows arriving in cities like Riga, where they interact with a demographic landscape shaped by a Latvian majority and large, established post-Soviet minority populations.

High levels of residential concentration, as a result of preference and constraint across socioeconomic and cultural dimensions, can lead to the formation of ethnic enclaves. These spaces can function ambivalently (Catney, 2016): offering initial vital resources, social capital, and a buffer against discrimination for newcomers (Harris, 2023), while potentially limiting wider social networks and long-term socioeconomic mobility (Hack-Polay, 2019). Strong concentrations of specific ethnic groups may also influence the residential decisions of other populations. While the term "white flight" carries specific historical connotations, broader processes of majority population avoidance or relocation from diversifying, predominantly non-European neighborhoods, driven by factors ranging from prejudice to preferences for social homogeneity or perceived changes in neighborhood status, have been observed in various European contexts (Bolt, 2009; Hårsman, 2006; Malmberg and Clark, 2021; Stonawski et al., 2022b). While this study's focus on a single time point cannot track such dynamics longitudinally, mapping the current multi-scalar concentrations of emerging non-European groups in Riga's inner-city core provides a crucial baseline for understanding potential future shifts in the residential distribution of all population segments within the area.

Ultimately, the spatial organization of ethnic groups has far-reaching consequences for migrants' individual opportunity structures and the overall trajectory of urban development. Residential location significantly shapes access to opportunities (employment, education, healthcare), exposure to risks (crime), and potential for social cohesion, or tension, with segregation amplifying these effects (Kaplan and Douzet, 2011). Furthermore, segregation reduces inter-ethnic contact and increases the risk of neighborhood stigmatization (Malmberg et al., 2018), contrasting with the benefits of ethnic mixing and diversification. Understanding how patterns of concentration and isolation for emerging ethnic groups vary across different spatial scales within Riga's rapidly diversifying inner-city core is therefore paramount for developing informed urban policies aimed at fostering equitable integration and mitigating potential spatial inequalities.

3 Study area: Riga's inner-city core

This study focused on the inner-city core of Riga, the capital of Latvia. This area, encompassing the historic Old Town and six adjacent neighborhoods (Centrs, Avoti, Grizinkalns, Brasa, Skanste, Petersala-Andrejsala), forms a distinct geographical and social unit within the city. The inner-city core of Riga is characterized by a predominantly regular street network, with residential neighborhoods that trace their origins to the early 20th century, prior to the onset of the First World War. The delineation of these neighborhoods largely aligns with the street network and the prevailing pattern of urban development (Figure 1). On the outskirts of the inner-city core, to the south and east lie former working-class residential districts and erstwhile manufacturing sites. In contrast, the northern areas comprise the former port, industrial, and railway territories.

Our focus on this area was based on three primary rationales. First, as demonstrated in previous research (Balode and Bērziņš, 2025) and corroborated by recent census data, Riga's inner-city core exhibits the most significant concentration and growth of newly emerging non-European ethnic minority groups compared to the rest of the city and country. Second, the area's unique urban morphology, which is largely characterized by 19th and early 20th-century architecture, creates a distinct built environment that contrasts sharply with the Soviet-era mass housing estates in surrounding neighborhoods, making it potentially more appealing to immigrant populations. Third, the inner core is geographically delineated by major railway lines and the Daugava River, creating a degree of spatial enclosure that limits social interactions and reinforces its suitability as a discrete analytical unit.

The administrative neighborhoods constituting the inner-city core display considerable heterogeneity in spatial extent (ranging from 94 to 373 hectares) and population size (1,900 to 30,700 residents in 2021). This results in substantial variations in population density (8.7 to 98.4 inhabitants per hectare), highlighting the potential pitfalls of using administrative boundaries for spatial analysis due to the Modifiable Areal Unit Problem (MAUP), encompassing both scale and zoning effects (Openshaw, 1996). This internal variability necessitates methods robust to these challenges.

3.1 Riga's inner-city core: from post-socialist legacies to fragmented gentrification

This subsection provides essential background on Riga's inner-city core, outlining the historical legacies, contemporary migration and socioeconomic trends, and housing characteristics that shape

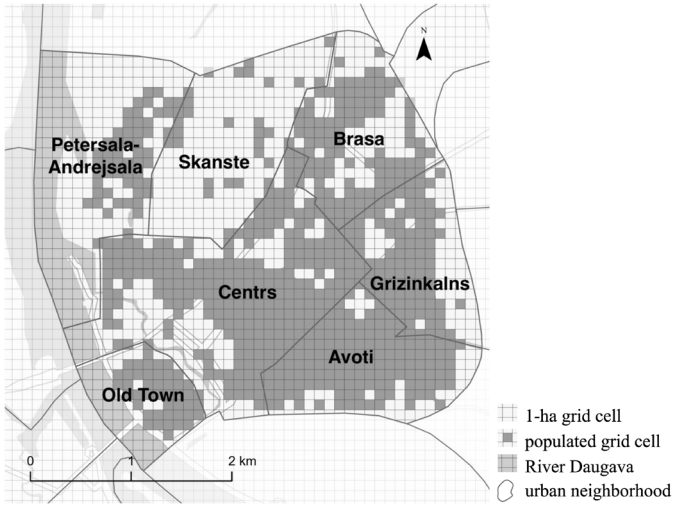


FIGURE 1
Study area: a grid of populated 100 m x 100 m cells and administrative neighborhoods of Riga's inner-city core.

the context for analyzing the residential patterns of emerging ethnic groups.

As Latvia's capital and primary economic hub, Riga's development has been significantly shaped by historical processes. During the Soviet era (1940–1991), the city experienced substantial in-migration, predominantly of Russian speakers, fundamentally altering its demographic composition. Understanding contemporary residential patterns requires acknowledging these legacies, particularly the Soviet-era housing allocation policies, subsequent large-scale privatization processes following independence, and a persistently underdeveloped social housing sector (Krišjāne et al., 2019). Notably, Soviet-era migrants usually possessed relatively high socioeconomic status (Bolt et al., 2010), and, consequently, Riga historically exhibited relatively low levels of both socioeconomic and ethnic residential segregation, lacking the pronounced ethno-social hierarchy similar to other post-socialist cities (Krišjāne et al., 2015; Hess et al., 2018). However, the emergence of new, post-independence migration flows necessitates a critical re-evaluation of ethnic segregation dynamics (Tammaru et al., 2016).

Latvia, like many Central and Eastern European (CEE) nations, fits within migration cycle theory as a country with relatively recent international migration patterns, characterized by a predominance of first-generation migrants (Arango, 2018). Migration policies are increasingly influenced by European Union directives, yet the specific trajectories of CEE countries are unlikely to simply replicate those of established Western European immigration nations due to recency of migrant reception, differing historical contexts, global positioning, and structural economic and social characteristics. Post-socialist cities across the region are witnessing new patterns of immigration (Křížková and Šimon, 2022), raising concerns about the potential for increased ethnic residential segregation as immigration levels rise.

The post-socialist transition to capitalism in Riga has coincided with increasing socio-spatial disparities, particularly evident within the inner city (Krišjāne and Bērziņš, 2014). Examining the interplay between contemporary immigration, ethnic change, and gentrification processes is therefore crucial, though it remains an understudied nexus. Existing international research often indicates a positive correlation between higher immigration rates and gentrification processes, particularly where less affluent neighborhoods experience ethnic diversification alongside urban renewal (Hwang, 2015). In-migration can stimulate housing demand, potentially leading to price escalation, subsequent in-migration of higher-income residents, and displacement pressures on lower-income populations (Haase et al., 2020; Malmberg and Clark, 2021). This highlights the complex role ethnic minorities can play as both potential victims and sometimes inadvertent agents of neighborhood change (Huse, 2018). Furthermore, fragmented socio-spatial transformations, encompassing marginal gentrification alongside non-EU migrant settlement, may intensify social divisions, especially if gentrifiers exhibit limited cross-ethnic social engagement while immigrants rely more heavily on neighborhood-based social networks (Malheiros et al., 2013).

Illustrating these dynamics, recent socio-demographic data (Table 1) revealed growing divergence between Riga's inner-city core and the rest of the city. Between 2011 and 2021, the inner core experienced significantly slower overall population decline, partly because of the smaller share of long-established declining ethnic groups and new in-migration. The inner core

TABLE 1 Demographic and socioeconomic characteristics of Riga's inner-city core and rest of the city in 2021, with changes from 2011 to 2021.

	Inner-city core (2021)	Change 2011–2021 (%)	Rest of the city (2021)	Change 2011–2021 (%)
Inhabitants (thousands)	82.3	−1.1	534.5	−7.1
Average age	38.8	−2.3	43.1	3.6
% of 15- to 44-year-olds	43.3	−4.6	36.1	−11.4
Income and education				
Median monthly net salary (EUR)*	837.9	129.7	718.6	123.7
Highest education**	52.7	24.9	38.7	22.1

*Reported annually, non-equalized.
**Share of permanent residents aged 18 and over who have highest education or doctorate degree.
Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).

TABLE 2 Housing profiles of Riga inner-city core neighborhoods: new-built (post-2011) and rental housing shares.

		% of residents in new-built housing	% of rental housing
Inner-city core neighborhoods	Avoti	0.3	48.0
	Brasa	2.2	27.4
	Centrs	1.7	37.8
	Grizinkalns	0.5	44.7
	Petersala-Andrejsala	8.6	20.8
	Skanste	50.3	18.3
	Old town	0.0	33.7
Riga avg.		2.7	17.4

Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).

also exhibited a younger population profile, which was also influenced by a notable surge among non-European residents in younger age classes—particularly males aged 15–29, suggesting an influx of international students (Apsite-Berina et al., 2023), and females aged 20–39 (Central Statistical Bureau of Latvia, 2025). Critically, markedly elevated median monthly net salaries and higher educational attainment levels in the inner core signaled a widening socioeconomic gap compared to the rest of Riga. This concentration of relative affluence risks exacerbating inequalities through differentiated housing markets, service provision, and urban policy outcomes.

The housing landscape within Riga's inner-city core is far from uniform, exhibiting significant heterogeneity at the administrative neighborhood level (Table 2). New-build gentrification appeared significant but spatially limited; only two neighborhoods showed a proportion of residents in new-build housing (post-2011) significantly above the city average (50.3% and 8.6% vs. city average of 2.7%). Such new developments can sometimes contribute to increased ethnic segregation (van Gent and Hochstenbach, 2020). The remaining inner-city neighborhoods, while displaying lower levels of new construction, have often experienced façade renovations and other forms of marginal gentrification.

A key characteristic was the high proportion of rental housing, which exceeded twice the city average in most inner-city neighborhoods. This prevalence of rental accommodation facilitates settlement for newcomers, contributing to the formation of "urban arrival spaces". These areas are often characterized by diverse international populations, high residential mobility (in- and out-migration), a concentration of disadvantaged residents, and relatively lower rents, though spatial outcomes remain strongly influenced by housing market dynamics (Hans et al., 2019; Haase et al., 2020). Notably, the neighborhoods featuring the highest share of new buildings tended to exhibit the lowest proportion of rental housing. This heterogeneous housing stock—encompassing older buildings, renovated structures, limited new builds, and extensive rental options—fundamentally shapes the opportunities and constraints faced by emerging ethnic groups seeking residence within Riga's inner-city core.

4 Data and methods

4.1 Data source and preparation

The primary data source for this analysis was the 2021 Population and Housing Census of Latvia, provided by the Central Statistical Bureau (CSB) of Latvia. We utilized anonymized, individual-level census records geo-referenced to precise residential locations. For analytical purposes, these individual data points were aggregated into a regular grid network of 1-hectare (100 m x 100 m) cells covering the study area (Figure 1). This grid-based approach provided spatially consistent units, overcoming the limitations of varying administrative boundary sizes.

The 2021 census identified 330 distinct ethnic groups based primarily on self-identified affiliation, usually tracing direct ancestral lineage. For this study, we focused on the spatial distribution of the two largest established populations (Latvians and Russians) and the three most rapidly expanding emerging ethnic groups identified in the inner core (Indians, Uzbeks, and Vietnamese). A key limitation of the census data is the lack of provision for mixed-ethnic identification and the inclusion of "unspecified" and "unknown" categories. The number of people who did not declare their ethnicity increased by about 5 times between the 2011 and 2021 censuses, and the share of non-responses/non-selection to the ethnicity question in the total population reached 4.4% in 2021 compared to 0.7% in 2011.

Recent demographic trends between 2011 and 2021 underscored the rationale for focusing on these specific groups. City-wide, the combined proportion of the five historically largest ethnic groups (Latvians, Russians, Belarusians, Ukrainians, and Poles) in Riga decreased from 96% to 92%, indicating a gradual decline in the dominance of established communities (Central Statistical Bureau of Latvia, 2025). Against this backdrop,

the inner-city core exhibited distinct dynamics, which can be characterized by two key movements detailed in Table 3. First, the absolute populations of all established ethnic communities, except Ukrainians, declined within the inner core, but despite the numerical decrease, the proportional share of Latvians in the inner core remained high and stable (64.9% in 2021), far exceeding their share in the rest of Riga (44.6% in 2021). Second, emerging communities from outside Europe experienced exceptionally high relative growth within the inner core. Indian, Uzbek, and Vietnamese populations grew by 95.7%, 89.8%, and 99.1% respectively. Although starting from a very low baseline, this rapid influx led to a substantial increase in their proportional representation (up to 16-fold). This observed demographic shift, characterized by the decline of established populations alongside the rapid, concentrated growth of specific non-European groups, marked the inner core as a key site of transformation warranting detailed multi-scalar analysis of their residential geographies, especially considering their recent arrival and potential socioeconomic vulnerabilities.

4.2 Addressing scale dependency: the k-nearest neighbors (k-NN) approach

To address the research questions regarding concentration, isolation, and segregation across varying spatial scales, and to mitigate the MAUP inherent in fixed administrative units, we employed a multi-scalar analytical approach based on k-nearest neighbors (k-NN), facilitated by advancements in software and high-resolution data availability.

The k-NN method was selected as it effectively mitigates the MAUP, enables nuanced multiscale analysis, and enhances inter-study comparability (Marcińczak et al., 2023). Multiscale measures derived from this approach reflect individual exposures to socio-spatial contexts, thereby providing a more comprehensive understanding of the multiscale nature of geographical context (Petrović et al., 2018). The k-NN method has proven instrumental in revealing subtle ethnic segregation patterns, as evidenced by numerous empirical studies, where residential segregation can simultaneously increase at one spatial scale while decreasing at another (Šimon et al., 2023). Segregation varies across contextual dimensions—including inter- and intra-city differences shaped by policies—as well as scalar and ethnic-group-specific dimensions driven by individual and institutional forces, with k-NN facilitating micro- and meso-level analyses that help to reveal highly localized concentrations, which are often masked at broader spatial scales (Malmberg et al., 2018; Marcińczak et al., 2023; Nielsen and Hennerdal, 2017; Sleutjes et al., 2018). In our study, the application of k-NN method facilitated a more comprehensive examination of the residential patterns of emergent ethnic groups at the inner-city core. Nonetheless, we recognize the conclusions of other researchers that this methodology does not encompass all potential advantages and does not entirely resolve the existing MAUP, as the current continuous grid coverage overlooks several physical aspects of the urban environment (Amcoff, 2025). While physical geographical constraints on mobility may influence meso-scale indices (Östh and Türk, 2020), this effect is considered mitigated within our study area, as discussed previously.

The k-NN method constructs local environments, or "bespoke neighborhoods", around each individual (or in this case, each grid cell centroid) based on population proximity rather than predefined boundaries. For each 1-hectare grid cell, the neighborhood is formed by expanding outwards until a specified population size (k) of nearest residential neighbors (individuals) is encompassed. This approach creates individualized, overlapping neighborhoods defined by the user-specified k-values, effectively mitigating MAUP and allowing for a nuanced assessment of segregation patterns across a continuum of spatial scales.

We implemented this approach using the EquiPop Flow software (Östh, 2024). Calculations were performed for eight different k-values: 50, 100, 200, 400, 800, 1,600, 3,200, and 6,400 nearest neighbors. This range allows examination of patterns from highly localized micro-scales (e.g., $k = 100$, representing local neighborhood) to broader meso- and macro-scales (e.g., $k = 6{,}400$, representing broader community) (Östh et al., 2015; Östh and Türk, 2020). Within Riga's inner-city core, these k-values corresponded to neighborhoods with average radii ranging from approximately 36 meters ($k = 50$) to 607 meters ($k = 6{,}400$), and areas from 0.4 hectares to 115.8 hectares, respectively, reflecting the varying spatial extents captured by different scales.

4.3 Quantitative indices

To measure different dimensions of spatial distribution, we calculated three indices for each of the five ethnic groups (Indians, Uzbeks, Vietnamese, Latvians, and Russians) at each analytical scale (k-value). The selected indices were the location quotient (LQ), the spatial isolation index (SII), and the index of segregation (IS), following the methodology of Tammaru et al., 2016 and van Ham et al. (2021), adapted for the k-NN context based on the methodology of Imeraj et al. (2018).

Location quotient (LQ) measures the relative concentration of an ethnic group within a specific k-NN neighborhood compared to the group's overall representation in the inner-city core study area. It identifies areas of over- or under-representation at different scales. The formula is:

$$\mathbf{LQ_{i,k}} = \frac{\mathbf{x_{i,k}}}{\mathbf{k}} \div \frac{\mathbf{X}}{\mathbf{T}} \tag{1}$$

where $x_{i,k}$ is the ethnic group size in neighborhood i with k-nearest neighbors; k is the number of nearest neighbors; X is the total ethnic group size in the study area; T represents the total population of the study area, serving as a benchmark to determine whether an ethnic group is more or less concentrated in an individualized neighborhood compared to its average presence across the entire study area. Consistent with Brown and Chung (2006), we defined a LQ range between 0.85 and 1.20, where a value of 1.20 or above indicates significant concentration and a value of 0.85 or below indicates under-representation.

Spatial isolation index (SII) measures the probability of an individual from an ethnic group encountering another individual from the same group across k-NN neighborhood. It reflects

TABLE 3 Changes in ethnic group composition and distribution in Riga's inner-city core and the rest of the city, 2011–2021.

		% population*				% change	
		Inner-city core		Rest of the city		Inner-city core	Rest of the city
		2011	2021	2011	2021	2011–2021	2011–2021
	Latvians	64.7	64.9	43.7	44.6	−3.5	−5.5
	Ethnic minorities	35.3	35.1	56.3	55.4	−4.3	−9.0
Declining ethnic groups	Russians	71.0	59.8	75.3	69.1	−19.4	−16.5
	Ukrainians	5.6	6.3	6.5	6.6	7.0	−7.8
	Belarusians	5.0	4.8	7.4	7.1	−8.9	−13.3
	Poles	3.8	3.4	3.4	3.2	−13.2	−14.0
	Jews	4.0	2.7	1.1	0.8	−35.3	−35.7
	Lithuanians	1.9	1.8	1.5	1.5	−9.5	−11.6
Growing ethnic groups	Vietnamese	0.0	0.4	0.0	0.0	99.1	83.8
	Indians	0.1	1.6	0.0	0.2	95.7	88.9
	Uzbeks	0.1	0.9	0.0	0.3	89.8	80.7
	Chinese	0.1	0.2	0.0	0.0	76.9	82.1
	French	0.2	0.5	0.0	0.0	60.5	59.2
	Azeris	0.2	0.4	0.3	0.3	47.2	−10.9

Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).
*Share of specific ethnic groups is calculated as a proportion of all ethnic minorities, i.e., excluding Latvians and those whose ethnic group is unspecified or unknown.

the degree of potential intra-group interaction within localized environments. The formula is:

$$\mathbf{SII_k} = \frac{\sum_{i=1} \left(\mathbf{x_{i,k}} \times \frac{\mathbf{x_{i,k}}}{\mathbf{k}}\right)}{\sum_{i=1} \left(\mathbf{x_{i,k}}\right)} \quad (2)$$

where k is the number of nearest neighbors; $x_{i,k}$ is the ethnic group size in neighborhood i with k-nearest neighbors; $\frac{x_{i,k}}{k}$ is the proportion of the ethnic group in neighborhood i with k-nearest neighbors. Values range from 0 (0% likeliness of encountering a co-ethnic neighbor) to 1 (100% certainty of encountering only co-ethnic neighbors).

Index of segregation (IS) measures the degree to which an ethnic group's spatial distribution across k-NN neighborhoods differs from that of the rest of the population. The formula is:

$$\mathbf{IS_k} = 0.5 \sum_{i=1} \left| \frac{\mathbf{x_{i,k}}}{\mathbf{X}} - \frac{\mathbf{k} - \mathbf{x_{i,k}}}{\mathbf{T} - \mathbf{X}} \right| \quad (3)$$

where $x_{i,k}$ is the ethnic group size in neighborhood i with k-nearest neighbors; X is the total ethnic group size in the study area; k is the number of nearest neighbors; T is the total population in the study area. Values range from 0 (perfect integration), where the group's distribution mirrors that of the rest of population, to 1 (complete segregation), where the group is exclusively concentrated.

We calculated the segregation indices using the Geo-Segregation Analyzer v.1.2. (Apparicio et al., 2014) and performed all subsequent spatial analysis and map production in ArcGIS Pro.

5 Results

The multi-scalar analytical strategy employed in this study yielded significant insights into the contemporary residential geographies of Riga's inner-city core, revealing stark contrasts between established populations and emerging ethnic communities, thereby addressing the central research questions regarding scale-dependent concentration, isolation, and segregation. The findings, derived from location quotient (LQ), spatial isolation index (SII), and index of segregation (IS) analyses of 2021 census data processed through a k-nearest neighbor framework, not only quantified current patterns but also situated them within Riga's unique post-socialist context and the broader dynamics of new migration in Central and Eastern Europe.

5.1 Aggregate concentrations and ethnic geographies

LQ analysis underscored the divergent spatial concentration processes operating within the inner core. The relatively even distribution of the established Latvian and slightly more concentrated Russian populations, exhibiting low and scale-stable maximum LQ values (Figure 2), aligned with Riga's historical legacy of comparatively low ethno-social segregation documented in the literature. Conversely, the emerging Indian, Uzbek, and Vietnamese communities demonstrated patterns characteristic of recent migration flows concentrating in specific urban locales and were highly sensitive to scale. Their exceptionally high maximum LQ values at micro- and meso-scales, despite more

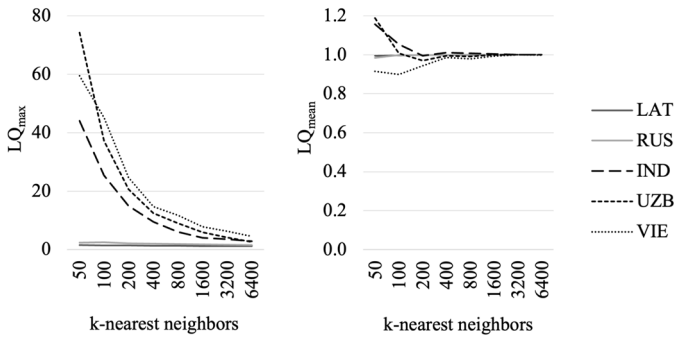


FIGURE 2
Maximum and mean location quotient in inner-city core of Riga, by ethnic group and k-nearest neighbors in 2021. Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).

moderate, seemingly balanced mean LQs—a consequence of zero presence in many generally populated local units—signified intense clustering rather than widespread integration. This finding validated the necessity of the multi-scalar methodology adopted, as aggregate measures or single-scale analyses would obscure the profound localized overrepresentation shaping the initial settlement geography of these newcomers.

Spatial mapping across varying scales (k = 200, 800, 6,400; Figure 3) further illuminated the distinct territorial expressions of these groups within Riga's transforming inner-city landscape. While all emerging groups exhibited high concentration clusters at all scales, their specific geographies differed: Indians showed clustering across several neighborhoods with a notable locus in the southwest, including Old Town, and balanced representation in the southeast; Uzbeks displayed partial overlap with Indians but were underrepresented in the east and also showed a distinct presence near established Russian communities in the north, particularly the western section; Vietnamese presented the most spatially confined pattern, concentrated strongly in the southeast across all scales. In contrast, at the micro- and meso-scale, both Indians and Uzbeks showed clusters of over- and underrepresentation across most study area, indicating localized concentrations within a broader distribution. Crucially, the macro-scale analysis revealed a convergence zone in the southern inner core for all studied groups. This area aligned with the characteristics of an "urban arrival space" identified in the contextual analysis—marked by higher residential density and rental housing prevalence indicative of transient populations, relative affordability attracting diverse socio-economic strata, and fragmented gentrification manifesting as uneven urban redevelopment—suggesting its pivotal role in accommodating diverse contemporary inflows.

Beyond this convergence, the divergent spatial patterns offered insights into the complex interplay of preferences, constraints, and ethnic infrastructure shaping settlement. The Indian concentration may reflect attraction to specific urban amenities, whereas the Uzbek proximity to Russian populations potentially indicates leveraging existing linguistic and social networks, consistent with Křížková and Šimon (2022) observations on the role of prior migration history on the availability of ethnic infrastructure. Simultaneously, the apparent spatial avoidance patterns—Latvians underrepresented near Russians, and Russians underrepresented where emerging groups concentrate—provided empirical traces of the potential socio-spatial separation within this diversifying post-socialist context, possibly linked to the broader processes of socio-economic divergence and gentrification previously discussed.

5.2 Spatial isolation and segregation

Turning to quantitative measures of isolation and segregation, the findings reinforced the scale-dependent nature of these phenomena. The SII indicated relatively stable potential for intra-group contact for established groups across scales, while for emerging groups, the higher, yet low probability of encountering co-ethnics within immediate micro-neighborhoods diminished to zero probability in broader contexts (Figure 4). Vietnamese consistently exhibited the highest isolation, reflecting their tight geographical clustering.

The IS demonstrated a markedly greater sensitivity to scale variation and inter-group variations than the SII and revealed profound levels of spatial separation for emerging groups, particularly at finer scales (Figure 4). Micro-scale IS values exceeding 0.7 starkly quantified the local unevenness, standing 3–4 times higher than those for Latvians and Russians and confirming the emergence of significant segregation patterns despite Riga's historical context of low ethnic segregation. The pronounced scale sensitivity of the IS, decreasing significantly but remaining high even at macro-scales (more than 2 times higher than those for Latvians and Russians), underscored the critical importance of the multi-scalar approach adopted. It is also important to note a methodological nuance: indices like the IS are sensitive to group size and can produce inflated values when applied to small ethnic populations at a fine neighborhood level, as minor clustering of a small group can result in a distribution that appears highly

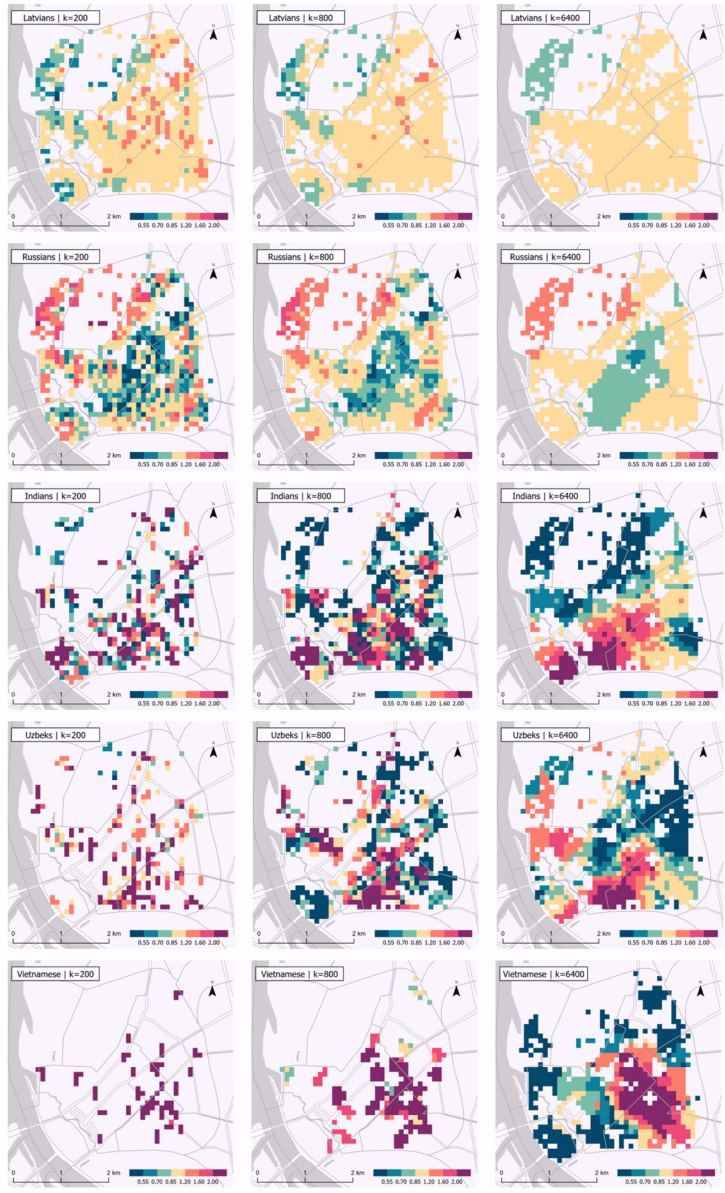


FIGURE 3
Distribution of location quotients of Latvians, Russians, Indians, Uzbeks, and Vietnamese in the inner-city core of Riga among 200, 800, and 6,400 nearest neighbors in 2021. Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).

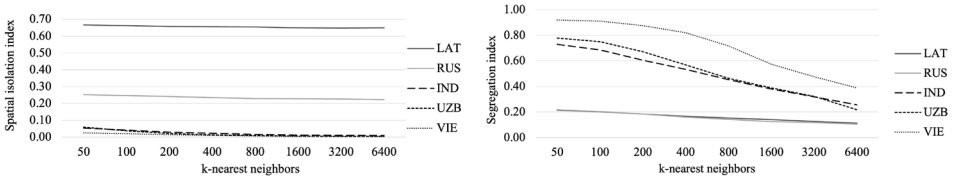


FIGURE 4
Spatial isolation index and segregation index in the inner-city core of Riga, by ethnic group and k-nearest neighbors in 2021. Source: Authors' calculations based on Central Statistical Bureau of Latvia (2025).

uneven (Stonawski et al., 2022a). Furthermore, the differential rates at which IS declined for each emerging group—highest for Uzbeks and lowest for Vietnamese—suggests that segregation intensity and its scale-dependency are influenced by complex factors beyond mere group size, likely including cultural differences and underlying socioeconomic vulnerabilities discussed earlier. This observation is supported by the work of Stonawski et al. (2022a), who also identified that even groups of a similar size can experience highly different levels of concentration.

In essence, these results painted a complex picture of Riga's inner-city core undergoing dynamic diversification. While the established groups maintained patterns resonant with historical integration, emerging communities were carving out distinct, highly concentrated, and significantly segregated niches within the urban fabric. The intensity and nature of these patterns were profoundly scale-dependent, highlighting the necessity of nuanced, multi-scalar analysis for understanding contemporary urban segregation processes, particularly within the evolving context of new migration to post-socialist European cities.

6 Discussion

The empirical findings of this study, which revealed high, scale-dependent residential segregation for emerging ethnic groups within Riga's inner-city core, necessitate a critical engagement with established theoretical frameworks, particularly spatial assimilation theory. While this theory posits a gradual dispersal from initial co-ethnic clusters contingent upon cultural and socioeconomic integration, the patterns observed in Riga present risks of growing spatial inequalities. Although it remains early to ascertain long-term outcomes, the intensity of emerging ethnic group local clustering raises important questions about the future socio-spatial fabric of the city.

The uncertainty surrounding the assimilation pathway for Riga's emerging groups is further amplified by broader empirical evidence questioning the universality and pace of spatial integration. Literature consistently highlights persistent ethnic hierarchies and limitations on upward spatial mobility, particularly for non-European migrants, even when controlling for income gains (Wessel et al., 2017; Kadarik, 2020). Other studies indicate that ethnic desegregation can occur based on upward economic status (Catney and Simpson, 2010; Catney, 2016), however, when it occurs, is often a slow process, spanning more than a decade and typically involving only a fraction of an immigrant cohort (Andersen, 2016; Vogiazides and Chihaya, 2020), with assimilation potentially proceeding even more gradually for groups originating from lower-income or culturally distinct countries (Murayama and Nagayasu, 2021). A similar pattern has also been observed in Prague, where groups with greater cultural and socio-economic distance from majority population exhibit higher residential segregation (Šimon et al., 2023). These insights are highly pertinent to Riga, suggesting that the pronounced initial clustering observed for Indians, Uzbeks, and Vietnamese may reflect not only voluntary self-segregation but also structural barriers, making a smooth transition toward dispersal unlikely without targeted interventions.

The concentration of emerging groups within specific inner-city areas identified as "arrival spaces"—characterized by higher rental housing prevalence and relative affordability—underscores the critical mediating role of the housing market (Hans et al., 2019). As noted by Imeraj et al. (2018), liberalized private housing markets can inadvertently exacerbate ethnic concentration. This context renders simplistic policy solutions, such as promoting mixing solely based on socioeconomic criteria, potentially ineffective or even counterproductive. Such approaches often underestimate systemic barriers like discrimination and can yield unintended consequences, including accelerated gentrification or deepening segregation within specific housing tenures (Bolt et al., 2010). The findings for Riga highlight this complexity; for instance, the spatial patterning of the Uzbek community, partially overlapping with areas of higher Russian concentration, suggests a significant influence of pre-existing ethnic infrastructure, a factor often overlooked in standard mixing policies. Therefore, effective integration strategies need to be sensitive to the multi-scalar nature of the observed segregation, acknowledge the importance of ethnic networks and infrastructure, confront potential discrimination, and operate within the realities of Riga's specific post-socialist housing legacies and ongoing fragmented gentrification. Ultimately, effective strategies must address the structural inequalities, housing market dynamics, and potential discriminatory barriers that shape residential outcomes to foster genuine integration opportunities within this evolving urban landscape.

7 Conclusions

This study presented a geographically detailed analysis of ethnic residential patterns within the inner-city core of Riga, focusing

on emerging ethnic groups. By utilizing individualized scalable neighborhoods, we addressed key research questions concerning the scale-dependent nature of concentration, spatial isolation, and segregation. In answer to our first research question, the analysis demonstrated high levels of residential concentration for emerging groups (Indians, Uzbeks, Vietnamese), particularly at micro-scales and manifesting spatially as distinct clustering, which contrasted sharply with the relative dispersal of established groups. Addressing the second question, the analysis revealed high segregation for emerging groups, particularly at local scales, which decreased substantially yet remained elevated at broader scales. Spatial isolation, while lower overall, also showed scale dependence for these groups, decreasing from micro- to macro-scales. Together, these findings revealed patterns of large variability across spatial scales and ethnic groups, and with indices tending to decrease as the scale broadens, confirmed the most pronounced segregation is at the hyper-local level. This study confirmed that substantial variability across scales persists even within a relatively compact urban zone, underscoring the importance of methodological approaches that capture this complexity.

Furthermore, distinct geographical patterns emerged, including the clustering of emerging groups in an "arrival space" within the south of Riga's inner-city core, aligning with observations in other European settings on "urban arrival spaces", where ethnically diverse populations, elevated rates of population turnover, and comparatively lower rents foster residential areas favorable to immigrants (Haase et al., 2020; Gerten et al., 2023). The noted overlap between Uzbeks and Russians also suggests the influence of pre-existing ethnic infrastructure. These findings indicated that both self-segregation and place stratification mechanisms may be at work, potentially leading to challenges related to socio-spatial inequalities and complicating straightforward spatial assimilation narratives, especially given the uncertain assimilation trajectories for non-European immigrants (Drouhot and Nee, 2019; Zuccotti, 2019).

Our findings contribute significantly to understanding ethnic residential patterns in this specific urban context of urban shrinkage and post-socialist transition and lay groundwork for observing the progression of ethnic residential patterns in Riga as the city continues to experience increased diversity. Acknowledging the time-bound scope of this analysis, which cannot definitively assess residential trajectories, future longitudinal studies are pivotal to determine if current patterns represent a temporary stage or more entrenched segregation. Moreover, research incorporating activity spaces and daily mobility patterns would yield a more holistic understanding of inter-ethnic interactions beyond residential areas, thus addressing the limitation of this study's emphasis on nighttime segregation (Silm and Ahas, 2014).

Ultimately, our findings suggest that although emerging ethnic groups currently represent a relatively small segment of Riga's population, their further expansion and significant spatial concentration within the inner-city core may presage challenges related to socio-spatial inequalities. Thus, the results carry substantial policy implications, underscoring the need for policymakers to acknowledge the multi-scalar and potentially enduring nature of segregation for emerging groups. Rather than presuming that spatial assimilation will naturally transpire over time, policies should address structural inequalities and specific housing obstacles faced by non-European immigrants in securing housing across diverse neighborhoods, moving beyond simplistic socio-economic mixing approaches. As Riga and similar Central and Eastern European cities navigate increasing diversity, developing a nuanced, scale-sensitive understanding of ethnic segregation, supported by appropriate methodological approaches, is essential for promoting inclusive urban development and social cohesion.

Data availability statement

The georeferenced census data utilized in this study are governed by an agreement between the Central Statistical Bureau of the Republic of Latvia and the University of Latvia. Disaggregated ethnic data are deemed sensitive, and their dissemination may potentially compromise individual privacy. The data in question were anonymized and processed in compliance with a confidentiality agreement, adhering to all data protection, privacy regulations, and contractual obligations. For further information regarding data usage, please contact maris.berzins@lu.lv.

Author contributions

SB: Methodology, Writing – original draft, Investigation, Visualization, Validation, Formal analysis, Software, Writing – review & editing. MB: Data curation, Formal analysis, Conceptualization, Writing – review & editing, Supervision, Writing – original draft.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This work was supported by the Recovery and Resilience Facility Project "Internal and External Consolidation of the University of Latvia" Under Grant No. 5.2.1.1.i.0/2/24/I/CFLA/007.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Gen AI was used in the creation of this manuscript. During manuscript preparation, the AI language model Gemini Advanced 2.5 Pro (Google) was utilized for language editing.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated

organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Amcoff, J. (2025). Reflections on the use of k-nearest neighbour bespoke neighbourhoods in urban studies. *Tijdschr. Econ. Soc. Geogr.* doi: 10.1111/tesg.70001

Andersen, H. S. (2016). Spatial assimilation? The development in immigrants' residential career with duration of stay in Denmark. *J. Hous. Built Environ.* 31, 297–320. doi: 10.1007/s10901-015-9459-0

Andersson, E. K., Lyngstad, T. H., and Sleutjes, B. (2018). Comparing patterns of segregation in north-western Europe: a multiscalar approach. *Eur. J. Popul.* 34, 151–168. doi: 10.1007/s10680-018-9477-1

Apparicio, P., Martori, J. C., Pearson, A. L., Fournier, É., and Apparicio, D. (2014). An open-source software for calculating indices of urban residential segregation. *Soc. Sci. Comput. Rev.* 32, 117–128. doi: 10.1177/0894439313504539

Apsite-Berina, E., Robate, L. D., Berzins, M., Burgmanis, G., and Krisjane, Z. (2023). International student mobility to non-traditional destination countries: evidence from a host country. *Hung. Geogr. Bull.* 72, 143–157. doi: 10.15201/hungeobull.72.2.3

Arango, J. (2018). "Early starters and latecomers," in *European Immigrations* (Amsterdam: Amsterdam University Press).

Arbaci, S. (2007). Ethnic segregation, housing systems and welfare regimes in Europe. *Eur. J. Hous. Policy* 7, 401–433. doi: 10.1080/14616710701650443

Balode, S., and Bērziņš, M. (2025). *Exploring Patterns of Ethnic Diversification and Residential Intermixing in the Neighborhoods of Riga*. Preprints. Available online at: https://www.preprints.org/manuscript/202505.1034/v1 (Accessed June 5, 2025).

Bolt, G. (2009). Combating residential segregation of ethnic minorities in European cities. *J. Hous. Built Environ.* 24, 397–405. doi: 10.1007/s10901-009-9163-z

Bolt, G., Phillips, D., and Van Ronald, K. (2010). Housing policy, (de)segregation and social mixing: an international perspective. *Hous. Stud.* 25, 129–135. doi: 10.1080/02673030903564838

Brown, L. A., and Chung, S. Y. (2006). Spatial segregation, segregation indices and the geographical perspective. *Popul. Space Place* 12, 125–143. doi: 10.1002/psp.403

Catney, G. (2016). Exploring a decade of small area ethnic (de-)segregation in England and Wales. *Urban Stud.* 53, 1691–1709. doi: 10.1177/0042098015576855

Catney, G., and Simpson, L. (2010). Settlement area migration in England and Wales: assessing evidence for a social gradient. *Trans. Inst. Br. Geogr.* 35, 571–584. doi: 10.1111/j.1475-5661.2010.00400.x

Central Statistical Bureau of Latvia (2025). *Population Statistics* [Database]. Available online at: https://stat.gov.lv/en (Accessed June 5, 2025).

Costa, R., and de Valk, H. A. G. (2018). Ethnic and socioeconomic segregation in Belgium: a multiscalar approach using individualised neighbourhoods. *Eur. J. Popul.* 34, 225–250. doi: 10.1007/s10680-018-9480-6

Drouhot, L. G., and Nee, V. (2019). Assimilation and the second generation in Europe and America: blending and segregating social dynamics between immigrants and natives. *Annu. Rev. Sociol.* 45, 177–199. doi: 10.1146/annurev-soc-073117-041335

Gerten, C., Hanhörster, H., Hans, N., and Liebig, S. (2023). How to identify and typify arrival spaces in European cities: a methodological approach. *Popul. Space Place* 29:e2604. doi: 10.1002/psp.2604

Hårsman, B. (2006). Ethnic diversity and spatial segregation in the Stockholm region. *Urban Stud.* 43, 1341–1364. doi: 10.1080/00420980600776434

Haase, A., Schmidt, A., Rink, D., and Kabisch, S. (2020). Leipzig's inner east as an arrival space? Exploring the trajectory of a diversifying neighbourhood. *Urban Plan.* 5, 214–225. doi: 10.17645/up.v5i3.2902

Hack-Polay, D. (2019). Migrant enclaves: disempowering economic ghettos or sanctuaries of opportunities for migrants? A double lens dialectic analysis. *J. Enterprising Communities* 13, 418–437. doi: 10.1108/JEC-01-2019-0008

Hans, N., Hanhörster, H., Polívka, J., and Beißwenger, S. (2019). The role of arrival spaces in integrating immigrants: a critical literature review. *Raumforsch. Raumordn.* 77, 443–457. doi: 10.2478/rara-2019-0019

Harris, R. (2023). A tale of four cities: neighbourhood diversification and residential desegregation in and around England's 'no majority' cities. *Geogr. J.* 189, 345–360. doi: 10.1111/geoj.12561

Hess, D. B., Tammaru, T., and van Ham, M. (2018). *Housing Estates in Europe*. Cham: Springer.

Huse, T. (2018). "Gentrification and ethnicity," in *Handbook of Gentrification Studies* (Cheltenham, UK: Edward Elgar Publishing).

Hwang, J. (2015). Gentrification in changing cities: immigration, new diversity, and racial inequality in neighborhood renewal. *Ann. Am. Acad. Pol. Soc. Sci.* 660, 319–340. doi: 10.1177/0002716215579823

Imeraj, L., Willaert, D., and de Valk, H. A. G. (2018). A comparative approach towards ethnic segregation patterns in Belgian cities using multiscalar individualized neighborhoods. *Urban Geogr.* 39, 839–862. doi: 10.1080/02723638.2018.1446584

Kadarik, K. (2020). Immigrants' mobility towards native-dominated neighbourhoods: the role of individual resources, country of origin, and settlement context. *Geogr. Ann. Ser. B Hum. Geogr.* 102, 25–42. doi: 10.1080/04353684.2019.1697939

Kaplan, D., and Douzet, F. (2011). Research in ethnic segregation III: segregation outcomes. *Urban Geogr.* 32, 589–605. doi: 10.2747/0272-3638.32.4.589

Krišjāne, Z., and Bērziņš, M. (2014). Intra-urban residential differentiation in the post-Soviet city: the case of Riga, Latvia. *Hung. Geogr. Bull.* 63, 235–253. doi: 10.15201/hungeobull.63.3.1

Krišjāne, Z., Bērziņš, M., and Kratoviš, K. (2015). "Occupation and ethnicity: patterns of residential segregation in Riga two decades after socialism," in *Socio-Economic Segregation in European Capital Cities: East Meets West* (London: Routledge).

Krišjāne, Z., Bērziņš, M., Sechi, G., and Kruminš, J. (2019). "Residential change and socio-demographic challenges for large housing estates in Riga, Latvia," in *Urban Book Series* (Cham: Springer).

Křížková, I., and Šimon, M. (2022). Measuring residential segregation of non-European migrants using the individualised neighbourhood method: how does Czechia fit to the European landscape? *Appl. Geogr.* 144, 102730. doi: 10.1016/j.apgeog.2022.102730

Lichter, D. T., Parisi, D., and Ambinakudige, S. (2020). The spatial integration of immigrants in Europe: a cross-national study. *Popul. Res. Policy Rev.* 39, 465–491. doi: 10.1007/s11113-019-09540-3

Malheiros, J., Carvalho, R., and Mendes, L. (2013). Gentrification, residential ethnicization and the social production of fragmented space in two multi-ethnic neighbourhoods of Lisbon and Bilbao. *Finisterra* 48, 65–87. doi: 10.18055/finis3619

Malmberg, B., Andersson, E. K., Nielsen, M. M., and Haandrikman, K. (2018). Residential segregation of European and non-European migrants in Sweden: 1990–2012. *Eur. J. Popul.* 34, 169–193. doi: 10.1007/s10680-018-9478-0

Malmberg, B., and Clark, W. A. V. (2021). Migration and neighborhood change in Sweden: the interaction of ethnic choice and income constraints. *Geogr. Anal.* 53, 259–281. doi: 10.1111/gean.12250

Marcińczak, S., and Bernt, M. (2021). Immigration, segregation and neighborhood change in Berlin. *Cities* 119:103417. doi: 10.1016/j.cities.2021.103417

Marcińczak, S., Mooses, V., Strömgren, M., and Tammaru, T. (2023). A comparative study of immigrant-native segregation at multiple spatial scales in urban Europe. *J. Ethn. Migr. Stud.* 49, 199–222. doi: 10.1080/1369183X.2021.2008887

Marcińczak, S., Musterd, S., Van Ham, M., and Tammaru, T. (2015). "Inequality and rising levels of socio-economic segregation: lessons from a pan-European comparative study," in *Socio-Economic Segregation in European Capital Cities: East Meets West* (London: Routledge).

Martori, J. C., and Apparicio, P. (2011). Changes in spatial patterns of the immigrant population of a southern European metropolis: the case of the Barcelona metropolitan area (2001–2008). *Tijdschr. Econ. Soc. Geogr.* 102, 562–581. doi: 10.1111/j.1467-9663.2011.00658.x

Massey, D. S., Rothwell, J., and Domina, T. (2009). The changing bases of segregation in the United States. *Ann. Am. Acad. Pol. Soc. Sci.* 626, 74–90. doi: 10.1177/0002716209343558

Murayama, K., and Nagayasu, J. (2021). Toward coexistence of immigrants and local people in Japan: implications from spatial assimilation theory. *Sustainability* 13:3849. doi: 10.3390/su13073849

Musterd, S. (2005). Social and ethnic segregation in Europe: levels, causes, and effects. *J. Urban Aff.* 27, 331–348. doi: 10.1111/j.0735-2166.2005.00239.x

Nielsen, M. M., and Hennerdal, P. (2017). Changes in the residential segregation of immigrants in Sweden from 1990 to 2012: using a multi-scalar segregation measure that accounts for the modifiable areal unit problem. *Appl. Geogr.* 87, 73–84. doi: 10.1016/j.apgeog.2017.08.004

Openshaw, S. (1996). "Developing GIS-relevant zone-based spatial analysis methods," in *Spatial Analysis: Modelling in a GIS Environment* (Cambridge: GeoInformation International).

Östh, J. (2024). *EquiPop Flow*. Available online at: https://www.uu.se/en/department/human-geography/research/equipop (Accessed June 5, 2025).

Östh, J., Clark, W. A. V., and Malmberg, B. (2015). Measuring the scale of segregation using k-nearest neighbor aggregates. *Geogr. Anal.* 47, 34–49. doi: 10.1111/gean.12053

Östh, J., and Türk, U. (2020). "Integrating infrastructure and accessibility in measures of bespoke neighbourhoods," in *Handbook of Urban Segregation* (Cheltenham: Edward Elgar Publishing).

Petrović, A., van Ham, M., and Manley, D. (2018). Multiscale measures of population: within- and between-city variation in exposure to the sociospatial context. *Ann. Am. Assoc. Geogr.* 108, 1055–1074. doi: 10.1080/24694452.2017.1411245

Rogne, A. F., Andersson, E. K., Malmberg, B., and Lyngstad, T. H. (2020). Neighbourhood concentration and representation of non-European migrants: new results from Norway. *Eur. J. Popul.* 36, 71–99. doi: 10.1007/s10680-019-09522-3

Salvati, L. (2016). Demographic diversity, immigration, and gentrification: patterns of re-urbanization in a southern European city. *Int. Soc. Sci. J.* 66, 83–94. doi: 10.1111/issj.12120

Silm, S., and Ahas, R. (2014). The temporal variation of ethnic segregation in a city: evidence from a mobile phone use dataset. *Soc. Sci. Res.* 47, 30–43. doi: 10.1016/j.ssresearch.2014.03.011

Šimon, M., KríŽková, I., and Klsák, A. (2023). "Residential segregation in Prague and the Central Bohemian Region in 2012–2018: a multiscalar approach using individualised neighbourhoods," in *Prague and Central Bohemia* (Prague: Karolinum Press).

Skifter Andersen, H., Andersson, R., Wessel, T., and Vilkama, K. (2016). The impact of housing policies and housing markets on ethnic spatial segregation: comparing the capital cities of four Nordic welfare states. *Int. J. Hous. Policy* 16, 1–30. doi: 10.1080/14616718.2015.1110375

Sleutjes, B., de Valk, H. A. G., and Ooijevaar, J. (2018). The measurement of ethnic segregation in the Netherlands: differences between administrative and individualized neighbourhoods. *Eur. J. Popul.* 34, 963–975. doi: 10.1007/s10680-018-9479-z

Society at a Glance 2024 (2024). *OECD*. Paris: OECD Publishing.

Stillwell, J., and Phillips, D. (2006). Diversity and change: understanding the ethnic geographies of Leeds. *J. Ethn. Migr. Stud.* 32, 1131–1152. doi: 10.1080/13691830600821851

Stonawski, J., Brzozowski, J., Pedziwiatr, K., and Georgati, M. (2022a). Investigating neighborhood concentration of immigrants in Poland: exploratory evidence from Krakow. *Bull. Geogr. Socioecon. Ser.* 56, 7–24. doi: 10.2478/bgss-2022-0060

Stonawski, M., Rogne, A. F., Christiansen, H., Bang, H., and Lyngstad, T. H. (2022b). Ethnic segregation and native out-migration in Copenhagen. *Eur. Urban Reg. Stud.* 29, 357–381. doi: 10.1177/09697764211039183

Tammaru, T., Marcińczak, S., van Ham, M., and Musterd, S. (2016). *Socio-Economic Segregation in European Capital Cities: East Meets West*. London: Routledge.

van Gent, W., and Hochstenbach, C. (2020). "The impact of gentrification on social and ethnic segregation," in *Handbook of Urban Segregation* (Cheltenham: Edward Elgar Publishing).

van Ham, M., Tammaru, T., Ubarevičiene, R., and Janssen, H. (2021). *Urban Socio-Economic Segregation and Income Inequality: A Global Perspective*. Cham, Switzerland: Springer.

Vogiazides, L., and Chihaya, G. K. (2020). Migrants' long-term residential trajectories in Sweden: persistent neighbourhood deprivation or spatial assimilation? *Hous. Stud.* 36, 875–902. doi: 10.1080/02673037.2019.1636937

Walker, K. (2018). Locating neighbourhood diversity in the American metropolis. *Urban Stud.* 55, 636–650. doi: 10.1177/0042098016641002

Wessel, T., Andersson, R., Kauppinen, T., and Andersen, H. S. (2017). Spatial integration of immigrants in Nordic cities: the relevance of spatial assimilation theory in a welfare state context. *Urban Aff. Rev.* 53, 812–846. doi: 10.1177/1078087416638448

Zuccotti, C. V. (2019). Ethnicity and neighbourhood attainment in England and Wales: a study of second generations' spatial integration. *Popul. Space Place* 25:e2252. doi: 10.1002/psp.2252

Balode, S., & Bērziņš, M. (2025).
Exploring patterns of ethnic diversification and residential intermixing in the neighborhoods of Riga, Latvia. *Urban Science, 9*(7), 274.
https://doi.org/10.3390/urbansci9070274

urban science

MDPI

Article

Exploring Patterns of Ethnic Diversification and Residential Intermixing in the Neighborhoods of Riga, Latvia

Sindija Balode * and Māris Bērziņš

Department of Geography, University of Latvia, LV-1586 Riga, Latvia; maris.berzins@lu.lv
* Correspondence: sindija.balode@lu.lv

Abstract

Residential segregation remains a persistent challenge in European urban environments and is an increasing focal point in urban policy debates. This study investigates the changing geographies of ethnic diversity and residential segregation in Riga, the capital city of Latvia. The research addresses the complex dynamics of ethnic residential patterns within the distinctive context of post-socialist urban transformation, examining how historical legacies of ethnic diversity interact with contemporary migration flows to reshape neighborhood ethnic composition. Using geo-referenced data from 2000, 2011, and 2021 census rounds, we examined changes in the spatial distribution of five major ethnic groups. Our analysis employs the Dissimilarity Index to measure ethnic residential segregation and the Location Quotient to identify the residential concentration of ethnic groups across the city. The findings reveal that Riga's ethnic landscape is undergoing a gradual yet impactful transformation. The spatial distribution of ethnic groups is shifting, with the increasing segregation of certain groups, particularly traditional ethnic minorities, coupled with a growing concentration of Europeans and non-Europeans in the inner city. The findings reveal distinctive patterns of ethnic diversification and demographic change, wherein long-term trends intersect with contemporary migration dynamics to produce unique trajectories of ethnic residential segregation, which differ from those observed in Western European contexts. However, the specific dynamics in Riga, particularly the persistence of traditional ethnic minority communities and the emergence of new ethnic groups, highlight the unique context of post-socialist urban landscapes.

Keywords: ethnic diversification; neighborhood change; residential segregation; demographic change; Latvia

Academic Editor: Mike Jenks

Received: 12 May 2025
Revised: 3 July 2025
Accepted: 14 July 2025
Published: 16 July 2025

Citation: Balode, S.; Bērziņš, M. Exploring Patterns of Ethnic Diversification and Residential Intermixing in the Neighborhoods of Riga, Latvia. *Urban Sci.* **2025**, *9*, 274. https://doi.org/10.3390/urbansci9070274

1. Introduction

Contemporary global migration is substantially reshaping urban landscapes, as migrants predominantly settle in urban centers [1], leading to significant transformations in the ethnic composition of cities worldwide. This increasing diversification has spurred considerable research on its implications, particularly focusing on the complex dynamics of ethnic residential segregation and associated spatial inequalities. Understanding these patterns is crucial, as neighborhood ethnic composition can influence social interactions, access to resources, and the overall integration trajectories of diverse population groups within a city. The study of ethnic residential segregation in post-socialist cities presents unique analytical challenges and opportunities. Contrary to Marxist theory and the official position during the socialist era, social residential segregation was evident in cities under socialism. Moreover, in terms of ethnic segregation, it could be contended that it even

"thrived" [2]. The legacy of Soviet-era migration policies, combined with the accession to the European Union (EU), recent immigration, urban shrinkage, and demographic shifts, creates a complex urban context where traditional ethnic minorities coexist with emergent migrant populations in ways that differ from patterns observed in other European cities.

Ethnic segregation studies examine inter-ethnic encounters across numerous domains [3], with ethnic residential segregation being one of the key research areas. Changes in the ethnic makeup of neighborhoods can drive spatial transformations [4] and affect the residential choices and socioeconomic outcomes of individuals in both native- and foreign-born populations. However, the factors shaping migrant residential patterns are multifaceted and debated. While socioeconomic status and self-perception play a role, the extent to which neighborhood ethnic composition, particularly the presence of co-ethnics, directly dictates residential decisions varies significantly across contexts [5,6]. Some studies suggest that immigrants often prefer proximity to co-ethnics, yet they may also favor living near native residents over other foreign groups [7]. Furthermore, factors like mixed-ethnicity households [8] and the complex pathways of long-term residents [9] add layers of complexity, indicating that spatial assimilation is not always a straightforward outcome.

In the context of post-socialist cities, these dynamics are further complicated by the persistence of housing patterns established during the socialist era, when residential allocation was largely state-controlled and market mechanisms were absent. The subsequent privatization processes and gradual introduction of market-based housing systems have created hybrid residential landscapes where historical settlement patterns interact with contemporary migration flows and individual housing choices in complex ways [10]. Latvia's experience exemplifies these complexities. Its history, particularly during Soviet occupation, involved large-scale migration dynamics that significantly altered the demographic makeup and strained ethnic relations. Upon regaining independence in 1991, Latvia inherited a multi-ethnic society with the highest proportion of ethnic minorities among the Baltic States, nearing half the population at the time [11–13]. Although large-scale immigration associated with the Soviet era ceased decades ago, its legacy persists in the country's ethnic composition, which remains unevenly distributed, with the majority of Latvia's ethnic minority population residing in major cities, most notably the capital city of Riga.

This study contributes to the limited but growing body of research on ethnic residential patterns in post-socialist cities by providing a comprehensive longitudinal analysis of ethnic diversification and segregation in Riga, Latvia. Our research addresses a significant gap in the literature by examining how segregation processes in Riga compare to those observed in other post-socialist cities, particularly in the context of the Baltic states, and assessing the extent to which Riga's patterns can be considered typical or specific within the broader post-Soviet urban context. Therefore, we aim to explore the residential geographies of ethnic diversity in Riga, utilizing geo-referenced population census data from 2000, 2011, and 2021. We seek to address the following research questions:

1. How did the levels of ethnic residential segregation between major ethnic groups in Riga change between 2000 and 2021?
2. How did the patterns of spatial over- and underrepresentation of major ethnic groups across Riga change between 2000 and 2021 at the chosen spatial scale?

A longitudinal analysis spanning these two decades provides insights into both longer-term shifts and more recent developments in ethnic residential patterns, including the geography of emerging groups. This study contributes to a deeper understanding of the dynamics shaping ethnic landscapes in post-socialist cities, offering findings relevant to urban planning and policy discussions concerning social cohesion and spatial inequalities in ethnically diverse urban settings.

This paper is structured as follows: Section 2 provides an essential background on Riga's historical context and the contemporary ethnic and sociodemographic landscape. Section 3 details the data sources and methodologies employed, including the Dissimilarity Index and the Location Quotient. Section 4 presents the core findings on population changes, segregation trends, and the geographical distribution of ethnic groups. Section 5 provides a comprehensive discussion that contextualizes our findings within broader theoretical frameworks and compares Riga's patterns to those observed in other post-socialist cities, particularly examining the role of suburbanization and demographic decline in shaping ethnic residential patterns. Finally, Section 6 presents our conclusions, summarizing key findings, reinforcing this study's contributions, and reflecting on broader implications for understanding ethnic diversification in post-socialist urban contexts.

2. Riga's Ethnic and Sociodemographic Landscape

Riga, the capital of Latvia and the largest city in the Baltic States, possesses a demographic structure that is profoundly shaped by its historical trajectory. Its legacy as a Hanseatic League trading center, followed by governance under various external powers, has cumulatively forged its contemporary ethnic composition. The Soviet occupation notably instigated significant demographic changes through state-enforced, large-scale migration policies. These policies significantly altered the city's ethnic balance, creating a complex sociodemographic landscape that persisted following the restoration of Latvia's independence. Consequently, Riga emerged as a city characterized by a substantial ethnic minority population, exhibiting relatively low levels of socioeconomic and ethnic residential segregation.

The 20% population decline experienced by Riga between 2000 and 2021 represents a critical structural backdrop that fundamentally shapes contemporary urban change. This demographic decline, driven by out-migration following EU accession, declining birth rates, and suburbanization processes, has created a context of urban shrinkage that significantly influences the patterns of ethnic intermixing and diversification. The selective nature of this population loss, with different ethnic groups experiencing varying rates of out-migration and age-specific demographic changes, has important implications for understanding the contemporary dynamics of residential segregation. In 2021, the city's population was recorded at 615,000 inhabitants, approximately 20% lower than in 2000, constituting 32% of Latvia's total population. Despite this decline, Riga retained a distinctly multi-ethnic character. Ethnic minorities represent 53% of the population, and 17% of the residents are foreign-born, originating from over 140 different countries [14]. Alongside established minority communities, recent migration flows, especially those emerging over the past decade, are contributing to increased diversity and raising considerations regarding the potential exacerbation of socio-spatial disparities within the urban fabric [15]. The phenomenon of suburbanization around Riga has become increasingly significant over the past two decades, particularly affecting the spatial distribution of the population. While comprehensive data on suburban ethnic composition remain limited, available evidence suggests that suburbanization has been diversified, covering both affluent groups and people who have moved to the suburbs in search of a cheaper life [16]. It can be posited that suburbanization has contributed to the relative concentration of ethnic minorities in Riga, particularly within large housing estates. This process mirrors patterns observed in other post-socialist cities but occurs within the specific context of Riga's demographic decline, creating unique dynamics where suburban growth coexists with urban population loss.

To facilitate a focused analysis of ethnic diversity patterns in Riga, this study categorizes the population into five aggregate groups: Latvians, Russians, other traditional ethnic minorities, Europeans, and non-Europeans (see Table 1). While Russians are considered a traditional ethnic minority, the substantial size of the group warrants their classification as a distinct group. This approach permits a clearer examination of the demographic and socioeconomic dynamics within the remaining traditional minority populations, which include

Belarusians, Ukrainians, Poles, Lithuanians, Estonians, Jews, Roma, Armenians, Tatars, and Moldovans. Recent migration trends have resulted in the emergence of minority groups comprising both Europeans and non-Europeans. These trends are characterized by the influx of skilled labor, international student mobility, and broader East–West migration patterns.

Table 1 presents a comprehensive longitudinal analysis of demographic and socioeconomic indicators across major aggregate ethnic groups in Riga, spanning three census years. The key demographic and socioeconomic variables encompass fundamental demographic characteristics including gender composition (percentage of women), age structure (mean age, percentage aged 0–14, and percentage aged 65+), educational attainment (percentage with university education among those aged 15+), occupational stratification (percentage in high-status and low-status occupations based on ISCO-08 classifications), and residential mobility patterns (percentage of mobile residents within the year prior to each census). The data reveal pronounced temporal transformations and persistent ethnic stratification patterns that reflect broader processes of demographic change, educational expansion, and migration dynamics in Riga, Latvia. Over the 21-year observation period, the city experienced significant demographic aging, with the mean age increasing from 39.7 to 43.0 years for the total population, though this trend manifested with considerable ethnic variation. Russians and other traditional minorities exhibited the most dramatic aging trajectories, with Russians' mean age rising from 40.0 to 47.9 years and other traditional groups reaching 53.4 years by 2021, accompanied by substantial declines in child populations (Russians from 14.0% to 8.9% aged 0–14; other traditional from 10.1% to 3.6%) and corresponding increases in elderly populations (Russians from 15.5% to 26.0% aged 65+; other traditional from 17.9% to 32.7%). In contrast, Latvians demonstrated relative demographic stability with their child population remaining constant at 17.4% across the period, while non-European groups exhibited demographic volatility with fluctuating age structures.

The period witnessed remarkable educational expansion across all ethnic groups, with university education rates more than doubling for most populations, rising from 18.9% to 40.2% for the total population. However, this educational transformation occurred within a context of persistent ethnic stratification, with European immigrants achieving the highest educational attainment levels (48.7% by 2021) and occupational status (46.5% in high-status occupations), while non-European groups, despite substantial educational gains (from 19.6% to 42.6% university-educated), remained disproportionately concentrated in low-status occupations (increasing from 18.8% to 29.4%). Residential mobility patterns further illuminate differential integration trajectories, with non-European populations exhibiting extraordinary mobility increases (from 4.8% to 31.5%), suggesting ongoing processes of immigration. Other traditional minorities maintained the lowest mobility rates, indicating established residential patterns and aging, as migration is highly age-selective.

These patterns illustrate how ethnic diversification persists despite overall socioeconomic advancement, with demographic aging particularly affecting Russian and other traditional ethnic minorities, educational expansion benefiting all groups but maintaining relative hierarchies, and mobility patterns reflecting differential stages of life course across native Latvians, established ethnic communities, and recent immigrants in contemporary Riga. Understanding this intricate mosaic, shaped by historical legacies, ongoing demographic shifts, and significant inter-group differences in age, gender, socioeconomic standing, and residential stability, is fundamental. It provides an essential context for investigating the spatial dimensions of ethnic diversity and segregation explored in this study, recognizing that these population segments are not uniformly distributed but exhibit distinct geographical concentrations and patterns of intermixing across Riga's neighborhoods. The interplay between these sociodemographic characteristics and the evolving spatial organization of ethnic groups forms the foundation for subsequent analysis.

Table 1. Sociodemographic indicators of major aggregate ethnic groups for Riga in 2000, 2011, and 2021 (authors' calculation based on population census data from the Central Statistical Bureau of Latvia).

	Latvians			Russians			Other Traditional *			European			Non-European			Total		
	2000	**2011**	**2021**	**2000**	**2011**	**2021**	**2000**	**2011**	**2021**	**2000**	**2011**	**2021**	**2000**	**2011**	**2021**	**2000**	**2011**	**2021**
share (%) of women	55.7	56.1	56.3	55.3	56.1	56.3	54.8	56.8	56.8	49.7	41.5	40.8	40.5	43.4	33.5	55.2	56.0	55.6
mean age	38.1	38.8	40.0	40.0	43.7	47.9	44.0	49.3	53.4	38.6	39.4	41.2	37.5	42.1	37.0	39.7	41.8	43.0
share (%) of 0–14	17.4	15.8	17.4	14.0	10.8	8.9	10.1	5.4	3.6	15.0	13.4	12.0	14.4	10.0	8.9	15.2	13.0	15.4
share (%) of 65+	15.3	17.6	17.5	15.5	18.3	26.0	17.9	25.4	32.7	12.5	12.6	15.8	8.7	13.3	11.3	15.6	18.6	21.4
share (%) of university educated (15+)	20.3	36.0	44.9	18.4	29.2	36.2	16.9	28.0	35.5	19.3	33.0	48.7	19.6	32.2	42.6	18.9	32.1	40.2
share (%) of high-status occupations **	35.1	40.4	41.4	25.5	26.5	26.3	25.3	27.9	27.4	37.2	37.2	46.5	31.7	32.2	27.4	29.8	33.3	34.0
share (%) of low-status occupations **	13.1	12.8	13.2	20.5	21.3	24.7	22.4	21.3	24.8	17.3	15.0	13.5	18.8	19.1	29.4	17.4	17.2	19.0
share (%) of mobile residents ***	5.5	8.9	9.6	3.8	5.3	6.6	3.4	5.1	7.8	3.8	7.2	15.5	4.8	7.3	31.5	4.4	6.9	8.6

Notes: * other major ethnic minorities specific to Latvia and Riga city (Belarusians, Ukrainians, Poles, Lithuanians, Estonians, Jews, Roma, Armenians, Tatars, Moldovans); ** managers and professionals for high-status and elementary occupations, plant and machine operators, and assemblers for low-status based on the International Standard Classification of Occupations (ISCO-08); *** all types of residential moves within a year prior to a census.

3. Materials and Methods

This study employed quantitative methodologies to analyze the residential geographies of major ethnic groups within Riga. The primary data source comprises census data for three distinct years: 2000, 2011, and 2021. The Latvian census primarily determines ethnicity through self-reported affiliation utilizing predefined categories. Supplementary information, such as country of birth, country of previous residence, citizenship, and, in earlier censuses, language spoken, may also inform classification. While the system accommodates approximately 160 distinct ethnic identifications, it currently lacks categories for individuals of mixed ethnicities. Notably, the proportion of residents reporting categories of "not selected" or "unknown" for ethnicity increased over the study period, reaching 4.4% in 2021.

The spatial analysis was conducted using a hexagonal grid system that divided Riga into approximately one thousand hexagonal bins. This hexagonal grid approach was chosen to provide consistent spatial units that were not influenced by administrative boundary changes over time and to ensure adequate population sizes for statistical analysis while maintaining sufficient spatial resolution to capture neighborhood-level patterns. Geo-referenced population census data were aggregated into these hexagonal bins. Each populated bin thus contained counts for the analyzed ethnic groups, enabling the calculation of spatial statistics. The demographic scale of these units shifted over time; the median population within a 16 ha bin decreased from 210 persons in 2000 to 193 persons in 2021. Concurrently, the peak density also decreased, with the maximum population in the most densely populated bin falling from approximately 6700 to 4600 residents over the same period.

The study area map (see Figure 1) also delineates Riga's broad urban structure, distinguishing between the inner-city zone, the Soviet-era housing estate zone, and the outer-city zone. These zones possess distinct historical development trajectories, built environment characteristics, demographic profiles, and migration histories. Consequently, it is hypothesized that the spatial distribution patterns of different ethnic groups vary significantly across these zones.

Figure 1. The study area of Riga, illustrating the hexagon grid of 16 ha bins and neighborhoods by urban zones (inner-city, Soviet-era housing estates, outer-city).

To investigate the ethnic geographies of Riga, two key quantitative measures were employed. The Location Quotient (LQ) was calculated for each 16 ha bin to assess the local concentrations of specific ethnic groups. Additionally, the Index of Dissimilarity (DI) was computed to measure the overall segregation between pairs of ethnic groups across all bins within the city. Data processing, calculation of segregation indices, and spatial visualization were performed using Geo-Segregation Analyzer v.1.2 software [17] and ArcGIS Pro (version 3.0).

The Index of Dissimilarity (DI) was used to quantify the level of residential segregation between pairs of ethnic groups across the 16 ha hexagonal bins. As a standard measure in segregation research, the DI quantifies the degree of evenness in the distribution of two groups across spatial units. The index ranges from 0 to 1, where 0 signifies perfect integration (both groups are distributed identically across units) and 1 represents complete segregation (the two groups share no spatial units) [18]. The formula is:

$$\mathrm{DI} = \frac{1}{2}\sum_{i=1}^{N}\left|\frac{x_i}{X} - \frac{y_i}{Y}\right| \quad (1)$$

where N is the total number of spatial units (hexagonal bins), x_i is the population of ethnic group X in spatial unit i, y_i is the population of ethnic group Y in spatial unit i, X is the total population of group X in the city, and Y is the total population of group Y in the city.

To visualize and quantify the relative concentration of specific ethnic groups at the local (16 ha bin) level, the Location Quotient (LQ) was calculated. The LQ compares the proportion of a specific ethnic group within a local unit to its proportion in the city as a whole. An LQ value of 1 indicates that the group's share in the bin is identical to its city-wide share. Values greater than 1 signify overrepresentation (concentration) of the group in the bin relative to the city, whereas values less than 1 indicate underrepresentation. A range between 0.85 and 1.20 is often considered indicative of a relatively balanced distribution [19]. The formula is:

$$\mathrm{LQ} = \frac{x_i}{t_i} \div \frac{X}{T} \quad (2)$$

where x_i is the population of ethnic group X in spatial unit i, t_i is the total population of all groups in spatial unit i, X is the total population of group X in the city, and T is the total population of all groups in the city.

4. Results

This section details the empirical findings on the evolving patterns of ethnic residential distribution and segregation in Riga between 2000 and 2021. The analysis starts with an examination of relative population shifts among the defined aggregate ethnic groups, followed by an assessment of inter-group residential segregation levels using the Index of Dissimilarity (DI). Finally, the geographical distribution and local concentration patterns of each aggregate group are explored using the Location Quotient (LQ). Employing major aggregate ethnic groups facilitates the identification of broader trends related to population dynamics, residential segregation, and spatial diversity, which might be obscured when analyzing numerous individual ethnicities separately. This approach is particularly pertinent for Riga, given its historically large minority population and the relatively small, albeit growing, size of more recently arrived ethnic groups.

4.1. Population Changes by Aggregate Ethnic Group

The analysis of population changes between 2000 and 2021 confirms significant shifts among major ethnic groups (see Figure 2). As anticipated, based on broader demographic trends, the populations classified as Russians and other traditional ethnic minorities ex-

perienced substantial declines, exceeding 30% for both groups. The Russian population decreased by nearly 113,000 individuals. In contrast, the decline within the Latvian group was comparatively modest in both absolute and relative terms. Conversely, the populations categorized as European and non-European exhibited growth. While modest in absolute terms, the relative increase exceeded 4% for the European group and a notable 25% for the non-European group. Consequently, the combined proportion of these two groups within Riga's total population nearly doubled during this period, highlighting their increasing demographic presence.

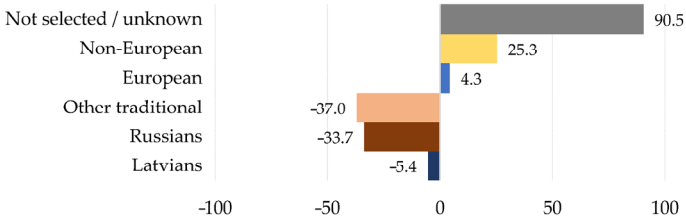


Figure 2. Relative population changes (%) by major aggregate ethnic groups between 2000 and 2021 (authors' calculation based on data from the Central Statistical Bureau of Latvia).

A concurrent trend observed was more than a 90% increase in the number of individuals recorded with "not selected" or "unknown" ethnicity between 2000 and 2021. This considerable rise warrants acknowledgement, as the underlying factors—potentially including evolving self-identification patterns, the absence of mixed-ethnicity categories in the census, or other societal dynamics—are beyond the scope of this study's data but represent an important contextual factor. This trend imposes a limitation, as individuals in the "not selected"/"unknown" category, representing more than 4% of Riga's population in 2021, cannot be included in the analysis of the five defined aggregate ethnic groups.

4.2. Ethnic Residential Segregation

Inter-group residential segregation levels were assessed using the Index of Dissimilarity (DI) calculated at the 16 ha hexagonal bin scale for 2000, 2011, and 2021 (see Table 2). The values presented here indicate the degree of spatial separation between the pairs of ethnic groups. A general trend observed across the study period was an increase in DI values for most group pairings, suggesting a gradual rise in overall residential segregation within Riga. Specifically, the DI between Latvians and Russians, the city's two largest populations, indicated moderate segregation levels that increased slightly during the study period. Other traditional ethnic minority groups consistently exhibited low segregation from Russians, indicating considerable spatial overlap, while showing similar segregation from Latvians. Conversely, both the European and non-European groups displayed substantially increasing segregation from the Russian and other traditional ethnic minority groups. Segregation between Europeans and Latvians also increased slightly, as did segregation between non-Europeans and Latvians. Notably, the segregation level between Europeans and non-Europeans remained relatively stable, with an interim increase in 2011.

Table 2 also presents the IS values calculated between each specified group and all the other residents combined. These values measure the overall residential separation of each group from the rest of the city's population. A consistent trend is that all five aggregate groups experienced an increase in this measure of separation between 2000 and 2021. The magnitude of this increase was most pronounced in the non-European group, followed by the European group. Examining the levels of separation by the end of the study period, other traditional minorities exhibited the lowest overall segregation. Russians displayed

the next lowest level, followed by Latvians. The highest levels of overall spatial separation from the remaining population were recorded in the European and non-European groups.

Table 2. Indices of Dissimilarity (DI) for major aggregate ethnic groups in Riga in 2000, 2011, and 2021 (authors' calculation based on data from the Central Statistical Bureau of Latvia).

		Latvians	Russians	Other Traditional	European	Non-European
Latvians	2000	[0.22]	0.23	0.23	0.29	0.31
	2011	[0.25]	0.25	0.25	0.31	0.32
	2021	[0.26]	0.27	0.26	0.33	0.34
Russians	2000	0.23	[0.17]	0.06	0.27	0.21
	2011	0.25	[0.20]	0.07	0.34	0.25
	2021	0.27	[0.22]	0.07	0.40	0.39
Other traditional *	2000	0.23	0.06	[0.12]	0.27	0.21
	2011	0.25	0.07	[0.14]	0.34	0.25
	2021	0.26	0.07	[0.15]	0.38	0.37
European	2000	0.29	0.27	0.27	[0.26]	0.32
	2011	0.31	0.34	0.34	[0.30]	0.36
	2021	0.33	0.40	0.38	[0.33]	0.32
Non-European	2000	0.31	0.21	0.21	0.32	[0.24]
	2011	0.32	0.25	0.25	0.36	[0.26]
	2021	0.34	0.39	0.37	0.32	[0.34]

Notes: * Other major ethnic minorities specific to Latvia and Riga city (Belarusians, Ukrainians, Poles, Lithuanians, Estonians, Jews, Roma, Armenians, Tatars, Moldovans); indices of segregation (IS) are shown in [].

4.3. Geographies of Ethnic Diversity

This subsection details the spatial distribution and concentration patterns of the five aggregate ethnic groups across Riga's neighborhoods, utilizing Location Quotients (LQs) calculated at the 16 ha bin level for 2000, 2011, and 2021 (Figure 3). Throughout the study period, Latvians consistently exhibited overrepresentation in inner-city and outer-city neighborhoods, while generally showing underrepresentation in large Soviet-era housing estates, albeit with exceptions in specific greener or more prestigious locations within these estates (Figure 3a–c). Over time, their distribution appears to have become more homogeneous, with fewer areas of high over- or underrepresentation. Within the inner city, overrepresentation was notable on both banks of the Daugava River, with more optimal LQ values in the northern inner-city neighborhoods.

Russians and other traditional ethnic minorities display persistent and similar spatial patterns. Both remained significantly underrepresented in outer-city areas and showed increasing underrepresentation in many inner-city neighborhoods between 2000 and 2021 (Figure 3d–i). Concurrently, their overrepresentation intensified in specific northern and southern sections of the city, predominantly within Soviet-era housing estates. While reflecting a shared tendency, these shifts towards greater spatial concentration and isolation were observed to be more pronounced for the Russian population compared to other traditional ethnic minorities.

The European group demonstrated increasing concentrations within the inner city, particularly on the right bank of the Daugava River, including marked growth in LQ values in northern inner-city areas (Figure 3j–l). In some peripheral inner-city areas, they transitioned from underrepresentation towards an optimal level or slight overrepresentation. Localized areas of overrepresentation were also observed in the southern inner city and its adjacent neighborhoods. However, underrepresentation persisted across most Soviet-era housing estates (barring some pockets of more affluent locations) and outer-city zones, where most areas remained unpopulated by Europeans, indicating a highly uneven distribution at the city scale.

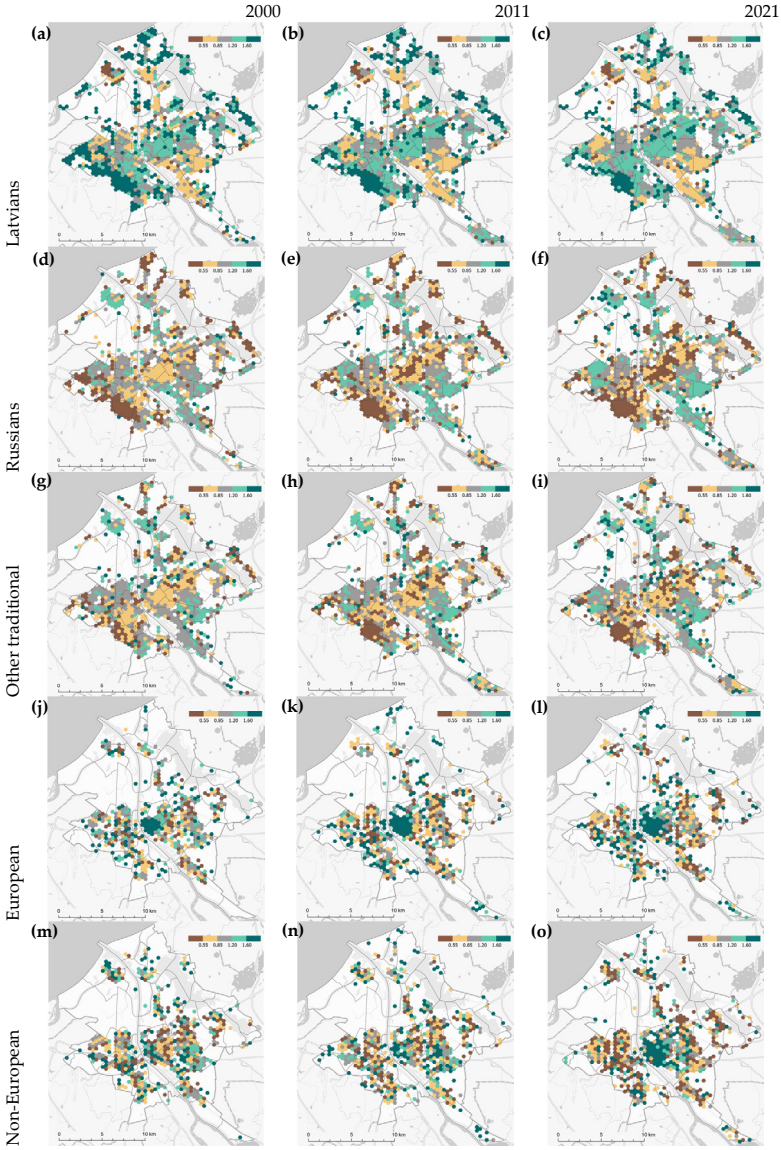


Figure 3. Location Quotient (LQ) at the 16 ha hexagon bin level by major aggregate ethnic group in Riga: (**a**) Latvians in 2000; (**b**) Latvians in 2011; (**c**) Latvians in 2021; (**d**) Russians in 2000; (**e**) Russians in 2011; (**f**) Russians in 2021; (**g**) Other traditional minorities in 2000; (**h**) Other traditional minorities in 2011; (**i**) Other traditional minorities in 2021; (**j**) Europeans in 2000; (**k**) Europeans in 2011; (**l**) Europeans in 2021; (**m**) Non-Europeans in 2000; (**n**) Non-Europeans in 2011; (**o**) Non-Europeans in 2021 (authors' figure based on data from the Central Statistical Bureau of Latvia).

The distribution of the non-European population shifted considerably. In 2000, their pattern was characterized by small, scattered clusters of varying representations across the city. By 2021, the concentration markedly increased in the right-bank inner city (Figure 3m–o) and decreased elsewhere. Inner-city neighborhoods like the Avoti neighborhood transitioned from widespread underrepresentation in 2000 to strong overrepresentation by 2021. This inner-city concentration also extended southward to the adjacent neighborhoods. Similar to Europeans, non-Europeans remained largely underrepresented in Soviet-era housing estates (except near higher education institutions) and exhibited only a minimal presence throughout most outer-city neighborhoods.

In summary, the LQ analysis revealed distinct and evolving spatial geographies for each aggregate ethnic group. Latvians displayed the most widespread distribution, becoming slightly more evenly distributed over time. Russians and other traditional minorities showed an increasing concentration within Soviet-era housing estates and a growing absence from inner- and outer-city zones. Europeans and non-Europeans both exhibited intensifying concentration within specific inner-city areas, contrasting with continued underrepresentation or even uninhibitedness across large parts of the remaining city, particularly extensive Soviet-era estates and outer-city zones.

5. Discussion

This section situates our findings within the broader theoretical framework of urban ethnic geography, offering a comparative analysis of Riga with other post-socialist cities. It specifically investigates how demographic change, suburbanization, and the post-socialist urban transition influence ethnic residential patterns.

5.1. Theoretical Framework and Causal Mechanisms

Our findings can be interpreted through various theoretical viewpoints that explain patterns of ethnic residential segregation. The spatial assimilation theory, originally developed by Massey and Denton [20], suggests that as immigrant groups achieve socioeconomic mobility, they tend to move away from ethnic enclaves toward more integrated and ethnically mixed urban neighborhoods. However, our results reveal a more complex pattern in Riga that challenges this linear progression model. The persistence and intensification of Russian and other traditional minority concentrations in Soviet-era housing estates, despite educational and occupational advancement among these groups (as shown in Table 1), suggests that spatial assimilation processes operate differently in contexts where Soviet-era settlement patterns create path-dependent residential trajectories. The place stratification model [21] provides additional explanatory power for understanding Riga's ethnic diversification. This model emphasizes how structural barriers limit residential choices for minority groups, creating hierarchical residential systems. In Riga, ethnic infrastructure plays a crucial role, particularly in the realm of education, where Russian-speaking families have been allowed the option to enroll their children in schools where Russian is the primary language of instruction [22]. This educational policy, in conjunction with the Soviet-era housing allocation system that prioritized immigrants, significantly contributes to the ongoing overrepresentation and residential concentration of Russians and other traditional ethnic minorities in housing estates [23,24]. The differential suburbanization rates observed across ethnic groups in other Baltic state capitals [25,26] might also reflect stratified housing opportunities in the case of Riga, where Latvians demonstrate greater access to suburban housing markets, while ethnic minorities remain concentrated in housing estates. The suburbanization effect helps explain several key findings of our study. First, the increasing concentration of Latvians in outer-city residential areas reflects both new suburban development and the relative advantage of Latvians in accessing suburban hous-

ing markets. Second, the intensification of traditional minority concentrations in Soviet-era housing estates occurs partly because these groups have lower rates of suburban migration, creating a residual concentration effect. Third, the concentration of non-European migrants in inner-city areas may reflect housing market constraints, access to urban amenities, and the availability of affordable housing [27,28] in areas experiencing population decline. These suburbanization dynamics create unique challenges for ethnic integration in post-socialist cities. Unlike Western European contexts where suburban areas are increasingly becoming sites of ethnic diversity [29,30], the selective nature of suburbanization in Riga may contribute to increasing spatial separation between ethnic groups, with implications for social cohesion and integration processes.

The causal mechanisms driving the observed ethnic residential patterns operate through three primary pathways. First, the effects of demographic change create differential aging and residential mobility patterns across ethnic groups. The dramatic aging of Russians and other traditional minorities reduces their residential mobility and creates aging-in-place dynamics that intensify spatial concentration. Simultaneously, the younger age structure of new migrant populations (Europeans and non-Europeans) creates higher mobility rates and different residential preferences, contributing to their concentration in inner-city areas with better access to employment and services. Second, economic stratification mechanisms shape residential choices through differential access to housing markets. The occupational structure reveals persistent ethnic stratification, with Europeans and non-Europeans showing higher rates of high-status occupations (46.5% and 27.4% respectively) compared to traditional ethnic minorities (26.3% for Russians, 27.4% for other traditional groups). This economic stratification translates into differential housing market access, where higher-income groups can access suburban housing, while lower-income ethnic minorities remain in affordable housing estates. Third, social networks and institutional mechanisms influence residential patterns through ethnic infrastructure and community ties. The persistence of Russian-language schools, cultural institutions, and social networks in Soviet-era housing estates creates institutional anchors that maintain ethnic residential concentration even as individual preferences might favor greater integration. Conversely, new migrant groups lack established ethnic infrastructure, leading to their concentration in areas with diverse amenities and international connectivity, primarily in inner-city neighborhoods. Thus, the residential dynamics identified in Riga highlight the complex interactions between historical legacies, demographic change, and contemporary patterns of international and internal migration.

5.2. *Theoretical Contribution and Comparative Analysis*

Our findings contribute to the theoretical understanding of ethnic residential patterns in post-socialist cities by highlighting three distinct features of Riga's contemporary ethnic geography. First, the concentration of new non-European migrants is highly focused within the inner-city, representing Riga's specific urban structure, housing market dynamics, and the particular characteristics of the most recent immigration. The substantial increase in segregation levels for non-European populations suggests that Riga may be experiencing more pronounced ethnic clustering of new migrants than its Baltic counterparts. Second, the intensification of traditional minorities' concentration in large housing estates, driven by selective out-migration, appears particularly pronounced in Riga. Third, and most crucially, the recent rise in segregation is not uniform; the sharpest increase in spatial separation occurred between new migrant groups and the established traditional minorities, whereas segregation between new migrants and the majority Latvian population increased only slightly. The persistence of Soviet-era spatial patterns, combined with new migration

dynamics and selective suburbanization, creates hybrid urban landscapes that challenge conventional models of ethnic residential change developed primarily in Western contexts.

The Riga case contributes to post-socialist urban theory by demonstrating how path dependency operates in residential systems. Unlike Western cities, where ethnic residential patterns primarily reflect market-driven processes and contemporary migration flows, post-socialist cities like Riga exhibit strong path dependency, where the historical Soviet-era housing allocation system continues to influence contemporary residential choices even after fundamental political and economic transitions. This path dependency operates through multiple mechanisms: the physical infrastructure of Soviet-era housing estates that continues to house large populations; the institutional infrastructure of ethnic communities (schools, cultural centers, social networks) that developed around these residential concentrations; and the economic constraints that limit residential mobility for populations who experienced disadvantages during the post-socialist transition.

Our findings also contribute to understanding how urban shrinkage affects ethnic residential patterns. Unlike growing cities, where ethnic segregation often results from competition for desirable residential areas, shrinking cities, like Riga, experience segregation through selective out-migration and residual concentration effects. The 20% population decline between 2000 and 2021 has not affected all ethnic groups equally, creating new forms of segregation through differential mobility rather than competitive displacement. This represents a distinct pathway to ethnic residential segregation that may be characteristic of post-socialist cities experiencing demographic decline.

Comparison with other Baltic capitals reveals both common patterns and unique features of Riga's ethnic residential dynamics. Like Tallinn, Riga exhibits a persistent concentration of Russian-speaking minorities in Soviet-era housing estates, but Riga shows more pronounced intensification of this concentration over time. All the Baltic capital cities must manage the integration of new migrant populations alongside established ethnic communities. However, Riga's pattern of new migrant concentration in inner-city areas appears very pronounced, possibly reflecting differences in urban structure, housing markets, and economic opportunities.

5.3. Policy Implications and Further Research

The findings of this study have significant implications for urban planning and social policy in Riga and similar post-socialist cities. The persistence and intensification of ethnic residential segregation, particularly the concentration of traditional minorities in Soviet-era housing estates and new migrants in inner-city areas, requires targeted policy interventions that address both the symptoms and underlying causes of residential segregation.

Areas with high concentrations of traditional ethnic minorities, particularly Soviet-era housing estates, require comprehensive revitalization programs that address both physical infrastructure and social cohesion challenges. These programs should include improvements that enhance the quality of life in these neighborhoods without displacing existing residents and community development programs that strengthen social networks and civic participation. In addition, the concentration of new migrants in inner-city areas presents both opportunities and challenges for integration. Policy interventions should include supportive services, e.g., language training programs and community integration programs that facilitate interaction between new migrants and established residents, including both Latvians and traditional minorities.

The selective nature of suburbanization and its role in intensifying urban ethnic concentration suggest the need for more inclusive suburban development policies. Current suburban development primarily serves higher-income populations, contributing to ethnic residential segregation. The results of this study highlight the need for metropolitan-

scale planning that considers the residential and mobility patterns of all ethnic groups. Current planning approaches that focus primarily on the administrative boundaries of Riga may miss important dynamics that occur in suburban municipalities. Policy interventions should include affordable housing; better coordination of public transportation to ensure that all ethnic communities have access to employment and services throughout the metropolitan area and to reduce the economic barriers to suburban residence for lower-income populations; and regional approaches to social integration that recognize the interconnected nature of urban and suburban ethnic residential patterns.

Several limitations of this study should be acknowledged, each of which opens important avenues for future research. First, while aggregating diverse ethnic groups into broad categories was necessary for this analysis, it may mask significant internal variations; future studies could therefore focus on specific ethnic communities to capture this heterogeneity. Second, our study concentrates on residential patterns rather than the underlying social and economic processes that drive them. A deeper understanding would require an investigation into the mechanisms behind residential choices, such as housing market dynamics, discrimination, and community formation processes. Furthermore, the analysis is confined to the administrative boundaries of Riga and does not capture suburban development in surrounding municipalities, pointing to the need for a metropolitan-scale approach to fully understand the interplay between suburbanization and ethnic residential patterns. Finally, the increasing proportion of residents not declaring an ethnic affiliation presents both a methodological challenge and a substantive phenomenon, making an inquiry into the factors driving this trend a crucial task for future research on diversity in post-socialist cities.

6. Conclusions

This study provides a comprehensive longitudinal analysis of ethnic diversification and residential segregation in Riga, contributing to our understanding of ethnic residential dynamics in post-socialist cities. Our findings reveal that Riga's ethnic landscape is undergoing transformation, characterized by the persistence of historical ethnic residential patterns alongside recent immigration-driven changes.

First, our analysis demonstrates that segregation levels between traditional ethnic groups (Latvians and Russians) have remained relatively stable, with a slight increase over the study period, suggesting that the fundamental spatial relationship between these two main ethnic groups has not dramatically altered despite substantial demographic changes. This stability contrasts with more dynamic patterns observed for newer immigrant populations.

Second, this study reveals increasing segregation levels for non-European populations, with Dissimilarity Index values rising substantially between 2000 and 2021. This trend, combined with the concentration of non-European migrants in inner-city neighborhoods, suggests the emergence of new ethnic geographies that differ from historical patterns.

Third, our comparative analysis places Riga's patterns within the broader context of post-socialist urban transition, revealing both typical characteristics shared with other Baltic cities and specific features that reflect Riga's unique demographic and socioeconomic trajectory. These findings have important implications for understanding ethnic diversification processes in post-socialist cities more broadly. The persistence of Soviet-era spatial patterns, combined with selective suburbanization, new migration dynamics, and demographic change, creates a complex urban landscape and unique contexts for ethnic residential segregation that differ from Western European experiences. The concentration of new migrants in inner-city areas, rather than suburban dispersal, suggests alternative pathways of spatial integration that may be characteristic of shrinking post-socialist cities.

This study also highlights the importance of considering demographic decline and suburbanization as key factors shaping ethnic residential patterns in post-socialist contexts. The selective nature of population loss and suburban in-migration creates residual concentration effects that intensify ethnic clustering in certain areas while promoting dispersal in others. Future research should expand the comparative analysis to include other post-socialist cities within and beyond the Baltic region, examining how different economic trajectories, migration patterns, and policy contexts shape ethnic residential outcomes.

From a policy perspective, our findings suggest the need for differentiated approaches to ethnic integration that recognize the distinct challenges and opportunities presented by different types of ethnic concentration. Traditional minority areas require investment and support to prevent marginalization, while areas of new migrant concentration need services and infrastructure to support successful integration.

Author Contributions: Conceptualization, M.B.; methodology, M.B. and S.B.; software, M.B. and S.B.; validation, S.B.; formal analysis, M.B. and S.B.; investigation, S.B.; resources, M.B.; data curation, M.B.; writing—original draft preparation, M.B. and S.B.; writing—review and editing, M.B. and S.B.; visualization, S.B.; supervision, M.B.; project administration, S.B.; funding acquisition, S.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Recovery and Resilience Facility project "Internal and External Consolidation of the University of Latvia", grant number 5.2.1.1.i.0/2/24/I/CFLA/007.

Data Availability Statement: The georeferenced census data utilized in this study are governed by an agreement between the Central Statistical Bureau of the Republic of Latvia and the University of Latvia. Disaggregated ethnic data are deemed sensitive, and their dissemination may potentially compromise individual privacy. The data in question were anonymized and processed in compliance with a confidentiality agreement, adhering to all data protection, privacy regulations, and contractual obligations. For further information regarding data usage, please contact maris.berzins@lu.lv.

Acknowledgments: During the preparation of this manuscript, the authors used Gemini Advanced 2.5 Pro (Google) for the purposes of text editing. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Benassi, F.; Bonifazi, C.; Heins, F.; Lipizzi, F.; Strozza, S. Comparing Residential Segregation of Migrant Populations in Selected European Urban and Metropolitan Areas. *Spat. Demogr.* **2020**, *8*, 269–290. [CrossRef]
2. Marcińczak, S.; Gentile, M.; Stępniak, M. Paradoxes of (Post)Socialist Segregation: Metropolitan Sociospatial Divisions under Socialism and after in Poland. *Urban Geogr.* **2013**, *34*, 327–352. [CrossRef]
3. van Ham, M.; Tammaru, T. New Perspectives on Ethnic Segregation over Time and Space. A Domains Approach. *Urban Geogr.* **2016**, *37*, 953–962. [CrossRef]
4. Tammaru, T.; Marcin'czak, S.; Aunap, R.; van Ham, M.; Janssen, H. Relationship between Income Inequality and Residential Segregation of Socioeconomic Groups. *Reg. Stud.* **2020**, *54*, 450–461. [CrossRef]
5. Lichter, D.T.; Parisi, D.; Ambinakudige, S. The Spatial Integration of Immigrants in Europe: A Cross-National Study. *Popul. Res. Policy Rev.* **2020**, *39*, 465–491. [CrossRef]
6. Järv, O.; Masso, A.; Silm, S.; Ahas, R. The Link Between Ethnic Segregation and Socio-Economic Status: An Activity Space Approach. *Tijdschr. Voor Econ. Soc. Geogr.* **2021**, *112*, 319–335. [CrossRef]
7. Ibraimovic, T.; Hess, S. A Latent Class Model of Residential Choice Behaviour and Ethnic Segregation Preferences. *Hous. Stud.* **2018**, *33*, 544–564. [CrossRef]
8. Tindale, A.; Klocker, N. Neighborhood Ethnic Diversity and Residential Choice: How Do Mixed-Ethnicity Couples Decide Where to Live? *Urban Geogr.* **2021**, *42*, 744–768. [CrossRef]
9. Bolt, G.; van Kempen, R. Ethnic Segregation and Residential Mobility: Relocations of Minority Ethnic Groups in the Netherlands. *J. Ethn. Migr. Stud.* **2010**, *36*, 333–354. [CrossRef]

10. Boterman, W.R.; Musterd, S.; Manting, D. Multiple Dimensions of Residential Segregation. The Case of the Metropolitan Area of Amsterdam. *Urban Geogr.* **2021**, *42*, 481–506. [CrossRef]
11. Rutland, P. Thirty Years of Nation-Building in the Post-Soviet States. *Natl. Pap.* **2023**, *51*, 14–32. [CrossRef]
12. Garda-Rozenberga, I.; Zirnite, M. Ethnic Diversity in the Construction of Life Stories in Latvia. *Acta Balt.* **2017**, *41*, 266–286. [CrossRef]
13. Németh, Á. Ethnic Diversity and Its Spatial Change in Latvia, 1897–2011. *Post. Sov. Aff.* **2013**, *29*, 404–438. [CrossRef]
14. Central Statistical Bureau of Latvia. Population and Its Characteristics. Available online: https://data.stat.gov.lv/pxweb/en/OSP_PUB/START__POP__IR/ (accessed on 15 March 2025).
15. Krišjāne, Z.; Bērziņš, M. Intra-Urban Residential Differentiation in the Post-Soviet City: The Case of Riga, Latvia. *Hung. Geogr. Bull.* **2014**, *63*, 235–253. [CrossRef]
16. Krisjane, Z.; Berzins, M. Post-Socialist Urban Trends: New Patterns and Motivations for Migration in the Suburban Areas of Rīga, Latvia. *Urban Stud.* **2012**, *49*, 289–306. [CrossRef]
17. Apparicio, P.; Martori, J.C.; Pearson, A.L.; Fournier, É.; Apparicio, D. An Open-Source Software for Calculating Indices of Urban Residential Segregation. *Soc. Sci. Comput. Rev.* **2014**, *32*, 117–128. [CrossRef]
18. Massey, D.S.; Denton, N.A. The Dimensions of Residential Segregation. *Soc. Forces* **1988**, *67*, 281–315. [CrossRef]
19. Brown, L.A.; Chung, S.Y. Spatial Segregation, Segregation Indices and the Geographical Perspective. *Popul. Space Place* **2006**, *12*, 125–143. [CrossRef]
20. Massey, D.S.; Denton, N.A. Spatial Assimilation as a Socioeconomic Outcome. *Am. Sociol. Rev.* **1985**, *50*, 94–106. [CrossRef]
21. Logan, J.R.; Alba, R.D. Locational Returns to Human Capital: Minority Access to Suburban Community Resources. *Demography* **1993**, *30*, 243–268. [CrossRef] [PubMed]
22. Rutland, P. Introduction: Nation-Building in the Baltic States: Thirty Years of Independence. *J. Balt. Stud.* **2021**, *52*, 419–424. [CrossRef]
23. Hess, D.B.; Tammaru, T. Modernist Housing Estates in the Baltic Countries: Formation, Current Challenges and Future Prospects. In *Housing Estates in the Baltic Countries*; Urban Book Series; Springer: Berlin/Heidelberg, Germany, 2019.
24. Gentile, M.; Sjöberg, Ö. Housing Allocation under Socialism: The Soviet Case Revisited. *Post. Sov. Aff.* **2013**, *29*, 173–195. [CrossRef]
25. Tammaru, T.; van Ham, M.; Leetmaa, K.; Kährik, A.; Kamenik, K. The Ethnic Dimensions of Suburbanisation in Estonia. *J. Ethn. Migr. Stud.* **2013**, *39*, 845–862. [CrossRef]
26. Ubarevičienė, R.; Burneika, D.; van Ham, M. Ethno-Political Effects of Suburbanization in the Vilnius Urban Region: An Analysis of Voting Behavior. *J. Balt. Stud.* **2015**, *46*, 217–242. [CrossRef]
27. Hans, N.; Hanhörster, H.; Polívka, J.; Beißwenger, S. The Role of Arrival Spaces in Integrating Immigrants. A Critical Literature Review. *Raumforsch. Raumordn.* **2019**, *77*, 511–524. [CrossRef]
28. Bolt, G.; Phillips, D.; Van Ronald, K. Housing Policy, (De)Segregation and Social Mixing: An International Perspective. *Hous. Stud.* **2010**, *25*, 129–135. [CrossRef]
29. Gilbert, D.; Dwyer, C.; Ahmed, N. Ethnic and Religious Diversity in the Politics of Suburban London. *Political Q.* **2019**, *90*, 72–80. [CrossRef]
30. Catney, G.; Wright, R.; Ellis, M. The Evolution and Stability of Multi-Ethnic Residential Neighbourhoods in England. *Trans. Inst. Br. Geogr.* **2021**, *46*, 330–346. [CrossRef] [PubMed]

Balode, S., & Krišjāne, Z. (2024).
Divergent population dynamics: the case of the inner city of Riga. *Rozwój Regionalny i Polityka Regionalna, 68*, 69–82.
https://doi.org/10.14746/rrpr.2024.68.06

Rozwój Regionalny i Polityka Regionalna 68: 69–82
https://doi.org/10.14746/rrpr.2024.68.06
2024

Sindija Balode, Zaiga Krišjāne

University of Latvia
Department of Human Geography
Faculty of Geography and Earth Sciences
SB: sindija.balode@lu.lv, https://orcid.org/0000-0002-6968-512X
ZK: zaiga.krisjane@lu.lv, https://orcid.org/0000-0002-3422-1958

Divergent population dynamics: The case of the inner city of Riga

Abstract: Population dynamics shape the spatial landscape of Europe. Although broadly studied, both suburban sprawl and inner-city reurbanisation have often been treated in isolation. Furthermore, these processes manifest distinctively across different local contexts. This research aimed to explore the population dynamics in the inner city of Riga from 2011 to 2021, contrasting them with the bordering municipalities of Riga, and to analyze how these dynamics align with the urban development model. Covering 58 neighborhoods and 7 bordering municipalities of Riga, the analysis revealed a shift in the trajectory of inner-city population dynamics during the latter half of the decade, which was finally characterized by growth. However, suburbanisation continued to outpace reurbanisation, indicating the coexistence of multiple urban development model stages.

Key words: population dynamics, urban development, reurbanisation

Introduction

Urban areas undergo constant transformation influenced by a range of interrelated factors, including changes in economic structures, government policies, and demographic landscape, which is the focus of this study. As the size and composition of a population shifts, spatial changes are inevitable. In the broadest context, urban areas typically progress through stages of initial population growth, urban sprawl, and a likely population return to the city.

Insights on stabilizing and growing inner-city populations in Europe have been explored in studies frequently (Buzar et al. 2007, Haase et al. 2010, Salvati et al. 2018), less commonly within the context of simultaneous suburbanisation. While this has allowed certain generalisations to be made, the context-specific characteristics of this phenomenon make it a worthwhile subject of research,

particularly in urban areas where reurbanisation is in its infancy, but suburbanisation is at its peak.

This study aimed to investigate how the population dynamics in the inner city of Riga changed compared to the bordering municipalities of Riga in the decade between 2011 and 2021, and to analyze how these dynamics fit within the urban development model. The study was based on quantitative analyses of full-scope population data collected by the Central Statistical Bureau of Latvia.

Applicability and flaws of the urban development model

Population dynamics, encompassing growth, decline, or stability, are linked to urban development. Leo van den Berg divided urban development into the following four stages: urbanisation, suburbanisation, disurbanisation, and reurbanisation (van den Berg 1982). The first stage, urbanisation, is characterized by fast population growth in the core. This growth slows down as the second stage, suburbanisation, begins; thus, instead of the core, the ring grows. Then, as the third stage, disurbanisation, starts, both the core and ring populations shrink, but the population grows in small- and medium-sized urban areas around the aforementioned urban area. This is a particularly hard hit on the urban core, negatively affecting both private and public services as the overall demand of the urban population declines. An alternative to the third stage of disurbanisation is the stage of reurbanisation, which, according to van den Berg's model, may or may not naturally replace disurbanisation. It is not predetermined and depends on the internal dynamics of the city and largely on government or municipal measures. If reurbanisation occurs, the ring is expected to shrink while the core grows. Nowadays, reurbanisation is of particular importance as a countermeasure to unsustainable urban sprawl in shrinking cities, including post-socialist cities where population decline has been prevalent following the transition.

The urban development model clearly shows the interconnectedness between its stages, where growth or shrinkage in one zone to a certain extent occurs at the expense of another. Initially, in the model's first two stages, the urban functional region experiences total growth, but in the last two stages, a total decline. Thus, when researching reurbanisation, analysis of the whole area, both the core and the ring, is suggested to understand how reurbanisation affects the demographics of the ring, and vice versa. The model is criticized for its limited ability to capture "wider trends", instead capturing fulfilment of a set of specific conditions. A study across England, France, Germany, and the Netherlands found that the last two stages – disurbanisation and reurbanisation – occurred only when there was no significant nationwide population growth (Dembski et al. 2021). Additionally, various studies (Kabisch, Haase 2009; Haase et al. 2010) suggest that reurbanisation may coincide with suburbanisation and disurbanisation, indicating model's limitations in representing contemporary demographic dynamics accurately; instead of a clear dominance of reurbanisation in Europe, the coexistence of various

stages is anticipated, suggesting a simultaneous occurrence of reurbanizing inner cities alongside persistent suburban sprawl.

Since the urban development model is purely based on population growth or decline, it disregards a set of factors that characterize population composition like age and household structures, ethnicity, occupational status, income, and education. Changes in these, for example, a growing share of Millennials and expatriates, an increase in non-traditional households, and indicators connected to the built environment such as housing costs, renovation and development, and public space (Haase et al. 2008), are also signs of reurbanisation and gentrification, which can help recognize some forthcoming trends of reurbanisation even if the core has not yet reached stability or growth in population. Gentrification, which is typically associated with a more adverse impact, primarily the displacement of less affluent residents due to an influx of wealthier newcomers, causes demographic change, and vice versa. Interestingly, the factors that facilitate gentrification include an underutilized inner city, new consumption patterns, and notably, suburban development (Zukin 1987). Given that suburban growth is connected to a simultaneous inner-city abandonment and subsequent inner-city revitalisation, suburbanisation can be seen as a precursor to reurbanisation.

Urban development and local conditions

The manifestations of reurbanisation and gentrification depend on local conditions – historic, institutional, social, and economic – which in turn influence residential preferences. In post-socialist cities, rental market peculiarities, privatisation, historic shortages of an affluent middle-class, bohemian communities, young professionals, or ethnic minorities favoring inner-city residence have to be considered; this can cause highly selective, façade, and marginal gentrification, such as an influx of students in the inner city, resulting in distinctive forms of gentrification, compared to Western countries (Kubeš, Kovács 2020). These changes can also be government- or foreign-investment-driven, leading to displacement through unjustified increases in rental prices or repurposing apartments for short-term rent (Kubeš, Kovács 2020). Thus, reurbanisation and gentrification case studies in post-socialist context are highly relevant, given the context variations across cities within this space and time-sensitiveness.

There are some general contrasts in the (de-)centralisation tendencies between Eastern and Western Europe. In the former, suburbanisation continues to play a more significant role; in the latter, population recentralisation in cities dominates (Hesse, Siedentop 2018). Before further exploring post-socialist cities, it is worth mentioning that generalisations of this kind are problematic in Western countries as well. For example, in the Netherlands, young affluent families have been observed to continue to choose to eventually move to the suburbs. Therefore, residential preferences remain largely intact after the original inner-city gentrifiers relocate (Booi et al. 2020). At the same time, a recent comprehensive research on gentrification in post-socialist cities concluded that

their inner cities are revitalizing, and their population composition is changing (Kubeš, Kovács 2020). These studies illustrate the difficulty of generalizing the aforementioned observations and support the necessity of new case and comparative studies.

Over the past two decades, post-socialist inner cities have undergone social upgrading. In the inner city of Tallinn, there has been notable social restructuring driven mainly by the market. A rise in socioeconomic status among residents is likely attributable to residents of a lower socioeconomic status being replaced by residents of a higher socioeconomic status, in some places accompanied by a decrease in the average age of the population (Temelová et al. 2016, Marcińczak et al. 2017). Similarly, the inner city of Vilnius has seen a surge in the share of residents with higher socioeconomic status, notably in areas previously characterized by lower socioeconomic status. This shift occurred after a major inner-city population decline in Vilnius until 2011, which was connected to commercialisation, as well as expansion of upscale residential dwellings (Valatka et al. 2015).

The changing consumption patterns, such as transport, cultural and dining preferences, and the aesthetics and character of old neighborhoods combined, have increased the relative attractiveness of the inner city. Residing in the inner city also serves as a means of ascertaining one's identity and social reproduction (Zukin 1987). Additionally, evolving urban lifestyles lead to an increase in non-traditional household structures, e.g., living alone, with a partner or flat-sharing. These trends, along with studentification and revitalisation projects, can disrupt local communities due to disparities in attitudes and values, and escalating socio-spatial inequalities (Fabula et al. 2017). Conversely, gentrifiers are sometimes found to have the potential to initiate positive changes related to social revitalisation that are inclusive and strengthen community ties, which to some extent is attributable to employing bottom-up revitalisation approaches (Grabkowska 2011). Additionally, it is worth noting that social upgrading may also be associated with in-situ change.

Although there are numerous similarities among post-socialist cities, comparative studies reveal differences in the pace of reurbanisation. For instance, when comparing Prague and Tallinn, the inner city of Prague was observed to have a higher degree of demographic stability (Temelová et al. 2016). However, a more recent study characterized Prague's inner city as undergoing a more intensified reurbanisation processes and diversification in residential behavior (Horňáková, Sýkora 2021), highlighting the temporal sensitivity of this research area.

The inner city and the bordering municipalities of Riga

Most post-socialist capitals have three zones – a historic area that developed before socialism, a residential and industrial area that developed under socialism, and a suburban area that developed after socialism (Marcińczak et al. 2017). This is also the case in Riga, the capital of Latvia. Riga has 58 neighborhoods, and it is a shrinking city, with a total population of 621 thousand in 2021, of whom 114

thousand or 18% were inner-city dwellers; although the share of the inner-city population slightly declined between 2011 and 2016, it experienced a modest increase between 2016 and 2021 (Table 1).

Table 1. Population in Riga, its inner city, and its bordering municipalities in 2011, 2016, and 2021 (CSB 2023)

	2011	2016	2021
Total population in Riga and its bordering municipalities	849,838	832,774	829,160
Total population in Riga	658,637	639,357	620,974
Inner-city population (*)	117,783 (17.88)	113,011 (17.68)	113,538 (18.28)
Population in Riga's bordering municipalities (**)	191,201 (22.50)	193,417 (23.23)	208,186 (25.11)

* Inner-city population divided by total population in Riga (%).
** Population of Riga's bordering municipalities divided by total population of Riga and its bordering municipalities (%),

The inner city of Riga consists of nine neighborhoods, separated by the River Daugava. On the left bank – Ķīpsala, Āgenskalns, and Torņakalns, on the right bank – Avoti, Brasa, Centrs, Grīziņkalns, Skanste, and Vecpilsēta. Additionally, Pētersala-Andrejsala, situated on the right bank, was included in this study due to its central location within the city's historical center's protection zone. Among these ten neighborhoods, Āgenskalns and Torņakalns are the only two that significantly extend beyond this protection zone. As of 2021, Centrs, with nearly 31 thousand residents (CSB 2023), was the largest inner-city neighborhood.

The inner-city neighborhoods are a densely built-up area, with 43% to 94% (depending on the neighborhood) of the buildings predating 1945. Buildings erected between 1946 and 2000 dominate in Pētersala-Andrejsala and make up about a half of the housing stock in Āgenskalns and Brasa. Skanste is the only inner-city neighborhood where buildings constructed since 2001 dominate, and a considerable number of new buildings are also present in Ķīpsala and Pētersala-Andrejsala. Additionally, Ķīpsala has the most varied mix of building ages (CSB 2023).

Under socialism, inner cities were left to decay, primarily housing residents of low socioeconomic status, but, in certain areas, also those of middle and upper socioeconomic status (Marcińczak et al. 2017). Since the transition and until 2010, Riga, particularly its inner city, experienced a significant population decline (Treija et al. 2020). During this period, suburbanisation both started and intensified, yet signs of a revival of the inner city were not to become evident before the start of the next decade.

As the decline of the inner-city slowed, indications of selective inner-city socioeconomic upgrading, growing share of non-traditional households, and higher residential mobility than the city average started to emerge (Krišjāne, Bērziņš 2014). The socioeconomic upgrading became even more evident between 2011 and 2021, resulting in a growing gap between the inner and outer city, as well

as within the inner city itself. Noteworthy is the decrease in the average age observed in many inner-city neighborhoods, in a city that is otherwise experiencing an aging population. Certain inner-city neighborhoods, particularly those located on the left side of the river and extending beyond the historical center's protection zone, lagged behind (Balode 2023).

Regarding the bordering municipalities of Riga, the study area includes the city of Jūrmala and six municipalities: Mārupe, Olaine, Ķekava, Salaspils, Ropaži, and Ādaži. In 2021, their combined population was 208 thousand residents, constituting 25% of the total study area population; the absolute population figures have been on a swift upward trajectory, attributed to suburbanisation. Notably, their share has been experiencing a more rapid increase compared to the inner city (Table 1).

Unlike suburbanisation, reurbanisation in Riga remains a relatively new and unexplored phenomenon, which is understandable given the persistent decline in inner-city population observed until recently. Additionally, the dynamics of inner-city population have not been thoroughly examined in the context of ongoing suburbanisation, nor analyzed how these population changes fit within the urban development framework.

Data and methods

The purpose of this research was twofold. Firstly, it aimed to explore the patterns of population dynamics in the inner city of Riga between 2011 and 2021, in comparison to the bordering municipalities of Riga. Secondly, it aimed to analyze how these patterns align with the urban development model. In order to achieve this, the study utilized data on population size across the neighborhoods of Riga (neighborhood-level data) and the bordering municipalities of Riga (municipality-level data). Fig. 1 provides an overview of the study area, which includes the neighborhoods of Riga, with a focus on the inner city, and the bordering municipalities of the city, which were briefly described in the section above.

The data utilized in this study was collected by the Central Statistical Bureau of Latvia and covers the year 2011 and the years from 2016 to 2021. This is a full-scope dataset, with no sampling involved. Furthermore, the dataset relies on geospatial data, ensuring that alterations in administrative boundaries do not compromise its accuracy. The 2011 data originates from a population census, while the data from 2016 to 2021 are population estimates that are based on a combination of more than 10 different national administrative registers and are subjected to a rigorous quality control procedure.

This research employed a quantitative method to observe the changes in population size in the aforementioned areas from 2011 to 2021. This decade was split into two 5-year intervals: 2011–2016 and 2016–2021, to detect demographic shifts efficiently. The key variable in this study was the population growth rate, calculated individually for all neighborhoods, including both inner- and outer-city neighborhoods as well as the bordering municipalities. Additionally, the annual

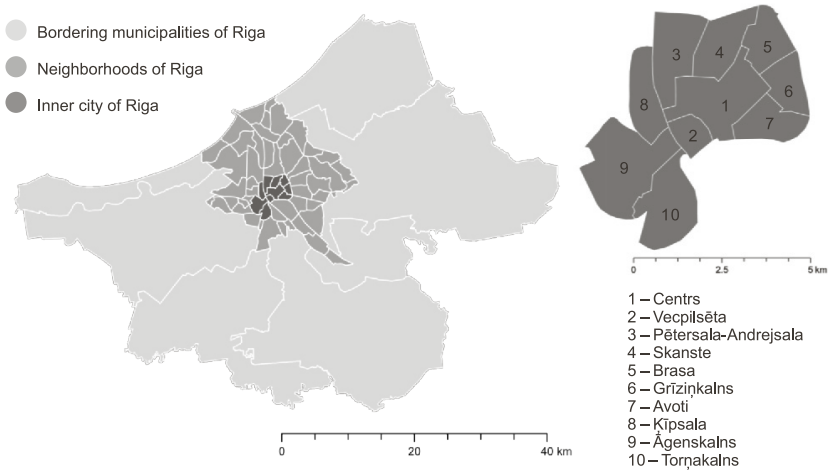


Fig. 1. Study area

population change in Riga between 2016 and 2021 was calculated to uncover any possible heterogeneity within the inner city. In order to identify spatial patterns, all population growth rates were mapped, resulting in three sets of maps. Finally, the overall growth rates were analyzed within the framework of the urban development model.

While straightforward and replicable, this method offers limited insights due to its inability to conduct a more thorough analysis, such as capturing shifts in population composition or policy effects.

Results

The results are summarized in Figs 2–4 (maps), Table 2 and Fig. 5 (findings within the context of the urban development model).

Fig. 2 illustrates the change in the total population in the city of Riga, highlighting the inner city, over the two five-year periods. During the first period, 39 out of 58 neighborhoods had a population decline of over 1%, which decreased to 31 neighborhoods in the second period. Despite the substantial decrease in the number of declining neighborhoods, the city still suffered an overall population decline of 2.9% in both periods, meaning that the population loss became more concentrated.

During the second half of the decade, there was a significant turnaround in the growth of the inner city of Riga. The overall growth rate increased from −4.1% (2011–2016) to 0.5% (2016–2021). The number of growing neighborhoods in the inner city also increased from one to six. The growth was mainly concentrat-

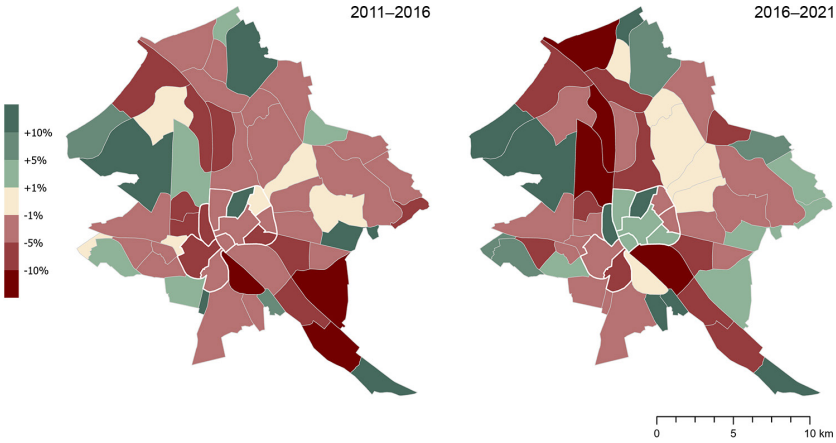


Fig. 2. 5-year population growth rates in neighborhoods of Riga from 2011 to 2016 and from 2016 to 2021
Source: authors' calculations based on CSB (2023).

ed in the "inner-city core", the area situated on the right bank, forming an integral part of the city's historical center and its protection zone. The high growth in Skanste and Ķīpsala, and to a smaller extent in Pētersala-Andrejsala, can be attributed to the construction of new residential buildings. The rest of the growing neighborhoods were characterized by their central location and affordable rents in case for the more peripheral ones. Overall, the inner city of Riga witnessed a reurbanisation trend in terms of population size, which was also paralleled by upgrades in the socioeconomic status of the inner-city residents (Balode 2023).

Fig. 3 provides a detailed analysis of the inner-city neighborhoods exclusively, focusing on the annual change during the latter half of the studied decade. This analysis reveals fluctuations in growth over the years and more disparities among the inner-city neighborhoods. In particular, year 2021 highlighted a spread of the "red" neighborhoods, primarily affecting those neighborhoods extending beyond the "inner-city core" or facing more socioeconomic challenges (Balode 2023). One plausible explanation for this is also the impact of the COVID-19 pandemic, which may have diminished the appeal of inner-city living. It also suggests that the assumption of homogeneity based solely on distance from the city center is problematic (Dembski et al. 2021). However, it is noteworthy that certain inner-city neighborhoods exhibited stability and continuous growth over all these years, but, in other areas, the growth in some years compensated for decline in others.

Table 2 shows how the share of the population living in each of the inner-city neighborhoods changed between 2011, 2016, and 2021. Neighborhoods that experienced growth or stability are highlighted in bold. Consistent with previous analyses, it is apparent that the "inner-city core" neighborhoods performed bet-

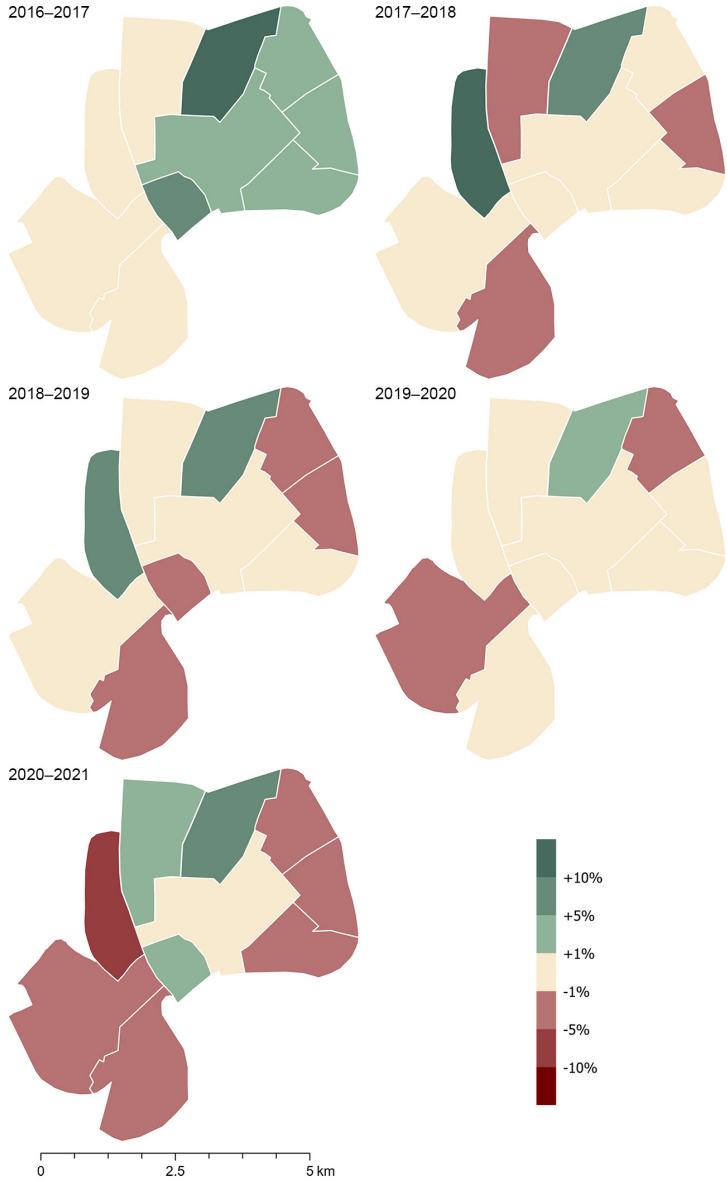


Fig. 3. Annual population growth rates in inner-city neighborhoods of Riga from 2017 to 2021
Source: authors' calculations based on CSB (2023).

Table 2. Share of the population living in the inner-city neighborhoods in 2011, 2016, and 2021

	Total population (2021)	Share (%)		
		2011	2016	2021
Centrs	30,673	4.67	4.58	4.94
Āgenskalns	24,024	4.07	3.94	3.87
Avoti	17,857	2.82	2.73	2.88
Brasa	12,721	2.01	2.05	2.05
Grīziņkalns	12,133	1.95	1.93	1.95
Torņakalns	6341	1.05	1.05	1.02
Pētersala-Andrejsala	5089	0.79	0.78	0.81
Vecpilsēta	1968	0.29	0.29	0.32
Skanste	1863	0.12	0.20	0.30
Ķīpsala	869	0.12	0.11	0.14

Source: CSB (2023).

ter overall; in fact, only two neighborhoods, Āgenskalns and Torņakalns, experienced a decline.

Fig. 4 provides an overview of population change across the entire study area, focusing particularly on the bordering municipalities. During the first half of the decade, some bordering municipalities witnessed a decline in population, while others experienced growth. However, during the latter half of the decade, all administrative areas surrounding the capital saw positive population growth rates, with many experiencing relatively high growth rates, up to a staggering 21%. This surge can be attributed to ongoing suburbanisation activities around Riga, evident also in the outer-city neighborhoods adjacent to the bordering municipalities. The overall population growth rate escalated from 1.2% in the first period to 7.6% in the subsequent period, marking an over six-fold increase.

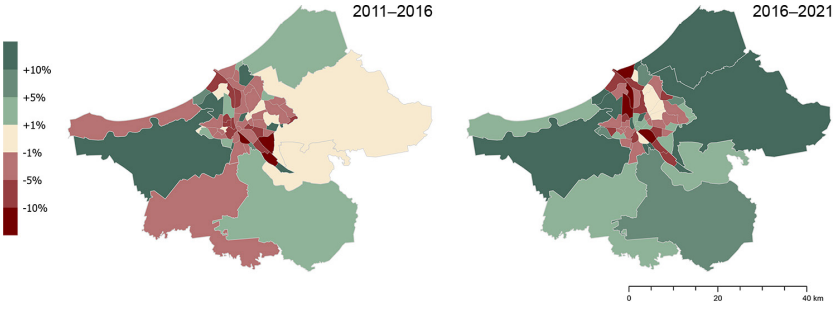


Fig. 4. 5-year population growth rates in neighborhoods of Riga and its bordering municipalities from 2011 to 2016 and from 2016 to 2021
Source: authors' calculations based on CSB (2023).

In general, the suburbanisation rates observed during the study period far surpassed the relatively moderate rates of reurbanisation. These findings also further underscore previous research indicating flaws in the core-ring model, as areas within both the core and the ring can display substantial variations from each other and from the average indicators. This heterogeneity is particularly pronounced in the core, where factors such as location (including being part of the "inner-city core" and the historical center or its protection zone), housing stock, socioeconomic environment, fragmentation, and pace of gentrification likely contribute to significant differences in population growth rates.

In the framework of the urban development model (Fig. 5), there was a significant positive increase in population within the ring during the study period, which theoretically conforms to the suburbanisation stage and total growth. However, despite this pronounced suburbanisation trend, the overall study area was in total decline, associated with either disurbanisation or reurbanisation stage. The model defines reurbanisation as resurgence in the share of the core population within the functional urban region. This can happen when the core declines slower than the ring or when the core grows while the ring simultaneously declines. Neither of these conditions apply in this case; however, there are signs of relative centralisation, marked by a modest increase in the inner-city population share within the study area between 2016 and 2021. Overall, these results suggest that the model indeed reflects specific conditions being met; instead, Riga experienced relative centralisation alongside simultaneous suburban growth. It is essential to note, as discussed earlier, that this unique outcome is a product of local conditions and particularly characteristic of post-socialist cities.

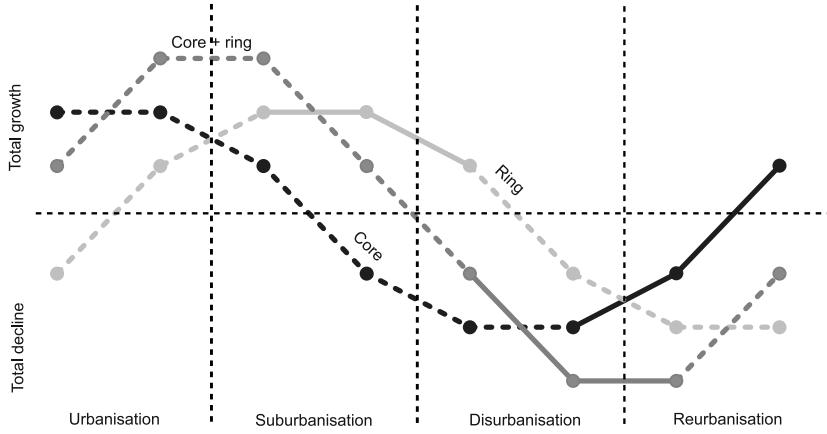


Fig. 5. Urban development model with the corresponding findings in the study area
Source: adapted from van den Berg (1982).

Conclusion and discussion

According to various case studies (Sýkora 2009, Haase et al. 2018), it is generally possible to conclude that, in the 21st century, post-socialist inner cities are experiencing reurbanisation, although it tends to differ from its forms observed in Western countries. One of the shortcomings in this research field has been the lack of investigating inner-city reurbanisation in the context of ongoing suburbanisation.

Analysis of population dynamics in the study area revealed that the inner-city population was growing alongside suburban population. Importantly, the inner-city population started to grow only in the latter half of the decade between 2011 and 2021. In the context of the urban development model, the results indicate a mix of suburbanisation, disurbanisation and reurbanisation stages, challenging the notion of the model's stages taking place sequentially.

This study has provided deeper insights into the current patterns of reurbanisation and suburbanisation processes in the inner city of Riga and its bordering municipalities. Between 2011 and 2021, after a prolonged decline, inner-city population finally experienced relative stability and even slight growth that aligns with urban development model's reurbanisation stage and the previous research on post-socialist cities discussed earlier. Additionally, the study identified heterogeneity within the inner city, with inner neighborhoods consistently outperforming outer neighborhoods. Population growth rates in the bordering municipalities of Riga were notably higher in the study period than those in the inner city, and the persistent suburbanisation trend is also a characteristic of post-socialist cities (Hesse, Siedentop 2018). Despite this, the total population decline observed in the study area suggests the model's closest fitting stage is disurbanisation, although it appears to be more of a mixed or parallel stage scenario.

This analysis contributes to existing research on urban areas in post-socialist contexts, highlighting shortcomings in the urban development model. Specifically, it underscores the potential coexistence of different stages of the model and emphasizes the importance of examining inner-city reurbanisation within a broader context. This broader context should not only include an exploration of demographic processes in outer city and suburban areas but also consider migration data between the inner city and suburbia. Could the growth observed in the inner city be attributable to younger suburbanites arriving, or is it a result of in-migration or international migration? At this moment, it may be premature to draw definitive conclusions, considering the relatively short history of suburbanisation in a post-socialist setting. The gradual increase in the inner-city population share relative to the suburban population presents an intriguing trend to monitor in the future. It remains to be seen whether, or rather when, reurbanisation rates will outpace suburbanisation rates. These are crucial considerations for future research.

Furthermore, conducting a mixed-methods research study on the residential preferences of both current inner-city residents and suburbanites would provide valuable insights. Understanding whether individuals currently fueling reurban-

isation may eventually opt for suburban living, and elucidating the factors influencing their decision-making process would be crucial not only for the inner city of Riga, but also the inner cities of Tallinn, Vilnius, and Budapest, which have also experienced high levels of residential mobility (Valatka et al. 2015, Temelová et al. 2016).

Research on reurbanisation holds significant implications for policymakers. Selective inner-city revitalisation and gentrification may intensify spatial inequalities, disrupt communities, undermine social cohesion, diminish residents' sense of belonging, or even cause displacement. An insight into residential behavior patterns can inform policymakers on how to mitigate spatial inequalities and sustainably facilitate reurbanisation to contain urban sprawl in shrinking cities.

Acknowledgments

This research is funded by the project "Strengthening of the capacity of doctoral studies at the University of Latvia within the framework of the new doctoral model", identification No. 8.2.2.0/20/I/006.

References

Balode S. 2023. Shifting inner-city sociodemographics: the case of Riga. Folia Geographica, 20(2): 64–73. https://doi.org/10.22364/fg.20.2.7

Booi H., Boterman W., Musterd S. 2020. Staying in the city or moving to the suburbs? Unravelling the moving behaviour of young families in the four big cities in the Netherlands. Population, Space and Place, 27(3). https://doi.org/10.1002/psp.2398

Buzar S., Ogden P., Hall R., Haase A., Kabisch S., Steinfiihrer A. 2007. Splintering Urban Populations: Emergent Landscapes of Reurbanisation in Four European Cities. Urban Studies, 44(4): 651–677. https://doi.org/10.1080/00420980601185544

Central Statistical Bureau of Latvia (CSB). 2023 (https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START__POP__IR/).

Dembski S., Sykes O., Couch C., Desjardins X., Evers D., Osterhage F., Siedentop S., Zimmermann K. 2021. Reurbanisation and suburbia in Northwest Europe: A comparative perspective on spatial trends and policy approaches. Progress in Planning, 150: 100462. https://doi.org/10.1016/j.progress.2019.100462

Fabula S., Boros L., Kovács Z., Horváth D., Pál V. 2017. Studentification, diversity and social cohesion in post-socialist Budapest. Hungarian Geographical Bulletin, 66(2): 157–173. https://doi.org/10.15201/hungeobull.66.2.5

Grabkowska M. 2011. Inner-city transformations after socialism findings from interviews with new residents of pre-war tenement houses in Gdańsk. Bulletin of Geography. Socio-economic Series, 15(15): 117–129. https://doi.org/10.2478/v10089-011-0008-7

Haase A., Kabisch S., Steinführer A., Bouzarovski S., Hall R., Ogden P. 2010. Emergent spaces of reurbanisation: Exploring the demographic dimension of inner-city residential change in a European setting. Population, Space and Place, 16(5): 443–463. https://doi.org/10.1002/psp.603

Haase A., Wolff M., Špačková P., Radzimski A. 2018. Reurbanisation in Postsocialist Europe – A Comparative View of Eastern Germany, Poland, and the Czech Republic. Comparative Population Studies, 42. https://doi.org/10.12765/CPoS-2018-02

Haase D., Haase A., Kabisch S., Bischoff P. 2008. Guidelines for the 'Perfect inner city'. Discussing the appropriateness of monitoring approaches for reurbanisation. European Planning Studies, 16(8): 1075–1100. https://doi.org/10.1080/09654310802315765

Hesse M., Siedentop S. 2018. Suburbanisation and suburbanisms – making sense of continental European developments. Raumforschung und Raumordnung/Spatial Research and Planning, 76(2). https://doi.org/10.1007/s13147-018-0526-3
Horňáková M., Sýkora J. 2021. From suburbanisation to reurbanisation? Changing residential mobility flows of families with young children in the Prague metropolitan area. Norsk Geografisk Tidsskrift – Norwegian Journal of Geography, 75(4): 203–220. https://doi.org/10.1080/00291951.2021.1970014
Kabisch N., Haase D. 2009. Diversifying European agglomerations: Evidence of urban population trends for the 21st Century. Population, Space and Place, 17(3): 236–253. https://doi.org/10.1002/psp.600
Krišjāne Z., Bērziņš M. 2014. Intra-urban residential differentiation in the post-Soviet city: The case of Riga, Latvia. Hungarian Geographical Bulletin, 63(3): 235–253. https://doi.org/10.15201/hungeobull.63.3.1
Kubeš J., Kovács Z. 2020. The kaleidoscope of gentrification in post-socialist cities. Urban Studies, 57(13): 2591–2611. https://doi.org/10.1177/0042098019889257
Marcińczak S., Tammaru T., Ogrodowczyk A. 2017. Exploring patterns of socioeconomic residential intermixing in Tallinn. Cities, 67: 95–103. https://doi.org/10.1016/j.cities.2017.04.011
Salvati L., Serra P., Bencardino M., Carlucci M. 2019. Re-urbanizing the European City: A Multivariate Analysis of Population Dynamics During Expansion and Recession Times. Eur. J. Population, 35: 1–28. https://doi.org/10.1007/s10680-017-9462-0
Sýkora L. 2009. Post-Socialist Cities.[W:] International Encyclopedia of Human Geography. Elsevier, s. 387–395. https://doi.org/10.1016/B978-008044910-4.01072-5
Temelová J., Novák J., Kährik A., Tammaru T. 2016. Neighbourhood Trajectories in the Inner Cities of Prague and Tallinn: What Affects the Speed of Social and Demographic Change? Geografiska Annaler: Series B, Human Geography, 98, 4: 349–366. https://doi.org/10.1111/geob.12109
Treija S., Bratuškins U., Barvika S., Bondars E. 2020. The Liveability of Historical Cities: Current State and Prospects for Habitation. WIT Transactions on The Built Environment. https://doi.org/10.2495/gd170021
Valatka V., Burneika D., Ubarevičienė R. 2015. Large social inequalities and low levels of socio-economic segregation in Vilnius. Socio-Economic Segregation in European Capital Cities: East Meets West, 313–332. https://doi.org/10.7480/abe.2017.9.3626
van den Berg L., Drewett R., Klaassen L. 1982. Urban Europe: A Study of Growth and Decline. Vol. 1. Pergamon Press.
Zukin S. 1987. Gentrification: Culture and capital in the urban core. Annual Review of Sociology, 13(1): 129–147. https://doi.org/10.1146/annurev.so.13.080187.001021.

Dywergencja dynamiki populacji: przypadek centrum Rygi

Zarys treści: Dynamika populacji wpływa na krajobraz przestrzenny Europy. Choć w literaturze podejmuje się badania w tym aspekcie zarówno obszarów podmiejskich, jak i śródmiejskich, to często traktowane są one oddzielnie. Co więcej, procesy te są odmienne w różnych kontekstach lokalnych. Celem opracowania było zbadanie dynamiki populacji w centrum Rygi w latach 2011–2021, porównanie z sąsiadującymi gminami Rygi, a także przeanalizowanie sposobu, w jaki dynamika ta odpowiada modelowi rozwoju obszarów miejskich. Analiza, obejmująca 58 dzielnic Rygi i 7 sąsiadujących gmin, wykazała zmianę trajektorii dynamiki populacji śródmiejskiej w drugiej połowie dekady, która ostatecznie charakteryzowała się wzrostem. Należy podkreślić, że urbanizacja w dalszym ciągu wyprzedzała reurbanizację, co wskazuje na współistnienie wielu etapów modelu rozwoju obszarów miejskich.

Słowa kluczowe: dynamika populacji, rozwój miast, reurbanizacja

Krisjane, Z., Berzins, M., Krumins, J., Apsite-Berina, E., & **Balode, S.** (2023).
Uneven geographies: ageing and population dynamics in Latvia. *Regional Science Policy and Practice, 15*(4).
https://doi.org/10.1111/rsp3.12648

Received: 20 June 2022 | Revised: 14 January 2023 | Accepted: 2 February 2023

DOI: 10.1111/rsp3.12648

ORIGINAL ARTICLE

Uneven geographies: ageing and population dynamics in Latvia

Zaiga Krisjane | Maris Berzins | Janis Krumins | Elina Apsite-Berina | Sindija Balode

Department of Geography, Faculty of Geography and Earth Sciences, University of Latvia, Riga, 1586, Latvia

Correspondence
Zaiga Krisjane, Department of Geography, Faculty of Geography and Earth Sciences, University of Latvia, Riga 1586, Latvia.
Email: zaiga.krisjane@lu.lv

Funding information
National Research Programme, Grant/Award Number: VPP-LETONIKA-2021/4-0002

Abstract

The twin phenomena of ageing populations and declining populations are profoundly transforming societies and economies in Europe. Driven by decreasing fertility rates and the continuing increased life expectancy, populations have not been ageing uniformly across time and space. In an increasingly urbanized world, the spatial distribution of the young and the elderly is a matter of growing scholarly and policy interest. In Europe, this process is more pronounced in peripheral areas than in the core regions, while the development of metropolitan areas is associated with suburbanization predominantly driven by young in-migrants. Latvia is an interesting case study for studying population ageing and its spatial imbalances due to the key role of emigration in population decline and ageing. By employing descriptive and spatial analysis, this study uses data from the Latvian census and population register to explore the relationships between population change and ageing processes. Global Moran's I and the local indicators of spatial association were used to identify spatial systems. The study confirmed global and local spatial autocorrelation for the both examined age variables. Using the Getis-Ord Gi* method identified spatial clusters of the young and the elderly. We found more pronounced residential clustering of the elderly aged 75 and over in the depopulating region of Latgale, whereas the Riga metropolitan region and areas around the largest towns tend to cluster young residents.

KEYWORDS
labor and demographic economics, demographic economics, demographic trends and forecasts, metropolitan and non-metropolitan regions, ageing population, population dynamics, Latvia

JEL CLASSIFICATION
J1, J11, R0, R19

1 | INTRODUCTION

The implications of population changes are a critical issue for urban and regional development in Central Eastern Europe (CEE) (Fihel & Okólski, 2019; Haase et al., 2016; Kulcsár & Brown, 2017). Even though the region as a whole is characterized by overall population decline, metropolitan areas have been experiencing population growth (Borén & Gentile, 2007; Kabisch et al., 2019; Ouředníček et al., 2015).

The key characteristics of population decline are birth rates below replacement level, low mortality, and rising life expectancy, which contribute to an increase in the number and proportion of the elderly population. Age distribution hampers Latvia's population growth (Bērziņš, 2019; Krūmiņš & Krišjāne, 2016). Overall, rural areas have seen the most extreme population loss (Pužulis & Kūle, 2016; Ubarevičienė et al., 2016).

Suburban growth has contributed to demographic inequalities between metropolitan and nonmetropolitan regions in Latvia, as in other CEE nations. Many of the region's core cities nowadays are characterized by reurbanization trends as well as ongoing parallel suburbanization processes in the city peripheries (Haase et al., 2010; Horňáková & Sýkora, 2021; Istrate et al., 2015; Krisjane & Berzins, 2012; Kurek et al., 2020; Ubarevičienė & Burneika, 2020).

Thus, the implications of demographic transition across metropolitan and nonmetropolitan areas are not uniform. Since the ageing of the population—caused by high life expectancy, in-migration of the elderly, out-migration of the young, and low birth rates—has not been heterogenous, the current demographic trends have prompted fears that an ageing population will exacerbate demographic polarization at both the local and regional levels (Gregory & Patuelli, 2015; Gutiérrez Posada et al., 2018; Kashnitsky et al., 2017; Kurek et al., 2020; Lang et al., 2022; Reynaud et al., 2018; Senbil & Yetiskul, 2022).

When investigating age-based residential patterns in metropolitan versus nonmetropolitan areas beyond CEE countries, spatially heterogenous ageing with different speeds of convergence and even divergence can be observed in Spain (Gutiérrez Posada et al., 2018). More specifically, the size of a municipality (urban versus rural) is negatively associated with ageing, whereas the distance of a municipality (central versus peripheral) holds a positive association. However, the magnitude of the association not only varies across space but also does not always have a restraining or triggering effect on ageing. Significant spatial differences in the distribution of the elderly, seemingly related to the area's urbanization level, are found in both Spain and Turkey (Gutiérrez Posada et al., 2018; Senbil & Yetiskul, 2022). Overall, across Organization for Economic Cooperation and Development (OECD) countries, population ageing is asymmetrical, and the elderly dependency rate in some countries can vary as much as 10% to 50%. Moreover, in the last two decades, the elderly dependency rate has increased in all the member states. The highest rise is observed in regions near metropolitan areas and the lowest in remote regions near small and medium-sized cities (OECD, 2020).

Similarly, differences in the level of population ageing and spatial dependencies can be seen when comparing age composition based on the degree of urbanization in CEE countries. In Czechia's Moravia region, the proportion of the elderly is higher in towns and cities than in rural areas (Vaishar et al., 2020). However, in Poland, there has been a decline in the rate of ageing in the largest functional urban areas due to suburbanization and reurbanization.

Meanwhile, the share of the pre-working age population in the cores of Polish functional urban areas is lower than in their peripheries (Kurek et al., 2020, 2021). There is greater spatial differentiation and dependence based on the size of the functional urban area. In the case of Slovakia, the districts in the metropolitan Bratislava region show the highest growth in the share of children compared to the rest of the country, revealing that population ageing in the region has slowed in the last decade (Kačerova et al., 2022).

The significance of recent studies on age-based residence patterns can be attributed to several factors. First, recent research efforts have focused more on the elderly or post-working population than the pre-working population, which can undermine the effectiveness of comprehensive planning. Second, since case studies tend to have contradictory findings and population distribution is rarely homogeneous, additional studies provide valuable input in the search for patterns. Third, to design effective spatial policies and planning, it is vital to understand the residential distribution and mobility of the ageing population, especially in smaller settlements that are affected by even small changes. Ageing and shrinking municipalities can face decreasing livability and a reduced workforce due to a lack of employment, which is a crucial factor in planning, significantly since shrinkage might not affect the region as a whole but its sub-municipalities and neighborhoods (Gutiérrez Posada et al., 2018; Segers et al., 2020; Senbil & Yetiskul, 2022).

Multiple transformations (Rink et al., 2019; Sýkora & Bouzarovski, 2012; Steinführer et al., 2011) can be utilized to understand the post-socialist urban changes, particularly the temporal and spatial dynamics of demographic change and their implications for policy, planning, and regional development. Numerous studies have found that demographic transition, ageing, fertility behavior, and diverse household structures have a significant impact on urban shrinkage, regional labor, and the real estate market (Botev, 2012; Buzar et al., 2005; Couch et al., 2012; Káčerová et al., 2014; Kashnitsky et al., 2021; Kazimierczak & Szafrańska, 2019; Kurek et al., 2017; Kurek & Wójtowicz, 2018; Steinführer & Haase, 2007; Wolff & Wiechmann, 2018).

Finally, current research on the COVID-19 pandemic shows that the risk of death among infected people increases rapidly with age. Additionally, it was shown that illness incidence is higher in densely inhabited and urbanized areas (Ferguson et al., 2020; Gurram et al., 2022; Nazia, 2022; Pilkington et al., 2021). European regions are ageing unequally; thus, coronavirus SARS-CoV-2 poses particular challenges to regions and populations with greater proportions of vulnerable older people (Kashnitsky & Aburto, 2020). Geographical differences in population age compositions partly explain the spread of COVID-19 (Dowd et al., 2020). Looking at population age structures with considerable variations in the degree of ageing is critically important to assess the potential impact of the pandemic in ageing European regions (Kashnitsky & Schöley, 2018). The increasing proportion of older people in Latvia raised concerns associated with the COVID-19 outbreak. The most recent study reveals the negative cumulative effect of COVID-19 exposure on excess mortality in Latvia (Gobiņa et al., 2022).

The current study aimed to better understand the relationships between population change and ageing processes in Latvia's metropolitan and nonmetropolitan regions. For this purpose, we utilized the 2000 census and the most recently available population register data to investigate changes in the residential patterns and numbers of youths (aged form birth to 14 years) and the elderly.

Accordingly, this study had two research objectives. First, we provide an overview of population dynamics and ageing over the past two decades across Latvia's regions by using a combination of data pertaining to changes in the young and elderly populations at the aggregated territorial units of the sub-municipal level. Second, we explore geographical variation in the residential patterns of both considered age groups, downscaled at a fine-grain spatial resolution.

This article is divided into four parts. The following section briefly presents the study's data and methods. The third or results section addresses both research objectives: (1) the relationships between population dynamics and ageing over the past two decades and (2) residential patterns of both considered age groups for two observation years and by the regional breakdown of interest. Explorative geographical analyses were conducted to delve into changes in the distribution of young and elderly populations over space and time. In the final

section, we discuss the results and offer a conclusion framed within broader ongoing debates of depopulation, remoteness, and access to services.

2 | DATA AND METHODS

2.1 | Data

Data on the size and distribution of the young and elderly populations were drawn from the 2000 population census and the 2020 population register. Both datasets come from Latvia's Central Statistical Bureau, ensuring appropriate anonymization of individual-level data and mutual comparability. For the spatial analysis, we used geocoded individual-level data regarding the population's size and age, encompassing the entire territory of Latvia. The research presented here was undertaken for two age groups: the young population, aged 0–14 years, and the elderly population, aged 75 and over. Both age groups were analyzed by comparing their size and distribution changes over the past two decades to better understand the relationships between population dynamics and ageing processes in Latvian regions. The distribution of the selected age groups was examined using spatial autocorrelation and spatial clustering analysis. For the spatial analysis, we used territorial units at the sub-municipal level and a fine-grain hexagonal grid of 16 hectares cells to apply the hot spot mapping technique to explore the residential patterns of both considered age groups. The available population data were geocoded according to the place of residence, and thus, linked to cells in the hexagonal grid we created. Each cell contains individual-level data on the registered residents' age and allows determination of the size of the analyzed age groups. Although the generated grid and cells may only partially correspond to the administrative boundaries of regions and municipalities, they provide the most geographically consistent detailed spatial scale and comparative robustness.

2.2 | Methods of spatial autocorrelation and clustering

This study employs quantitative methods to observe the residential patterns of the young and the elderly in Latvian metropolitan and nonmetropolitan regions. First, we investigated the spatial autocorrelation of the selected age groups using the global Moran's I index to assess whether the residential patterns of the young and the elderly populations are spatially clustered, dispersed, or randomly distributed (Lloyd, 2014; Matthews & Parker, 2013). The generated hexagonal grid was the primary input data for the spatial autocorrelation and clustering analysis. The Moran's I estimation is based on the following equation:

$$I = \frac{n}{W} \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} (x_i - \overline{x}) (x_j - \overline{x})}{\sum_{i=1}^{n} (x_i - \overline{x})^2} \quad (1)$$

Here, n is the number of spatial units (grid cells); X is the variable of interest (given age group); $\overline{X}$ acts as the mean of X; $w_{i,j}$ the spatial weight between all pairs of points i and j; and W is the sum of all $w_{i,j}$ values. The value of the global Moran's I index ranges from -1 (clustering of dissimilar values) to $+1$ (clustering of similar values), and a value of 0 indicates no spatial autocorrelation. Index values closer to $+1$ indicate higher spatial autocorrelation; index values closer to -1 indicate greater spatial disparity. The calculations were performed using ESRI ArcGIS Spatial Analysis. The tool calculates the values of the global Moran's I, along with the z-score and p-value, which help to evaluate the index's significance. The global Moran's I analysis results are interpreted within the context of its null hypothesis of random spatial distribution. One cannot reject the null hypothesis when the p-value is not statistically significant. When the p-value is statistically significant, the spatial distribution is not randomly distributed. A positive

z-score indicates spatial clustering, while a negative *z*-score indicates spatial dispersion. If the *z*-score equals 0, the autocorrelation is absent in the observed area.

Local indicators of spatial association (LISA) can help to identify spatial systems or cells from an adopted hexagonal grid surrounded by neighboring cells with high or low values (so-called hot spots and cold spots) of both age variables. To complement the global spatial statistics, local spatial statistics were used to evaluate where the clustering or dispersion tested by Moran's I index is located across the regions of Latvia. We used the Getis-Ord Gi* statistics to detect statistically significant local concentrations of hot spots and cold spots. In essence, this tool identifies each neighboring cell within the context of the analyzed feature (selected age group) and observed area and assesses whether the feature is part of spatially aligned statistically significant spatial clusters (Getis & Ord, 1992). The Getis-Ord Gi* local statistics were calculated using the formula:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j} x_j - \overline{X} \sum_{j=1}^{n} w_{i,j}}{S \sqrt{\frac{n \sum_{j=1}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j}\right)^2}{n-1}}} \quad (2)$$

Here, n grid cells are assumed with numerous measurements $X = [x_1, \ldots, x_n]$. Additionally, $\overline{X}$ acts as the mean of all measurements; S as the standard deviation of all measurements; $w_{i,j}$ as the spatial weight between all pairs of cells i and j. The Getis-Ord Gi* is sensitive to the distance in which the spatial relationships among features are calculated (Songchitruksa & Zeng, 2010). A positive G_i^* value shows that high values cluster around cell i; hence the area is deemed a hot spot; a negative G_i^* value shows that low values cluster around cell i, so the area is termed a cold spot. The analyses were applied using ESRI ArcGIS software and mapped for age groups that show clustered conditions according to the global Moran's I. Spatial autocorrelation, and clustering methods have been widely used in studies related to spatial demography (Kurek et al., 2021; Matthews & Parker, 2013; Raymer et al., 2019).

3 | RESULTS: YOUNG AND ELDERLY POPULATIONS IN LATVIA

Since the early 1990s, Latvia and other CEE countries have experienced sudden and simultaneous turnabouts in all the main demographic processes: fertility, mortality, and migration (Fihel & Okólski, 2019). The consequent depopulation, urban shrinkage, and population ageing marked the most far-reaching societal changes of the post-Soviet (socialist) transformations. These transformations resulted in a radical demographic shift characterized by increased life expectancy, low fertility rates, more diverse family patterns. and the increasing significance of migration (Frejka et al., 2016; Krūmiņš & Krišjāne, 2016). Due to low fertility rates from the 1990s onwards, increasing longevity, and the emigration of young adults, Latvia, similar to other CEE countries, is have one of the oldest populations in Europe in the near future (Bērziņš, 2019).

3.1 | Ageing and population dynamics

Numerous indicators have been used to study population ageing (for example, see Lutz, 2009). These indicators often depend on an age threshold defining the "older" population. In the developed world, 65 years is the typical age for defining the older population, as this age is usually linked to retirement age. In this study, we focused on the share of the young and elderly as a summary measure to analyze the changes in the population age structure and its spatial patterns. Despite the widely used threshold of 65 years, we used the age of 75 and over as the threshold for the old population. Those aged 75 and over represent the fastest-growing section of the population in the developed world (Matthews et al., 2005). In the case of Latvia, it is also evident that this age group has had the most remarkable

growth compared to other age groups during the study period (Figure 1). This is likewise true for Riga's metropolitan and nonmetropolitan areas. We also opted to analyze the changes and distribution of the young population group (aged 0–14 years). Specifically, we investigated the major macro-regions, distinguishing the Riga metropolitan area from the rest of the country (nonmetropolitan areas).

1.9 million people were living in Latvia as of 2020, of whom almost half were concentrated in the capital city, Riga (32.6%), or the surrounding metropolitan region (13.3%). The total population of the capital's metropolitan area was slightly lower than that of the nonmetropolitan population. Just over half (54.1%) of the country's population lived in regions outside the capital (Table 1). Overall, Latvia has been experiencing depopulation, and since 2000, the population has decreased by 19.9%. Population dynamics show a decline in most of Latvia's regions since 2000, apart from those within close proximity of Riga. Only suburbs have witnessed a population increase (18.1%). This is associated with the processes of suburbanization and positive in-migration (Berzins et al., 2021). The most significant decrease in the share of the population is observed in the nonmetropolitan regions. In total, these areas have witnessed their population decline by more than a quarter. The region of Latgale has experienced the most significant decrease, losing approximately one-third of its population. This easternmost region lags behind other regions within the European Union and is characterized by emigration and population ageing.

The median age in the country increased between 2000 and 2020 from 37 to 43 years, indicating that the population is ageing considerably. In 2000, the highest median age was observed in Riga (39 years) and the lowest in its suburbs (36 years). The nonmetropolitan regions of Kurzeme (in Latvia's west), Vidzeme (in the north), and Zemgale (in the south) were slightly below the national average and showed similar ageing patterns to Riga's suburbs. In the nonmetropolitan region of Latgale (in the eastern), the median age was 38 years.

In contrast, for 2020, the highest median age indicators were in the nonmetropolitan regions (44 years), especially in Latgale, where it reached 47 years. The median age has also increased in the Riga metropolitan region;

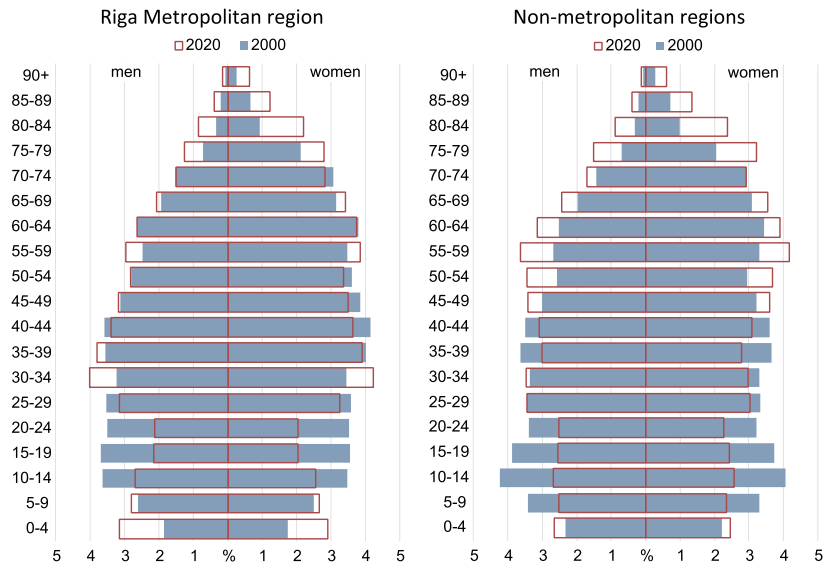


FIGURE 1 Standardized gender age structure for the Riga metropolitan region and Latvia's nonmetropolitan regions in 2000 and 2020. *Source*: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

TABLE 1 Population change and median age in Latvia (2000–2020).

	Population in 2020		Population change %	Median age	
	Thousands	Distribution %	2000–2020	2000	2020
Riga metropolitan region	875	45.9	−10.2	39	42
Riga city	621	32.6	−19.0	39	42
Suburbs	254	13.3	+18.1	36	40
Nonmetropolitan regions	1,032	54.1	−26.6	36	44
Kurzeme	283	14.8	−24.8	36	44
Vidzeme	262	13.7	−25.4	36	45
Zemgale	230	12.1	−21.7	36	43
Latgale	257	13.5	−33.3	38	47
Latvia	1,907	100.0	−19.9	37	43

Source: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

however, the increase is less than in other regions. Therefore, Riga and its suburbs were below the national average in 2020.

Data on the age composition of Latvia's population reveal that the young population has not changed as dramatically as the elderly population in recent decades. There are, however, geographical variations and a rise in the number of children in the Riga metropolitan area (Figure 1).

The bars in Figure 1 show the relative share of each age category in the respective year and by region. This allows us to see the disproportionate age distribution by the dichotomous regional split.

The age pyramid for Latvia shows that the metropolitan area of the capital city and nonmetropolitan areas were not demographically affected in the same way. While fertility decline and out-migration created a general ageing trend, relatively rapid suburbanization over the past two decades has lured many young families with children to the suburbs of metropolitan areas. In contrast, the populations of nonmetropolitan areas in Latvia have got older, with a higher proportion of the middle-aged and elderly but a relatively low proportion of children and young adults compared to the Riga metropolitan area.

Regarding both observed population groups, the elderly (75 plus years) have witnessed the highest relative increase, especially among women. In contrast, the population share of children has considerably decreased among 10–14 year olds in both the metropolitan and nonmetropolitan regions. The pattern of 0–4 year olds and 5–9 year olds is differentiated territorially and temporarily. The share of 5–9-year-old children in the Riga metropolitan region has slightly increased, whereas in nonmetropolitan regions it has decreased.

In order to assess the change in spatial distribution, we categorized the territorial units into four groups based on the increase/decrease of the total population and the specific age group. The predominant population change pattern for the younger population has been its decrease, supplemented with a decline in the total population (Figure 2). More patterns are evident among most territorial units of the Riga metropolitan region, where the total population has increased, including the younger population, except for three units where the younger population has dwindled. Larger urban centers in the Riga metropolitan area and peripheral rural territories show a negative pattern. Therefore, there has been a difference between the metropolitan and nonmetropolitan regions, with the former being more positive and the latter mostly negative.

The most predominant population change pattern among elderly people from 2000 to 2020 has been a decrease in the total population and an increase in the elderly population. This has been the most apparent characteristic in nonmetropolitan regions, such as Kurzeme, Zemgale, and Vidzeme, whereas the eastern part of Latvia has predominantly decreased both in terms of the total population and the elderly subpopulation. However, the Riga

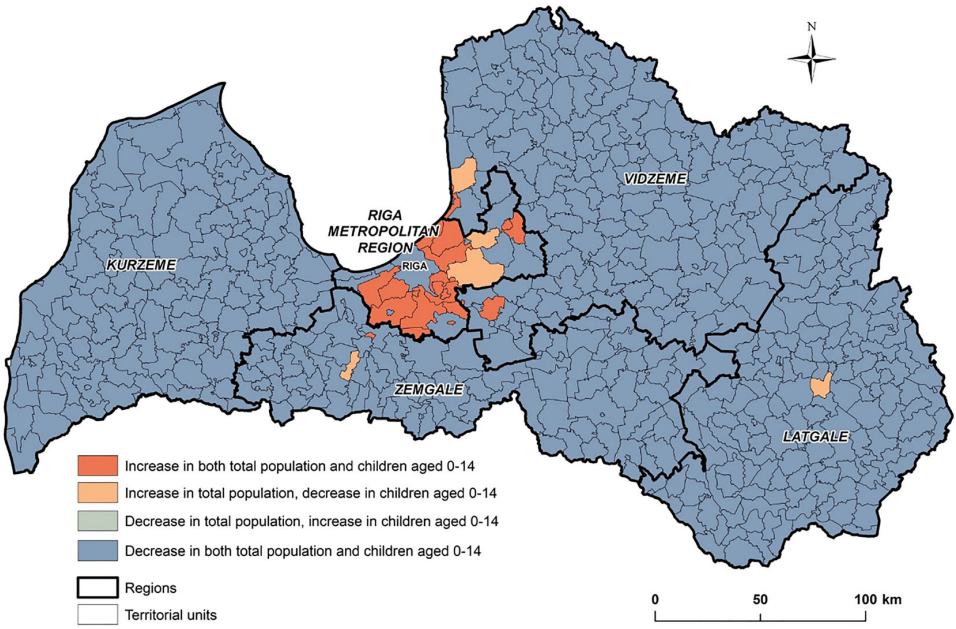


FIGURE 2 Distribution of the young population (0–14 years old) in Latvia, 2000–2020. *Source*: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

metropolitan region has witnessed an increase in the elderly in all territorial units, along with a rise in the total population in most units.

The overall pattern shows a relative increase in the younger population (0–14 years old) from 2000 to 2020 on a territorial unit level in the units near Riga, whereas for the units farther away, the younger and total population have decreased. In contrast, the elderly population has increased in most territorial units, including those within the Riga metropolitan region (Figure 3).

3.2 | Analysis of global Moran statistics

The results of the global spatial autocorrelation analysis are shown in Table 2. When analyzing the obtained results, a statistically significant positive spatial autocorrelation (p-value > 0.0000) was observed for both age groups in the studied years. This indicates the strong spatial autocorrelation of both selected age variables, meaning that the young and the elderly in Latvia are not randomly distributed.

The young populations in 2020 and the elderly populations in 2000 have the highest spatial autocorrelation values. Thus, it can be concluded that both selected age variables exhibit moderate or high spatial autocorrelation. When comparing the tested years, it should be noted that an increase in spatial autocorrelation values was observed for the young residents. In contrast, a decrease was observed for elderly residents over the last 20 years. As a result, the young population has become more spatially concentrated, while the elderly population has become less spatially concentrated. The calculated z-scores are positive and statistically significant, indicating that both age groups studied are clustered, that is, areas with high (hot) and low (cold) values tend to be close,

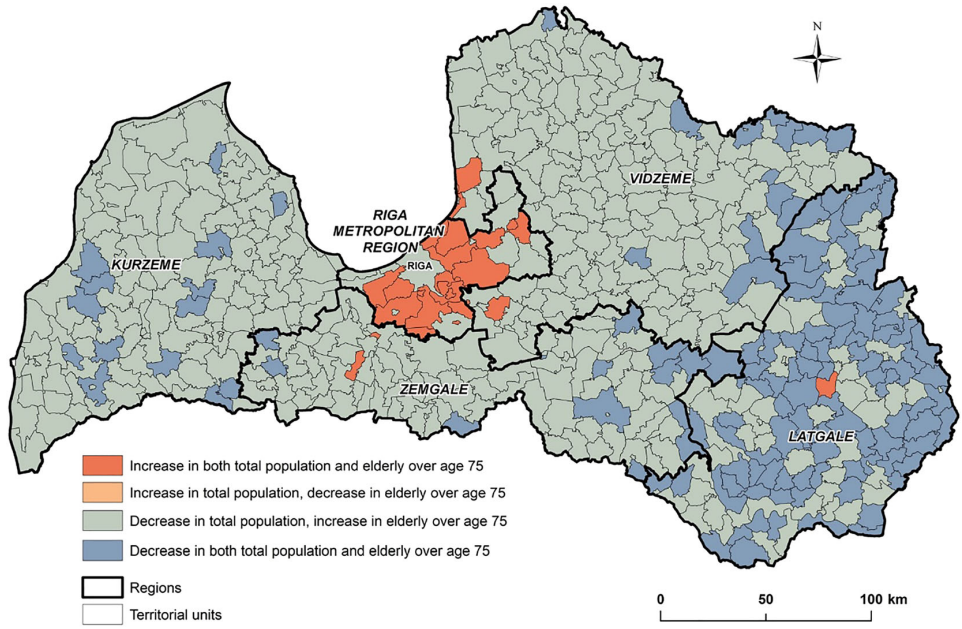


FIGURE 3 Distribution of the elderly (75 plus years) population in Latvia, 2000–2020. *Source*: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

TABLE 2 Global Moran's I statistics for selected age variables.

Year	2000		2020	
Age variable	0–14	75+	0–14	75+
Moran's I	0.7025	0.8980	0.8719	0.7572
z-score	1236.7*	1581.9*	1336.1*	1160.4*
p-value	0.0000	0.0000	0.0000	0.0000

*statistically significant, $p < 0.05$.

respectively. Given the nature of data aggregation on the hexagonal grid, we used inverse distance to conceptualize spatial relationships for both global and local analysis.

3.3 | Analysis of local spatial autocorrelation and clustering

While the global Moran's I index values show the general trend, the Getis-Ord Gi* shows the spatial pattern in local spatial autocorrelation and clustering. We used the Getis-Ord Gi* statistics to detect the hot spots and cold spots of young and elderly residents across the regional divides in Latvia. Different mapping techniques are used to depict hot spots in spatial analysis (Chainey et al., 2008; Songchitruksa & Zeng, 2010). We used the previously described unified hexagonal grid to map the residential patterns of the young and the elderly, effectively aggregating the data and spatial details by the specified area of 16 hectares. Hot spots detected through this mapping approach are

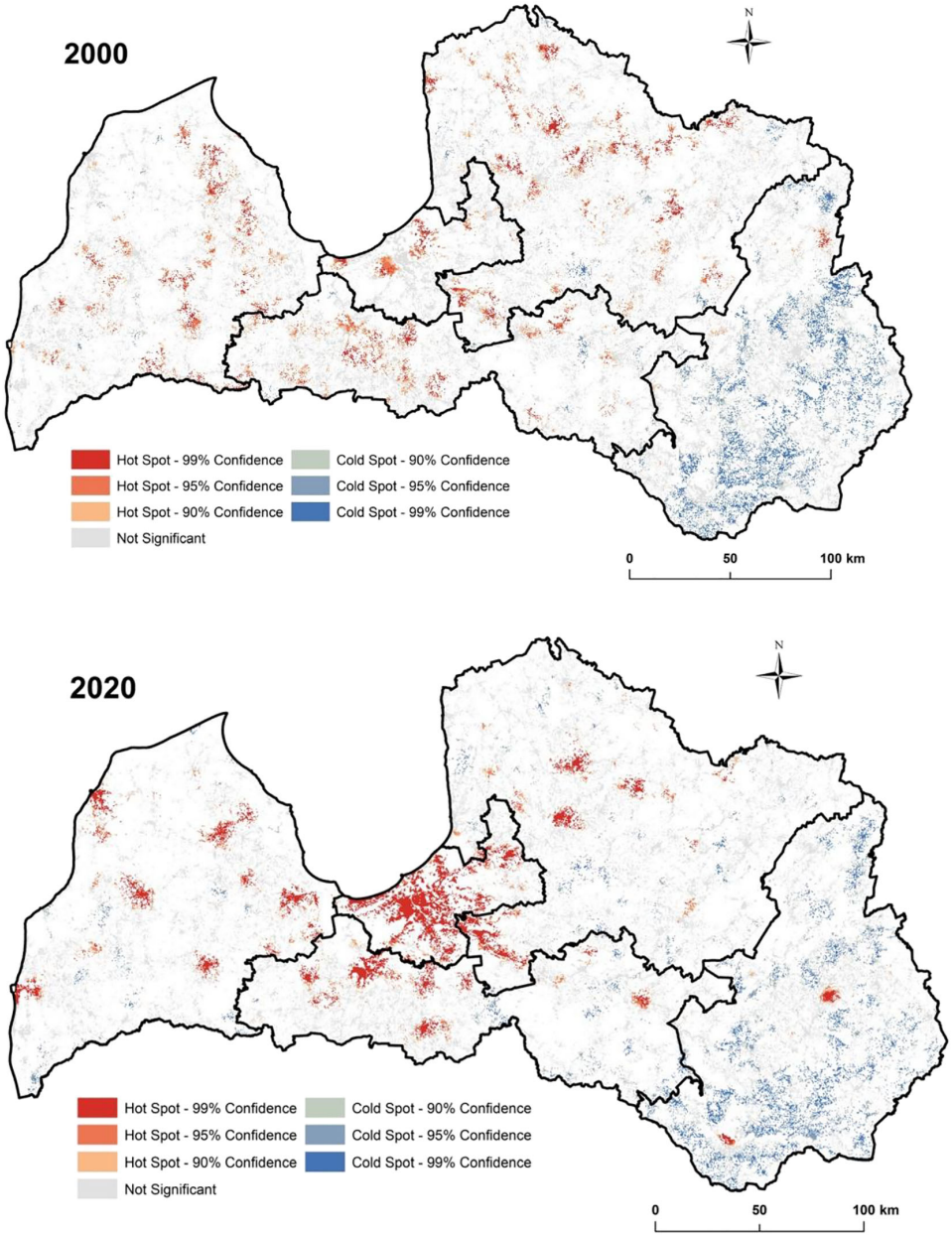


FIGURE 4 Getis-Ord Gi* statistics for the young population (0–14 years old), 2000 and 2020. *Source*: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

restricted to the shape of the grid cells, which should be considered when interpreting the results. The local Getis-Ord Gi* statistic demonstrates the diversity of clusters, which considers various confidence intervals. The result of the Getis-Ord Gi* statistic in 2000 showed multiple areas of statistically significant high clustering of young

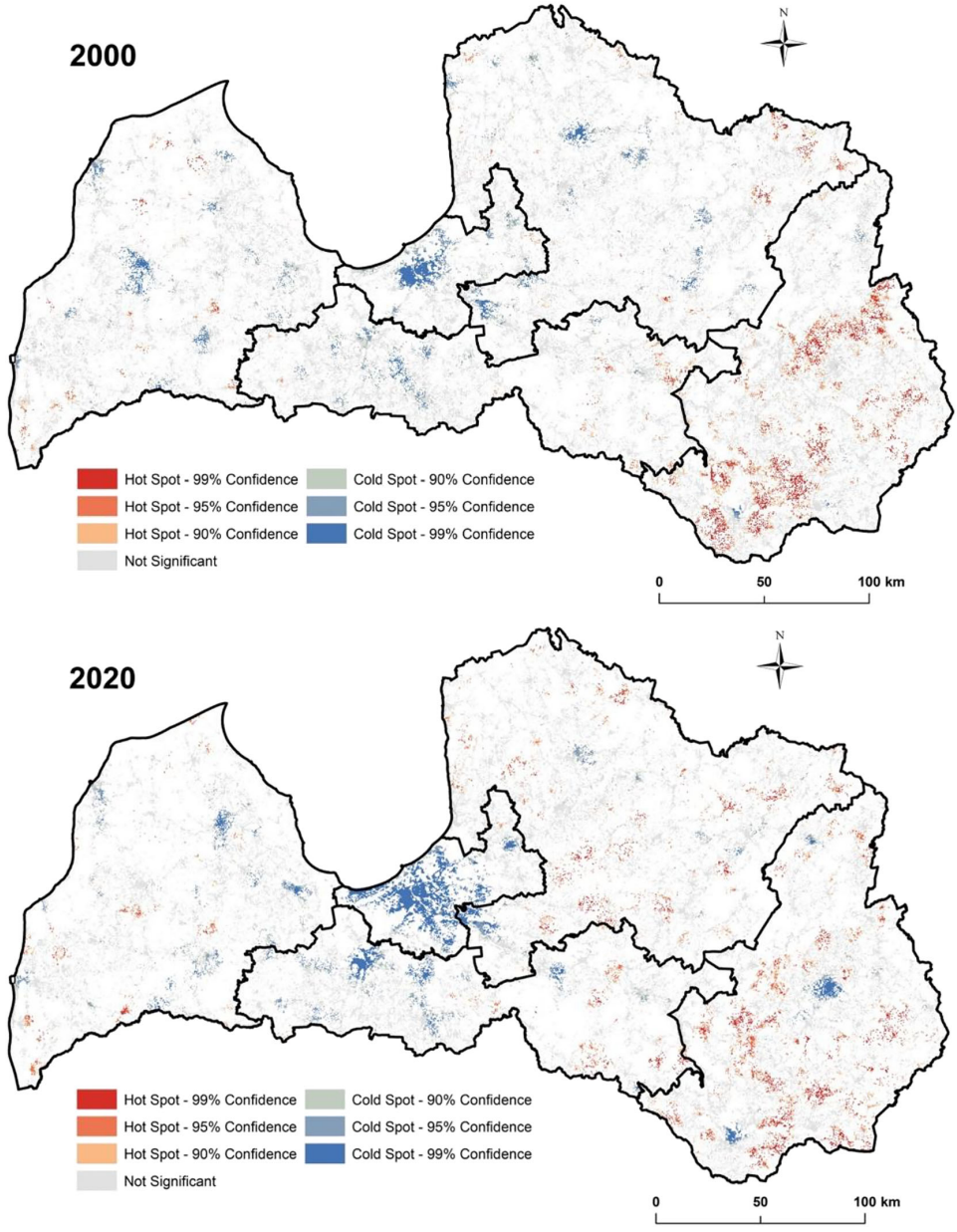


FIGURE 5 Getis-Ord Gi* statistics for the elderly (75 plus) population, 2000 and 2020. *Source*: Authors' calculations based on Central Statistical Bureau data (CSB) of Latvia, (2022).

residents in the rural regions and low clustering in eastern Latvia (the Latgale region). Thus, the hot spots of young residents in 2000 are sparsely located across the country, apart from the Latgale region. In 2020, the hot spots of young residents were more clustered in the Riga metropolitan region, especially in the suburbs, all the largest towns,

and their surrounds, including the Latgale region (Figure 4). The concentration of cold spots in 2020 remained high in Latgale and was visible in other regions of Latvia to a much lesser extent.

Similarly, the Getis-Ord Gi* analysis revealed a noticeable regional split in easternmost Latvia, which is typically older with high clustering of elderly residents in the Latgale region (Figure 5). The hot spots indicate that the elderly in 2000 were mainly concentrated in rural areas in the east of the country. Meanwhile, a noticeable cold spot of elderly residents was detected in the capital city, Riga, and some areas around the large towns in the nonmetropolitan regions other than the Latgale region.

The Getis-Ord Gi* results revealed interesting changes when comparing the two studied years. The Riga metropolitan region highlighted a clear cold spot in the capital city and its suburbs in 2020 for elderly people. In fact, elderly cold spots were found in all the nonmetropolitan regions around the largest towns. Conversely, hot spots for the elderly were still primarily concentrated in rural areas of the country's easternmost region and, to a lesser extent, in certain rural areas of nonmetropolitan regions.

4 | CONCLUSION

Over the past two decades, a declining and ageing population have been the most significant demographic phenomena in Latvia. Fertility rates in all regions of the country have long been below the replacement level, resulting in natural population decline, while the continuing increase of life expectancy has increased number of older people. The only areas experiencing population growth are suburbs in the Riga metropolitan region, where in-migration from the core city and all nonmetropolitan regions is primarily driving population increase. This unprecedented demographic shift has substantially impacted the population's size and composition across Latvia's regions. Although the elderly population is increasing, their increase is rather heterogeneous across the regions, and there is a lack of geographical study to contextualize adequately and theorize the relationships between population change and ageing, and more specifically, residential patterns of certain age groups.

This study analyzed changes to the size of the young and the elderly populations in the context of the overall population dynamics and explained geographical variation in the residential patterns of both considered age groups. We used spatial analysis and mapping techniques, which allowed us to respect the established metropolitan/nonmetropolitan divide and take advantage of the fine-grain data.

There have been significant changes in the population's gender–age structure during the observed period, with a substantial increase in the number of elderly people in all regions of Latvia and a noticeable gender imbalance in age groups above 65 years of age. Meanwhile, the results of our study reveal that the population growth in the suburbs of the Riga metropolitan region largely overlaps with the growth of the young and the elderly in these areas. Thus, despite initial expectations, there was no remarkable divergence in the dynamics of analyzed age groups within the Riga metropolitan region. The results indicate that the increase of the young and the elderly tend to converge in the metropolitan region. In contrast, all of Latvia's nonmetropolitan regions have experienced an overall decline in the total population and the young population, along with an increase in the elderly population, indicating more pronounced ageing. The exception is the easternmost Latgale region, which has experienced depopulation over the past two decades. Population decline is set to overtake population growth and, alongside regionally uneven ageing patterns, become the primary trend of population dynamics in most European countries (Kashnitsky & Aburto, 2020; Newsham & Rowe, 2022).

The findings indicated that both the young and the elderly in Latvia exhibited spatial autocorrelation on a global and local scale. The global Moran's I and the Getis-Ord Gi* spatial autocorrelation methods identified statistically significant clustering of both studied age groups. In the case of both age variables and across both analyzed years, the global Moran's I statistics revealed statistically significant moderate or strong spatial autocorrelation. Positive autocorrelation of the young and the elderly means there is a tendency to cluster spatially across the applied hexagonal grid. An analysis of local spatial autocorrelation statistics revealed a division into

metropolitan/nonmetropolitan regions or more precisely, into central eastern Latvia, where the former is characterized by more favorable demographic trends, especially Riga's suburbs. We found less pronounced residential clustering of the elderly (aged 75 years and over) in areas with positive demographic dynamics, such as in-migration and lower fertility rates, particularly in the Riga metropolitan region. Similarly to other case studies conducted in CEE countries, our results show that the proportion of the elderly population is growing in both metropolitan and nonmetropolitan areas, with the growth being more rapid in nonmetropolitan regions (Kačerova et al., 2022; Kurek et al., 2020; Vaishar et al., 2020). At the same time, the increase in the share of children is exclusively limited to the metropolitan area. Our findings on the elderly population align with studies of ageing patterns beyond CEE countries, for example, in Spain, where more urbanized areas are found to age at a slower rate (Gutiérrez Posada et al., 2018). The study showed that spatial autocorrelation methods can be useful in analyzing age variables, including their temporal variation. Spatial autocorrelation at a fine-grain resolution can be a useful tool in analyzing the extent of processes, such as suburbanization, gentrification, and rural shrinkage.

Our analysis of population dynamics, depopulation pathways, and residential patterns of the selected age groups has important policy implications. It can serve as a useful tool to identify at-risk areas and regions of future concern in need of urgent policy intervention to mitigate or prevent the negative consequences associated with population decline and ageing. Moreover, the ageing population require direct and sustained public services, provisions, support, and resources. Therefore, the applied methods of spatial statistics may support identifying vulnerable areas characterized by similar or different values of selected demographic variables, allowing for the monitoring and planning of needed services.

Further research is required to thoroughly investigate the spatial and temporal relationships in population change, ageing, and distribution. In comprehensive policy design, it is important not to overemphasize the focus on the elderly population and also consider the changes in the number and proportion of children. As Latvia, along with the other CEE countries, is becoming one of the more rapidly ageing in Europe, policies must be adaptive, especially considering that the elderly population is also becoming more spatially dispersed.

ACKNOWLEDGEMENTS

The authors are grateful to the editor and anonymous reviewers for their comments on earlier version of the paper. This research is funded by the Latvian Council of Science, project DemoMigPro, project No. VPP-LETONIKA-2021/4-0002 and the University of Latvia.

ORCID

Zaiga Krisjane https://orcid.org/0000-0002-3422-1958
Maris Berzins https://orcid.org/0000-0002-5773-3307
Janis Krumins https://orcid.org/0000-0003-2262-9742
Elina Apsite-Berina https://orcid.org/0000-0001-5537-5879
Sindija Balode https://orcid.org/0000-0002-6968-512X

REFERENCES

Bērziņš, A. (2019). Iedzīvotāju sastāva novecošana. Krūmiņš, J., Krišjāne, Z.(zin. red.) *Tautas ataudze Latvijā un sabiedrības atjaunošanas izaicinājumi*. LU Akadēmiskais apgāds, Rīga, https://doi.org/10.22364/talsai.07

Berzins, M., Krisjane, Z., Krumins, J., & Spude, M. (2021). Ethnic and regional disparities of ageing in Latvia: Measuring residential segregation by age. New Challenges in Economic and Business Development–2021: Post-Crisis Economy, 92.

Borén, T., & Gentile, M. (2007). Metropolitan processes in post-communist states: An introduction. *Geografiska Annaler: Series B, Human Geography*, *89*(2), 95–110. https://doi.org/10.1111/j.1468-0467.2007.00242.x

Botev, N. (2012). Population ageing in central and Eastern Europe and its demographic and social context. *European Journal of Ageing*, *9*(1), 69–79. https://doi.org/10.1007/s10433-012-0217-9

Buzar, S., Ogden, P. E., & Hall, R. (2005). Households matter: The quiet demography of urban transformation. *Progress in Human Geography*, *29*(4), 413–436. https://doi.org/10.1191/0309132505ph558oa

Central Statistical Bureau (CSB) of Latvia. (2022). Population statistics (Database).

Chainey, S., Tompson, L., & Uhlig, S. (2008). The utility of hot-spot mapping for predicting spatial patterns of crime. *Security Journal*, *21*(1), 4–28. https://doi.org/10.1057/palgrave.sj.8350066

Couch, C., Cocks, M., Bernt, M., Grossmann, K., Haase, A., & Rink, D. (2012). Shrinking cities in Europe. *Town & Country Planning*, *81*(6), 264–270.

Dowd, J. B., Andriano, L., Brazel, D. M., Rotondi, V., Block, P., Ding, X., & Mills, M. C. (2020). Demographic science aids in understanding the spread and fatality rates of COVID-19. *Proceedings of the National Academy of Sciences*, *117*(18), 9696–9698. https://doi.org/10.1073/pnas.2004911117

Ferguson, N., Laydon, D., Nedjati-Gilani, G., Imai, N., Ainslie, K., Baguelin, M., & Ghani, A. C. (2020). Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. *Imperial College London*, *10*(77482), 491–497. https://doi.org/10.25561/77482

Fihel, A., & Okólski, M. (2019). Demographic change and challenge. In *Social and economic development in central and Eastern Europe* (pp. 101–132). Routledge. 10.4324/9780429450969-6

Frejka, T., Gietel-Basten, S., Abolina, L., Abuladze, L., Aksyonova, S., Akrap, A., & Zvidrins, P. (2016). Fertility and family policies in central and Eastern Europe after 1990. *Comparative Population Studies*, *41*(1), 3–56. https://doi.org/10.12765/CPoS-2016-03

Getis, A., & Ord, J. K. (1992). The analysis of spatial association by use of distance statistics. *Geographical Analysis*, *24*(3), 189–206. https://doi.org/10.1111/j.1538-4632.1992.tb00261.x

Gobiņa, I., Avotiņš, A., Kojalo, U., Strēle, I., Pildava, S., Villeruša, A., & Briģis, Ģ. (2022). Excess mortality associated with the COVID-19 pandemic in Latvia: A population-level analysis of all-cause and noncommunicable disease deaths in 2020. *BMC Public Health*, *22*(1), 1–12, 1109. https://doi.org/10.1186/s12889-022-13491-4

Gregory, T., & Patuelli, R. (2015). Demographic ageing and the polarisation of regions—An exploratory space–time analysis. *Environment and Planning a*, *47*(5), 1192–1210. https://doi.org/10.1177/0308518X15592329

Gurram, M. K., Wang, M. X., Wang, Y. C., & Pang, J. (2022). Impact of urbanisation and environmental factors on spatial distribution of COVID-19 cases during the early phase of epidemic in Singapore. *Scientific Reports*, *12*(1), 1–15, 9758. https://doi.org/10.1038/s41598-022-12941-8

Gutiérrez Posada, D., Rubiera Morollon, F., & Viñuela, A. (2018). Ageing places in an ageing country: The local dynamics of the elderly population in Spain. *Tijdschrift voor Economische en Sociale Geografie*, *109*(3), 332–349. https://doi.org/10.1111/tesg.12294

Haase, A., Bernt, M., Großmann, K., Mykhnenko, V., & Rink, D. (2016). Varieties of shrinkage in European cities. *European Urban and Regional Studies*, *23*(1), 86–102. https://doi.org/10.1177/0969776413481985

Haase, A., Kabisch, S., Steinführer, A., Bouzarovski, S., Hall, R., & Ogden, P. (2010). Emergent spaces of reurbanisation: Exploring the demographic dimension of inner-city residential change in a European setting. *Population, Space and Place*, *16*(5), 443–463. https://doi.org/10.1002/psp.603

Horňáková, M., & Sýkora, J. (2021). From suburbanisation to reurbanization? Changing residential mobility flows of families with young children in the Prague metropolitan area. *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography*, *75*(4), 203–220. https://doi.org/10.1080/00291951.2021.1970014

Istrate, M., Muntele, I., & Bănică, A. (2015). Spatial resilience of the ageing population in the Romanian functional urban areas. *International Journal of Humanities and Social Sciences*, *9*(5), 1565–1575.

Kabisch, N., Haase, D., & Haase, A. (2019). Reurbanisation: A long-term process or a short-term stage? *Population, Space and Place*, *25*(8), e2266. https://doi.org/10.1002/psp.2266

Kačerova, M., Mladek, J., & Kusendova, D. (2022). Temporal and spatial analysis of population ageing and growing younger in Slovakia. *Folia Geographica*, *64*(1), 112–130.

Káčerová, M., Ondačková, J., & Mládek, J. (2014). Time-space differences of population ageing in Europe. *Hungarian Geographical Bulletin*, *63*(2), 177–199. https://doi.org/10.15201/hungeobull.63.2.4

Kashnitsky, I., & Aburto, J. M. (2020). COVID-19 in unequally ageing European regions. *World Development*, *136*, 105170. https://doi.org/10.1016/j.worlddev.2020.105170

Kashnitsky, I., De Beer, J., & Van, L. (2021). Unequally ageing regions of Europe: Exploring the role of urbanisation. *Population Studies*, *75*(2), 221–237. https://doi.org/10.1080/00324728.2020.1788130

Kashnitsky, I., De Beer, J., & Van Wissen, L. (2017). Decomposition of regional convergence in population aging across Europe. *Genus*, *73*(1), 1–25, 2. https://doi.org/10.1186/s41118-017-0018-2

Kashnitsky, I., & Schöley, J. (2018). Regional population structures at a glance. *The Lancet*, *392*(10143), 209–210. https://doi.org/10.1016/S0140-6736(18)31194-2

Kazimierczak, J., & Szafrańska, E. (2019). Demographic and morphological shrinkage of urban neighbourhoods in a post-socialist city: The case of Łódź, Poland. *Geografiska Annaler: Series B, Human Geography*, *101*(2), 138–163. https://doi.org/10.1080/04353684.2019.1582304

Krisjane, Z., & Berzins, M. (2012). Post-socialist urban trends: New patterns and motivations for migration in the suburban areas of Rīga, Latvia. *Urban Studies*, *49*(2), 289–306.

Krūmiņš, J., & Krišjāne, Z. (2016). Demogrāfiskā attīstība Latvijā: problēmas un izaicinājumi. *Latvijas Zinātņu Akadēmijas Vēstis" a" daļa*, *70*(3), 40–50.

Kulcsár, L. J., & Brown, D. L. (2017). Population ageing in Eastern Europe: Toward a coupled micro-macro framework. *Regional Statistics*, *7*(1), 115–134. https://doi.org/10.15196/RS07107

Kurek, S., & Wójtowicz, M. (2018). Reurbanisation in a post-socialist city: Spatial differentiation of the population in the Kraków area (Poland). *Geographia Polonica*, *91*(4), 449–468. https://doi.org/10.7163/GPol.0130

Kurek, S., Wójtowicz, M., & Gałka, J. (2017). Does suburbanisation contribute to the rejuvenation of a metropolitan area?: Changes in the age structure of the Kraków metropolitan area in Poland in the light of recent suburbanisation. *Geographia Polonica*, *90*(2), 59–70. https://doi.org/10.7163/GPol.0085

Kurek, S., Wójtowicz, M., & Gałka, J. (2020). The Population Ageing Process in Functional Urban Areas. In *Functional urban areas in Poland* (pp. 91–127). Springer.

Kurek, S., Wójtowicz, M., & Gałka, J. (2021). Using spatial autocorrelation for identification of demographic patterns of functional urban areas in Poland. *Bulletin of Geography. Socio-Economic Series*, *52*(52), 123–144. https://doi.org/10.2478/bog-2021-0018

Lang, T., Burneika, D., Noorkõiv, R., Plüschke-Altof, B., Pociūtė-Sereikienė, G., & Sechi, G. (2022). Socio-spatial polarisation and policy response: Perspectives for regional development in the Baltic States. *European Urban and Regional Studies*, *29*(1), 21–44. https://doi.org/10.1177/09697764211023553

Lloyd, C. D. (2014). Assessing the spatial structure of population variables in England and Wales. *Transactions of the Institute of British Geographers*, *40*(1), 28–43. https://doi.org/10.1111/tran.12061

Lutz, W. (2009). The demography of future global population aging: Indicators, uncertainty, and educational composition. *Population and Development Review*, *5*(2), 357–365. https://doi.org/10.1111/j.1728-4457.2009.00282.x

Matthews, R. J., Smith, L. K., Hancock, R. M., Jagger, C., & Spiers, N. A. (2005). Socioeconomic factors associated with the onset of disability in older age: A longitudinal study of people aged 75 years and over. *Social Science & Medicine*, *61*(7), 1567–1575. https://doi.org/10.1016/j.socscimed.2005.02.007

Matthews, S. A., & Parker, D. M. (2013). Progress in spatial demography. *Demographic Research*, *28*, 271–312. https://doi.org/10.4054/DemRes.2013.28.10

Nazia, N. (2022). Spatial variations of COVID-19 risk by age in Toronto, Canada. *Geospatial Health*, *17*(s1), 203–220. https://doi.org/10.1080/00291951.2021.1970014

Newsham, N., & Rowe, F. (2022). Understanding the trajectories of population decline across rural and urban Europe: A sequence analysis. *Population, Space and Place*, e2630. https://doi.org/10.1002/psp.2630

OECD. (2020). Regions and cities facing ageing. In *OECD regions and cities at a glance 2020*. OECD Publishing. 10.1787/9a6f8396-en

Ouředníček, M., Šimon, M., & Kopečná, M. (2015). The reurbanisation concept and its utility for contemporary research on post-socialist cities: The case of the Czech Republic. *Moravian Geographical Reports*, *23*(4), 26–35. https://doi.org/10.1515/mgr-2015-0022

Pilkington, H., Feuillet, T., Rican, S., de Bouillé, J. G., Bouchaud, O., Cailhol, J., Bihan, H., Lombrail, P., & Chantal, J. (2021). Spatial determinants of excess all-cause mortality during the first wave of the COVID-19 epidemic in France. *BMC Public Health*, *21*(1), 1–10. https://doi.org/10.1186/s12889-021-12203-8

Pužulis, A., & Küle, L. (2016). Shrinking of rural territories in Latvia. *European Integration Studies*, *10*, 90–105. https://doi.org/10.5755/j01.eis.0.10.14988

Raymer, J., Willekens, F., & Rogers, A. (2019). Spatial demography: A unifying core and agenda for further research. *Population, Space and Place*, *25*(4), e2179. https://doi.org/10.1002/psp.2179

Reynaud, C., Miccoli, S., & Lagona, F. (2018). Population ageing in Italy: An empirical analysis of change in the ageing index across space and time. *Spatial Demography*, *6*(3), 235–251. https://doi.org/10.1007/s40980-018-0043-6

Rink, D., Couch, C., Haase, A., Krzysztofik, R., Nadolu, B., & Rumpel, P. (2014). The governance of urban shrinkage in cities of post-socialist Europe: Policies, strategies and actors. *Urban Research & Practice*, *7*(3), 258–277. https://doi.org/10.1080/17535069.2014.966511

Segers, T., Devisch, O., Herssens, J., & Vanrie, J. (2020). Conceptualising demographic shrinkage in a growing region–creating opportunities for spatial practice. *Landscape and Urban Planning*, *195*, 103711. https://doi.org/10.1016/j.landurbplan.2019.103711

Senbil, M., & Yetiskul, E. (2022). Spatial variation of elderly population and its dynamics in Turkey. *Population, Space and Place*, *28*(3), e2516. https://doi.org/10.1002/psp.2516

Songchitruksa, P., & Zeng, X. (2010). Getis–Ord spatial statistics to identify hot spots by using incident management data. *Transportation Research Record*, *2165*(1), 42–51. https://doi.org/10.3141/2165-05

Steinführer, A., & Haase, A. (2007). Demographic change as a future challenge for cities in east Central Europe. *Geografiska Annaler: Series B, Human Geography*, *89*(2), 183–195. https://doi.org/10.1111/j.1468-0467.2007.00247.x

Steinführer, A., Kabisch, S., & Grossmann, K. (2011). In A. Haase (Ed.), *Residential change and demographic challenge: The Inner City of east Central Europe in the 21st century* (1st ed.). Routledge. 10.4324/9781315605654

Sýkora, L., & Bouzarovski, S. (2012). Multiple transformations: Conceptualising the post-communist urban transition. *Urban Studies*, *49*(1), 43–60. https://doi.org/10.1177/0042098010397402

Ubarevičienė, R., & Burneika, D. (2020). Fast and uncoordinated suburbanisation of Vilnius in the context of depopulation in Lithuania. *Environmental & Socio-Economic Studies*, *8*(4), 44–56. https://doi.org/10.2478/environ-2020-0022

Ubarevičienė, R., Van Ham, M., & Burneika, D. (2016). Shrinking regions in a shrinking country: The geography of population decline in Lithuania 2001–2011. *Urban Studies Research*, *2016*, 1–18. https://doi.org/10.1155/2016/5395379

Vaishar, A., Šťastná, M., Zapletalová, J., & Nováková, E. (2020). Is the European countryside depopulating? Case study Moravia. *Journal of Rural Studies*, *80*, 567–577. https://doi.org/10.1016/j.jrurstud.2020.10.044

Wolff, M., & Wiechmann, T. (2018). Urban growth and decline: Europe's shrinking cities in a comparative perspective 1990–2010. *European Urban and Regional Studies*, *25*(2), 122–139. https://doi.org/10.1177/0969776417694680

How to cite this article: Krisjane, Z., Berzins, M., Krumins, J., Apsite-Berina, E., & Balode, S. (2023). Uneven geographies: ageing and population dynamics in Latvia. *Regional Science Policy & Practice*, *15*(4), 893–908. https://doi.org/10.1111/rsp3.12648

DOI: 10.1111/rsp3.12648

Resumen. El doble fenómeno del envejecimiento y el declive de la población está transformando profundamente las sociedades y las economías europeas. Impulsado por el descenso de las tasas de fertilidad y el continuo aumento de la esperanza de vida, las poblaciones no han envejecido de manera uniforme en el tiempo y el espacio. En un mundo cada vez más urbanizado, la distribución espacial de los jóvenes y las personas mayores es un tema de creciente interés académico y político. En Europa, este proceso es más pronunciado en las zonas periféricas que en las regiones centrales, mientras que el desarrollo de las áreas metropolitanas está asociado a la suburbanización impulsada predominantemente por los jóvenes inmigrantes. Letonia es un caso interesante para estudiar el envejecimiento de la población y sus desequilibrios espaciales debido al papel clave de la emigración en el declive y envejecimiento de la población. Mediante un análisis descriptivo y espacial, este estudio utiliza datos del censo y el registro de población de Letonia para explorar las relaciones entre el cambio demográfico y los procesos de envejecimiento. Se utilizaron la I de Moran global y los indicadores locales de asociación espacial para identificar los sistemas espaciales. El estudio confirmó la autocorrelación espacial global y local para las dos variables de edad analizadas. Se utilizó el método Getis-Ord Gi* para identificar conglomerados (*clusters*) espaciales de jóvenes y personas mayores. Se encontró una conglomeración residencial más pronunciada de los mayores de 75 años en la región despoblada de Latgale, mientras que la región metropolitana de Riga y las zonas alrededor de las ciudades más grandes se suelen encontrar conglomerados de residentes jóvenes.

抄録: 高齢化と人口減少という2つの現象は、ヨーロッパの社会と経済を大きく変えつつある。人口の高齢化は時間的及び空間的に均一に進展しているのではないが、これは出生率の低下と平均寿命の継続的な延伸が要因となっている。都市化が進む地域では、若年者と高齢者の空間的分布は、学術的および政策的な問題として関心が高まっている。ヨーロッパにおいては、こうしたプロセスは中心地域よりも周辺地域で顕著であるが、大都市圏の発展は、主に若年者の流入に促進される郊外化と関連している。ラトビアは、人口高齢化と、人口減少と高齢化における人口流出の重要な役割による高齢化の空間的不均衡を研究するのに興味深い事例となる。本稿では、記述的および空間的分析を採用し、ラトビアの国勢調査と人口登録のデータを使用して、人口変化と高齢化のプロセスの関連性を検討した。グローバルモランIと空間的関連性のローカルの指標を用いて空間システムを特定した。この研究では、調査した両方の年齢変数について、グローバルとローカルの空間的自己相関が確認された。Getis‐Ord Gi*法を用いて若年者と高齢者の空間クラスターを特定した。ラトガレの人口が減少している地域では、75歳以上の高齢者の居住集積がかなり顕著であることがわかった。その一方で、リガ都市圏や最大規模の町の周辺地域では若年の住民が集積する傾向がある。