

The burden of mobility: multi-local living and its effects on infrastructure, services, and housing markets in rural areas

OLLI LEHTONEN, OLLI VOUTILAINEN & VENLA HEISKANEN



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Multi-locality has become increasingly common over the past decade in many countries, and it has increased the temporal population, especially in rural areas. Despite the growing popularity of this lifestyle, an overall picture of the effects of mobility is missing. A lack of official data is one of the main reasons why little attention has been paid to this phenomenon in rural areas. The results of this study illustrate the need to ensure that the burden caused by this lifestyle, especially for telecommunications connections, is better considered in planning. Special attention is needed because this lifestyle is directed towards rural municipalities, which are vulnerable to the increase in population and the resulting spatial injustice.

Keywords: multi-local living, effects, infrastructure, services, housing markets, Finland

Olli Lehtonen (<https://orcid.org/0000-0003-2040-7265>), Department of Geographical and Historical Studies, University of Eastern Finland, Finland. E-mail: olli.lehtonen@uef.fi

Olli Voutilainen (<https://orcid.org/0000-0003-2661-1611>), Natural Resources Institute Finland (Luke), Finland. E-mail: olli.voutilainen@luke.fi

Venla Heiskanen (<https://orcid.org/0000-0002-3374-3615>), Department of Geographical and Historical Studies, University of Eastern Finland, Finland. E-mail: venla.heiska@gmail.com

Introduction

The concept of multi-locality is used to represent a phenomenon or lifestyle where a person repeatedly moves between, spends time in, and lives in two or more places and residences (Pitkänen & Strandell 2018; Greinke & Lange 2022; Rehunen *et al.* 2022). A single established definition of multi-locality does not exist, its definition varies according to the context (Weichhart 2015). Multi-locality is distinct from daily commuting (circulation) and relocation (migration) (Greinke & Lange 2022). It changes the mobility flows of people and their stay in areas, which, in turn, has diverse effects on the use of and demand for infrastructure and services (Adamiak *et al.* 2017).

Multi-locality has become increasingly common over the past decade in several countries in Europe. It has especially been observed in the Nordic countries, Switzerland, Austria, Germany, and the UK (Overvåg & Berg 2011; Adamiak *et al.* 2015; Di Marino 2022). Furthermore, during the last few years and because of the COVID-19 pandemic, this lifestyle has strengthened rapidly in Europe, with a notable share of people starting to work remotely from their second homes, for instance (Voutilainen *et al.* 2021b; Di Marino 2022). In examining the dimensions of multi-local living, it is essential to consider contexts driven by impoverished living conditions and labour needs. For instance, Zickgraf (2022) explores the relational (im)mobilities of Senegalese coastal fishing populations, highlighting how economic necessity and environmental pressures shape their multi-local living arrangements. Similarly, Farbotko and others (2022) discuss the climate justice perspective on international labour migration and climate change adaptation among Tuvaluan workers, illustrating how climate-induced vulnerabilities necessitate multi-local living as a survival strategy. However, our focus shifts to this lifestyle within Western or Global North contexts, where the phenomenon predominantly involves socioeconomically well-off individuals. In these regions, multi-local living is often a lifestyle choice rather than a necessity, driven by the desire for secondary residences, better work-life balance, or enhanced quality of life (Greinke & Lange 2022; Rannanpää *et al.* 2022).

In this article, our case country is Finland. We focus on multi-local residence, which means that an individual has two or more accommodations situated in different places, where living and staying overnight shift rhythmically (Rannanpää *et al.* 2022). Although they are not registered as residents, temporary multi-locals use and consume local infrastructure and services and are therefore likely to have effects on the availability and status of the infrastructure and services in municipalities where the seasonal population varies strongly (Adamiak *et al.* 2017). A lack of official data is one of the main reasons that multi-local living is not considered more extensively in the decision-making, planning, and construction of infrastructure or in the production of services (Dittrich-Wesbuer *et al.* 2015; Pitkänen & Strandell 2018; Back *et al.* 2022).

The article analyses the effects of multi-locality on the availability of infrastructure and services as well as the effect on the dynamics of the housing market in municipalities with varying degrees of multi-local living. The goal is to enrich the literature by creating an overall picture of this lifestyle in Finnish municipalities with a statistical analysis utilising matching methods to determine its effects on infrastructure, services, and housing markets. The three chosen themes have a crucial role in the attractiveness of rural areas for living and as a guarantee for everyday life and work (OECD 2020; Alonsopérez *et al.* 2022). Earlier research on the effects of this lifestyle is fragmented and has relied mostly on questionnaire surveys (Finnish context, Adamiak *et al.* 2015; Czarnecki & Sireni 2018; Saukkonen & Majoinen 2022) and case studies of certain regions (Finnish context, Kujala *et al.* 2018). Based on an international bibliometric analysis, Alonsopérez and others (2022) argued that economic aspects of second-home tourism have not been properly scrutinised, and the effects, both positive and negative, on property markets and national or regional economies are poorly understood. Information on these effects is needed to respond to the challenges and development needs that the increasing demand for multi-local living generates as well as to enable more efficient and equitable planning and decision-making at the municipal level.

Increased mobility and temporally varying populations challenge spatial justice in terms of fair access to infrastructure, resources, and services (Soja 2010), and the mechanisms involved have not been studied. The increasing multi-locality and mobility of the population creates a growing demand for research also from the viewpoint of the relationship between temporary and permanent population, equality, and spatial justice. Spatial justice can be defined as fair and equitable distribution of socially valued resources in space, for example, income, social services, political influence, or public investments, and opportunities to utilise them (Marcuse 2010; Soja 2010. On spatial justice see Jones *et al.* 2019. In the rural context Nordberg 2020; Woods 2023). While multi-local living affects the whole population structure — and the number of people living in the region at a given time — it has impacts on both temporary and permanent population. Within the context of spatial justice, our empirical analysis and the identified effects of this lifestyle are connected to the municipal level. However, the separate effects on the temporary as well as the permanent population can also be identified.

The is structured as follows: next, the paper outlines the previous literature on the multiple effects of multi-local living on municipalities. The third section introduces this lifestyle in Finland and a constructed category of multi-local living in municipalities used to identify its effects on municipalities. The fourth section presents the variables used to investigate these effects and how they were collected, and introduces the matching techniques used for analysis. The fifth section focuses on the main results of this article by raising issues that are influenced by this lifestyle. Finally, the last two sections discuss the implications of the results and suggest avenues for further research.

Multiple effects of multi-local living

In the literature, there have been two opposing arguments on the issue of the economic effects of second-home expansion on local development. Some argue that second homes represent an additional burden to the management of public goods, since investments needed for building and maintaining physical infrastructure and societal services are not compatible with their temporary use, and a permanent population is forced to fund services not only for themselves but also for a growing multi-local population (Larsson & Müller 2019). Additionally, the seasonality of this lifestyle is seen as a factor that leads to seasonal variations in the volume of use of services and infrastructure (Parhiala *et al.* 2020) and accordingly can lead to capacity problems, especially during the summer (Overvåg & Berg 2011). Others see second homes as an opportunity for rural areas, especially those marked by depopulation, to take advantage of some additional revenue, whether through property taxes, other payments, or income for local businesses, or through an increase in consumption, which, in turn, can lead to positive consequences for the supply of services, employment, and the local economy (Müller 1999; Oliveira *et al.* 2015; Finnish Consulting Group 2016; Kujala *et al.* 2018; Lehtonen *et al.* 2019; Kauppila 2020; Parhiala *et al.* 2020; Voutilainen *et al.* 2021b; Saukkonen & Majoinen 2022). In addition to direct economic effects as well as effects on services and infrastructure, second-home tourism and multi-locality has cultural, social, and ecological impacts (Hiltunen 2007; Hoogendoorn & Visser 2010; Hiltunen *et al.* 2013; Alonsopérez *et al.* 2022).

Based on a survey study (Czarnecki & Sireni 2018), in the context of Finnish municipalities with more second-home residence than average, permanent residents considered the total effect of second-home residence on infrastructure and services to be minor. The effect was mainly generated in cultural, recreational, and tourism services. On the other hand, officials from Finnish municipalities considered second-home residence to be highly beneficial for the maintenance of infrastructure and services of the municipality, although it increased the net costs (Adamiak *et al.* 2015). Additionally, based on earlier studies, multi-locality has been found to increase the need for controlled planning and land use management (Hiltunen 2007; Larsson & Müller 2019) and has some effect on the provisioning water system management (Czarnecki & Sireni 2018). Furthermore, this lifestyle has been evaluated to have a minor effect on the security of the area (*ibid.*) and on fire and rescue services (Larsson & Müller 2019).

Telecommunications infrastructure is an increasingly important prerequisite for the development of place-independent society and digitalization (OECD 2020), but it is also an enabler for multi-locality, as it supports a mobile lifestyle. In a recent study in Finland (Voutilainen *et al.* 2023), the temporary population in municipalities with notable second-home living was found to reduce the download speeds of mobile networks in peak periods of second-home residence, which, in turn, can negatively affect opportunities to work or study remotely. Rural areas are vulnerable to the burden of this lifestyle because of less developed telecommunications networks in rural areas (OECD 2020). It should be noted that the effects of weaker network connections concern not only temporary second-home residents but also permanent residents, as an increasing number of users reduces the download speed of the telecommunications network (Voutilainen *et al.* 2023).

Multi-locality generally leads to an increased volume of traffic (Scheiner 2020), and most Finnish second-home users travel to their second homes by private cars (Hiltunen & Rehunen 2014; Adamiak *et al.* 2015). While in many countries rural second homes are concentrated in certain areas with high recreational and amenity values, in Finland second homes are often located outside community centres, and the second-home pattern is characterised by a dispersed spatial distribution in sparsely

populated rural areas (Pitkänen 2008). Meanwhile, municipal street networks and private roads suffer from maintenance backlogs and are in urgent need of renovation investments (Finnish Transport Infrastructure Agency 2023a). The extra traffic load on the road infrastructure caused by second-home owners has been noticed by municipality officials in Finland (Adamiak *et al.* 2015; Vepsäläinen *et al.* 2015). At the same time, the seasonal population has been seen as a maintaining factor for the infrastructure in rural areas. Multi-locality improves the maintenance of road networks and increases the need for and expense of road maintenance (Adamiak *et al.* 2015; Vepsäläinen *et al.* 2015; Rehunen *et al.* 2022). In Sweden, roads are being built and adjusted to the continuous increase in summer traffic (Larsson & Müller 2019).

Several studies have reported the positive effects of second-home owners on the survival and profitability of local shops in rural areas (Müller 1999; Larsson & Müller 2019) as well as on the accessibility and supply of services in local grocery shops for the permanent population (Farstad 2011). In Finland, the role of multi-local second-home residents can be notable for grocery shops but also for other shops, although the role varies regionally (Voutilainen *et al.* 2021a; Voutilainen *et al.* 2021b). Multi-local living also seems to improve the accessibility of recreational sites (Rehunen *et al.* 2022), increase the demand for recreational activities (Adamiak 2017), and have a positive effect on recreational and tourism services (Czarnecki & Sireni 2018). These observations support the views of the Finnish municipal managers who have reported thinking that this lifestyle diversifies the service provision of municipalities (Saukkonen & Majoinen 2022). The complementary aspect of multi-local residents is also highlighted in the literature. When second-home residents and other seasonal users of regions compensate for the decrease in the permanent population, it is easier to maintain the level of service and infrastructure of the regions (Rehunen *et al.* 2022).

The increasing influence of multi-local living on housing markets has been observed in several studies (Brida *et al.* 2011; Adamiak *et al.* 2015). In Sweden, the housing markets for purpose-built second homes and former primary residences have developed unevenly spatially in the last few decades, creating a divergent development of geographical second-home patterns regarding demand and property values (Back *et al.* 2022). Multi-local living has been observed to maintain and increase real estate prices in South Tyrol in Italy (Brida *et al.* 2011) and in Finland (Adamiak *et al.* 2015), for instance, and to increase the prices of former primary residences acquired for secondary use in Sweden because of increasing demand (Back *et al.* 2022), for instance. In Sweden, the housing markets for former primary residences are strong in areas that have larger multi-local populations and are close to urban areas, while sparsely populated areas are lagging (*ibid.*).

Multi-local living in Finland

In Finland, some studies have been carried out on this lifestyle, and efforts have been made to identify the extent of the phenomenon, using mobile data, for example (Rannanpää *et al.* 2022), but there are no official statistics on it. Therefore, this study first creates a multi-local category for municipalities, which is used to examine the effects of this lifestyle on municipalities. In an international comparison, Finland stands out as a country of notable second-home residence, which, in turn, is strongly concentrated in rural regions (Pitkänen & Strandell 2018; Adamiak *et al.* 2015) and especially in sparsely populated rural municipalities (Voutilainen *et al.* 2021b).

Identifying multi-local living in municipality categories

The identification of multi-local municipalities is carried out in this study with a cluster analysis (Jain & Dubes 1988). This method aims to detect the relative importance of this lifestyle on municipalities based on the proportion of multi-local people in the permanent official population. In this way, the clustering detects strong multi-local municipalities with a relatively high proportion of multi-local people from the official permanent population, and, on the other hand, the non-multi-local municipalities, where, as a result of the mobile lifestyle, the proportion of multi-local people is lower than the official population. The former group of municipalities serves as a destination for a mobile living style and the latter as an origin. The analysis in this study focuses on municipalities, which are

the smallest self-governing administrative units in Finland; they provide many social and educational services and are responsible for infrastructure and land use planning and, more generally, their development. In 2022, the number of municipalities in Finland was 309.

As official statistics on multi-local living are missing from municipalities, the variables on this lifestyle used in the cluster analysis were calculated from mobile phone activity data derived from Telia (2023). These data report the number of people staying overnight in a municipality, thus making it possible to distinguish multi-local living from day-to-day mobility. The dataset covers all of Finland, and it gives an estimation of how many people have been staying overnight on average per month in municipalities; thus, the data differ from permanent population statistics describing the population permanently resident in Finland at the turn of the year. Mobile phone data were successfully utilised earlier in studies to map the extent of multi-local living (Rannanpää *et al.* 2022) and related mobility in Finland during the COVID-19 pandemic (Willberg *et al.* 2021). The mobile phone data utilised were based on the period from January 2021 to December 2021.

Despite the dynamic aspects of mobile phone data, there are also several challenges. In Finland, Telia have roughly one-third of the market share (Traficom 2022c); therefore, in the mobile phone data, the number of people has been weighted to represent the total population based on the operator's market share in individuals' places of residence. Another weakness is that since the mobile phone data are fully anonymised to maintain privacy, the motives for mobility are missing. It should also be noted that estimating multi-local living with the monthly average population is an approximate variable, as it includes all overnight mobility that crosses municipal boundaries. According to estimates, a significant part of mobility is related to second homes, with about 90.000.000 annual overnight stays, and leisure tourism, with about 45.000.000 annual overnight stays (Rannanpää *et al.* 2022). In addition to multi-local living related to leisure time, the data also include multi-local living related to work, study, and family ties; however, the mobility for these purposes is lower than the mobility related to leisure-time multi-local living, which covers more than 60% of all mobility in Finland. This approximation of this lifestyle should be considered in the interpretation of the results; they cannot be used to identify the effects of individual multi-local groups, as they remain low in volume, although they could otherwise be very significant, for instance from the perspective of rural areas (seasonal work).

The variables from Telia's mobile phone data used in the cluster analysis measured the ratio of the average population of the municipality (calculated from mobile data) to the official population statistics by the municipality (population change by multi-local living), the ratio of the maximum population to the average population (the variability of diversity), and the coefficient of variation of the average population by month (the temporality of diversity) (Table 1). In addition to the mobile phone data, there is also a variable that describes the proportion of second-home residents living outside the municipality relative to the official population of the municipalities in 2021. This variable focuses on leisure time and has therefore been added to the cluster analysis. By utilising the variables described above, this cluster analysis differs from previous ones, as it combines multi-local living based on second homes (Alasalmi *et al.* 2020) with a broader perspective on leisure-time mobility using Telia's mobile data (Rannanpää *et al.* 2022). More details on the variables used in the cluster analysis follow:

1. Ratio of the average population to the official population (%): This variable represents the ratio of the average population (based on mobile data) to the official population of the municipality. The data source is Telia (2023) Crowd Insights, and the data are from 2021.
2. Ratio of the maximum average population to the average population (%): This variable indicates the ratio of the maximum monthly average population (based on mobile data) to the average population of the municipality during the year (also based on mobile data). The data source is Telia (2023) Crowd Insights, and the data are from 2021.
3. Variation coefficient of the average population (%): This variable measures the variation coefficient of the monthly average population (based on mobile data). The data source is Telia (2023) Crowd Insights, and the data are from 2021.
4. Second-home residents living outside the municipality (%): This variable shows the proportion of second-home residents living outside the municipality relative to the official population. The number of second-home residents is calculated based on the number of persons in households owning second homes. The data source is Statistics Finland (2022), and the data are from 2021.

In this study, a cluster analysis was performed using the Partitioning Around Medoids (PAM) algorithm with the cluster package in R (Maechler *et al.* 2022). Since cluster analysis traditionally depends on the researcher's choice to categorize the data into a specific number of groups, cluster validation was used to evaluate the validity of the clustering algorithm results. This aimed to objectively identify how many categories of municipalities are clustered with the PAM algorithm, thereby avoiding subjective selection of the number of groups by the researcher. Validation of the clustering results was based on the *clValid* package in R (Brock *et al.* 2008).

Mapping multi-local categories in Finland

The cluster analysis described in the previous section identified four categories of multi-local living which have clear geographical patterns (Figure 1) and statistical differences between the categories (Table 1). Strongly and moderately affected municipalities are mainly located in the Lakeland region or in the northern and eastern parts of Finland, whereas non-affected municipalities are more common in the southern and western parts, where the largest urban municipalities are also located. Clustering identifies the different intensities of this lifestyle in municipalities. In strongly affected municipalities, the population variation during the year is the highest and, for instance, the average population is over 61 percent higher than the official population in the municipality. In moderately affected municipalities, the population variation is smaller than in strongly affected ones but higher than in weakly affected ones. The municipalities in the least affected category are referred to as non-multi-local municipalities because in these municipalities, the population variation coefficient and the ratio of the average population and official population are the lowest of all the municipality categories. A negative ratio in the latter variable suggests that these municipalities are the so-called origins, and the other municipality categories are the destinations of this lifestyle in Finland.

Table 1. Statistics from the multi-local categories.

Variable	Category				F-value (p-value)
	Non-multi- local municipality (average)	Weakly multi-local municipality (average)	Multi-local municipality (average)	Strongly multi-local municipality (average)	
Ratio of the average population to official population (%)	-9.8	8.2	27.1	61.3	4.276 (0.039)
Ratio of the maximum average population to average population (%)	22.9	29.4	40.8	53.6	7.820 (0.005)
Variation coefficient of the average population (%)	4.2	7.3	13.7	28.4	29.141 (<0.001)
Summer residents living outside the municipality (%)	6.5	27.0	62.9	131.0	15.591 (<0.001)

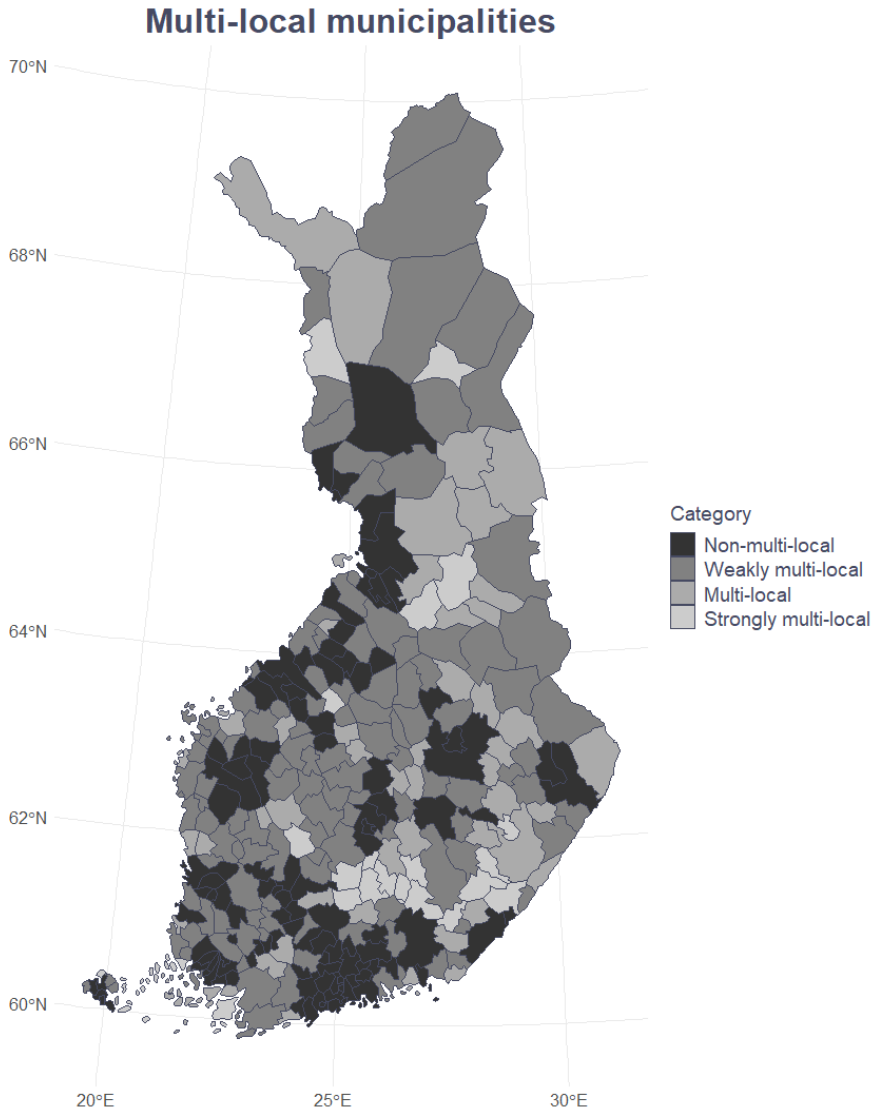


Fig. 1. Spatial distribution of the multi-local municipalities in Finland.

Detecting the effects of multi-local living in municipalities — setting the analysis

The effects of multi-local living on the municipal categories identified in the previous section are studied in this article using a statistical analysis that focuses on the matching method. The idea behind this method is to identify the multiple effects of multi-local living on the variables identified in the literature review in section two, thereby creating an overall picture of these effects in municipalities. At the beginning of the section, the variables based on the literature review and their compilation from various statistical data are described in more detail. Then, at the end of this section, the matching

method is introduced. The analysis is carried out at the municipality level. This approach is justified by the availability of statistical data and the role of municipalities in local administration. However, it must be acknowledged that not all the analysed subthemes are decided at the municipality level, and the impacts are not formed solely at the municipality level.

Variables describing availability of infrastructure, services and housing markets

The effects of multi-local living on municipalities are analysed with several variables selected based on the extensive literature review in section two, where several earlier studies highlighted the potential effects of this lifestyle on the availability of infrastructure, services, and housing markets (Appendix 1). Due to the use of diverse statistical sources, it was not possible to access all variables for the same years.

The variables describing the *availability of digital infrastructure* were collected as part of this study from Traficom's and Ookla's open databases (Appendix 1). The Traficom (2022a) statistics contain data per municipality on the proportion of households for which fixed broadband subscriptions are available. The data are collected from telecommunications companies once a year. In addition, the data from Traficom (2022b) include the geographical coverage of mobile networks. In this data, coverage represents the area where (under ideal conditions) the service in question is available on a conventional mobile network terminal outdoors at a height of about 1.5m above the ground. A key weakness in the mobile network coverage is that the calculation does not take network load into account. Thus, in our analysis, the quality of mobile connections is also assessed by the download speed of the mobile network, the examination of which is based on the speed test data of Ookla (2022), where each quarter has approximately 90.000 observation points around Finland.

The variables describing the *traditional road infrastructure* were collected from several statistical databases (Appendix 1). The share of roads in need of repair was calculated from the original road network inventory data presenting the condition of road surfaces (Finnish Transport Infrastructure Agency 2023a). The variable indicates the proportion of roads in need of repair per municipality from the total road network maintained by the Finnish Transport Infrastructure Agency. The actual costs of road construction are not coherently compiled into official statistics, so public road investments were observed through cost estimates of executed road construction plans (Finnish Transport Infrastructure Agency 2023c). The data for the cost estimate were manipulated by extracting the names of the municipalities from the names of the construction plans and summarising the cost estimate by municipalities to get the total sum of estimated costs in the municipalities from the years 2002–2022.

Geographical information system methods were used to calculate average *distances to services* (Appendix 1). The calculation was carried out using the ArcGIS Pro software with the Network Analyst Closest Facility tool. Distances were calculated along road networks using the Digiroad national road and street data (Finnish Transport Infrastructure Agency 2023b), with 1km x 1km population grid data representing the permanent population (Statistics Finland 2021), and geo-coded point data of the locations of service facilities. The average distances (in meters) to the nearest grocery shops were calculated from population grid centroids to the closest facility within the municipality. Other distances, including the average distance to the three nearest grocery shops (in meters), were calculated from the population grid to the closest facilities without considering municipality boundaries, as people's use of commercial services is not confined to these borders. Accessibility was also measured as the number of grocery shops per 1.000 inhabitants in each municipality to describe the availability of commercial services.

In addition to accessibility measured with the distance, the net costs of municipal service production for cultural, library, physical activity and outdoor activities, fire and rescue services, community services, and transportation services (Kuntaliitto 2021) were examined by calculating the averages for the years 2019–2021 (Appendix 1).

The variables describing the *housing markets* were also based on various databases (Appendix 1). Estimated average actual prices of properties for housing and their development by postal code area were obtained from Reaktor's (2023) databases. Average actual prices of second homes per municipality (National Land Survey of Finland 2023) were examined by calculating the average prices

from 2017 to 2021. Etuovi.com housing advertisement data were also utilised in the analysis, as they reveal different aspects of housing markets than other statistics. The Etuovi.com database consisted of 1.185.597 housing advertisements starting from July 2014 and ending March 2023. The data from individual housing advertisements made it possible to calculate average variables from 2015 to 2020, including advertisement times, housing market dynamics, asking prices, and construction years by municipalities for properties for housing. This allowed for a more detailed understanding of the housing market dynamics in these municipalities (Appendix 1).

Testing the effect of multi-local living on infrastructure, services, and housing markets

The effects of multi-local living on municipalities were analysed in this study utilising a matching method and statistical analysis. The aim with matching is to come as close as possible to a randomised trial design, and thus to improve the generalisability of results compared to the studies which have used traditional statistical analyses (Austin 2011). The purpose of matching is to find one (or more) non-treated unit(s) (for instance, a municipality that is not or is only weakly affected) for every treated unit (for instance, a strongly affected municipality) with similar observable characteristics against which the effect be assessed. The use of matching enables the effects to be interpreted more reliably within these matched groups because matching aims to reduce selection bias (Rosenbaum & Rubin 1983). With matching, the aim is to tackle a shortcoming that is related to earlier studies, where the real net effects of multi-locality are challenging or even impossible to find out because the methods utilised can make it difficult to distinguish effects that are solely due to this lifestyle. Genetic matching is used, which maximises the balance of observed covariates between treated and control groups (Diamond & Sekhon 2013) and improves covariate balance compared to propensity score matching techniques (Sekhon 2011). The genetic matching method can be found in the MatchIt package of the R programme (Ho *et al.* 2011). Due to the small number of multi-local municipalities, the sampling algorithm was used with replacement. The distance measure for propensity scores estimated with logistic regression and the number of individuals the genetic optimisation uses to solve the optimisation problem was set to 500 units. During the analysis process, other matching techniques from the MatchIt package were also tested, but genetic matching proved to be the most reliable.

For the purposes of this study, the matching is based on the variables that have been extracted from Statistics Finland's (2022) database, which describes the key statistical indicators of the municipalities (Appendix 2). These variables include the socio-economic status, economic structure, demographic development, and population structure of municipalities. In addition to these key indicators, a variable representing the average distance from the municipality to the nearest city with a population over 200.000 (Helsinki, Espoo, Tampere, Vantaa, Oulu) was added to the list of matching variables (Statistics Finland 2022). This variable was added to the matching process, as it depicts the municipality structure in relation to the biggest cities and the most rapidly growing areas. When choosing variables, relevant but highly correlated variables were treated by choosing one to represent both variables for matching. The aim was to keep the number of matching covariates as small as possible because in a small data set the variables that are not associated with multi-local living may prevent finding a balance between multi-local and control municipalities (Brookhart *et al.* 2006). Therefore, of the highly correlated variables, only one was used in the matching process.

With matching methods, it is important to draw attention to the balance of the covariates used in the matching because it has a key effect on the reliability of the identified results and further on the conclusions to be drawn from it. The balance between the treatment and control groups reflects the quality of the matching and helps to assess how well the observed differences between sample groups reflect real differences (Ho *et al.* 2007). When balance is achieved in the sample, the results are expected to be close to the actual situation and less sensitive to misinterpretations (Greifer 2023). Variables used in the matching are mainly balanced (Figure 2). A better balance was achieved in moderately multi-local living municipalities than in strongly affected municipalities, where the number of municipalities is small. Thus, interpretations of the sample of moderately multi-local living municipalities are less vulnerable to misinterpretation.

A more detailed sensitivity analysis was not conducted, because the research setting is generalised, making it likely that some variables are missing. Conducting available sensitivity analyses would require a separate study design for each variable, which would be quite laborious given that 31 separate variables are included in the analysis. Therefore, the results need to be interpreted generally, as it is likely that some important variables are missing in the matching process. Future studies should use a more precise research design, focusing on individual variables rather than a broad analysis. Differences between the averages of the unmatched and matched groups in the infrastructure, services, and housing markets variables were tested using Student’s t-test with the stats package in R. The most reliable way to determine the effects of multi-local living on municipalities is by comparing the differences verified by the t-test between treated and control municipalities.

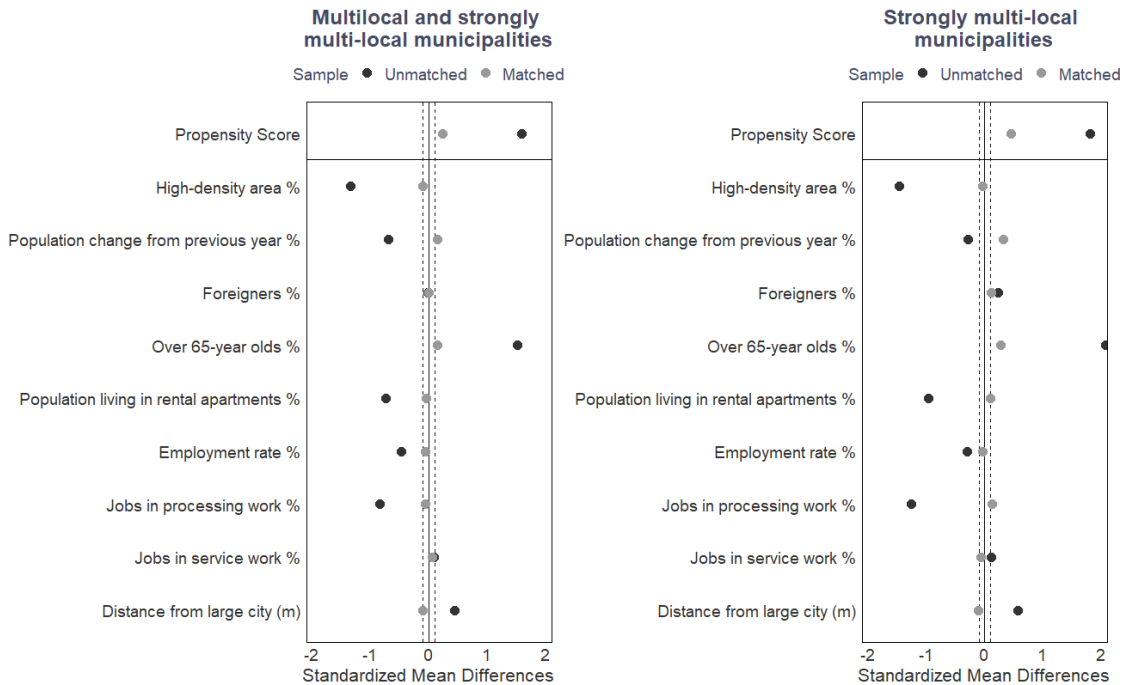


Fig. 2. Balance of the covariates used in the matching in control and treatment groups.

Varying effects of multi-local living in municipalities

Matching methods were used to test the effects of multi-local living on infrastructure, services, and housing markets. In the matching, the strongly affected municipalities were also compared separately with control groups to analyse whether the intensity of multi-locality influenced the variables of interest. In unmatched samples, multi-local and strongly affected municipalities were compared with non-affected and weakly affected municipalities, referred to as other municipalities. The control groups for the matched samples consisted of matched municipalities from non-affected and weakly affected municipality groups. The results from t-tests without matching describe general differences between municipality categories in the allocation of multi-local living, while the results from the matched samples reveal the potential effects on the municipalities.

Infrastructure

The impact of multi-local living on infrastructure was analysed by examining the availability of telecommunications and road infrastructure (Table 2). Initially, digital infrastructure availability was

generally weaker in strongly and moderately affected municipalities compared to non-affected ones. However, in the matched sample, differences in the availability of 5G connections, mobile network download speeds, and broadband access disappeared, indicating that these differences in the unmatched sample are not directly related to multi-local living. The only significant difference in the matched sample was the availability of 4G networks, which was lower in multi-local municipalities compared to the control group. Similarly, for road infrastructure, differences between municipality categories were only observed in the unmatched samples, suggesting that multi-local living does not significantly impact road infrastructure variables. Without matching, strongly affected municipalities appeared to receive fewer investments but had fewer roads in need of repair compared to other municipalities, indicating a positive effect of this lifestyle on road infrastructure condition.

Table 2. Results of testing differences in infrastructure variables. Statistically significant results are bolded in the table.

Variable	Without matching			Matched samples					
	Other municip alities (n=228)	Strongly multi-local municipalities (n=28)		Strongly multi-local and multi-local municipalities (n=78)		Control group for strongly multi-local municipalities (n=16)		Control group for multi-local municipalities (n=41)	
	Average	Average	t-value (p-value)	Average	t-value (p-value)	Average	t-value (p-value)	Average	t-value (p-value)
Mobile network availability (5g & 100 mb/s) (%), 2021	46.5	11.8	6.108 (<0.001)	10.8	9.641 (<0.001)	4.0	-1.230 (0.227)	17.5	1.225 (0.225)
Mobile network availability (4g & 100 mb/s) (%), 2021	83.1	68.9	5.710 (<0.001)	69.5	8.932 (<0.001)	70.9	0.502 (0.620)	74.2	2.098 (0.039)
Download speed of mobile network (mb/s), 2021	64.30	40.89	6.294 (<0.001)	44.06	8.551 (<0.001)	41.86	-0.234 (0.816)	46.56	0.906 (0.368)
Fixed broadband connection (1000Mb/s) (%), 2021	43.8	35.4	1.313 (0.201)	30.7	3.039 (0.003)	15.4	-2.027 (0.051)	31.1	0.071 (0.943)
Roads in need of repair 2011-2018 (%)	19.1	16.5	2.158 (0.040)	18.1	1.135 (0.259)	19.8	1.448 (0.162)	19.4	0.940 (0.351)
Road investments 2002-2022 (€/resident)	2,525	931	2.334 (0.021)	1,712	1.005 (0.316)	1,060	0.335 (0.741)	4,136	1.233 (0.225)
Traffic lane maintenance 2019- 2021 (€/resident)	150.66	148.27	0.240 (0.812)	140.14	1.573 (0.118)	131.17	-1.200 (0.240)	128.10	-1.275 (0.206)

Services

The impact of multi-local living on services was assessed by examining the net cost of service production as well as the potential accessibility and availability of various services. T-test results indicated that the net costs of producing services in multi-local municipalities are higher than in other municipalities for library services, fire and rescue services, and community infrastructure services (Table 3). However, when comparing municipalities using matched samples, the statistical differences in the net costs of fire and rescue services between multi-local and other municipalities disappeared. This suggests that the observed differences are not directly related to multi-local living. Additionally, there were no differences in the net costs of sports and outdoor activities or cultural activities between multi-local and other municipalities. This indicates that control group municipalities allocate similar resources to these services as multi-local municipalities.

Table 3. Results of testing differences in municipality service variables. Statistically significant results are bolded in the table.

Variable	Without matching					Matched samples			
	Other municipalities (n=228)	Strongly multi-local municipalities (n=28)	t-value (p-value)	Strongly multi-local and multi-local municipalities (n=78)	t-value (p-value)	Control group for strongly multi-local municipalities (n=16)	t-value (p-value)	Control group for multi-local municipalities (n=41)	t-value (p-value)
Fire and rescue services 2019-2021 (€/resident)	93.28	107.14	-2.066 (0.050)	99.62	-1.809 (0.073)	110.14	0.310 (0.758)	103.50	0.764 (0.447)
Sports and outdoor activities 2019-2021 (€/resident)	106.06	108.97	-0.317 (0.754)	111.52	-0.809 (0.420)	111.88	0.190 (0.851)	98.44	-1.377 (0.172)
Cultural activities 2019-2021 (€/resident)	98.46	104.23	-0.947 (0.351)	98.89	-0.115 (0.908)	103.60	-0.054 (0.957)	97.52	-0.234 (0.816)
Libraries 2019-2021 (€/resident)	63.97	82.60	-4.027 (0.001)	77.05	-5.256 (>0.001)	69.56	-2.459 (0.019)	67.69	-2.805 (0.006)
Community infrastructure services, 2019-2021 (€/resident)	328.56	388.41	-3.105 (0.005)	344.69	-1.458 (0.148)	328.56	-2.543 (0.016)	310.11	-2.361 (0.020)
Average distance to grocery store 2020 (m)	4,456	4,717	-0.389 (0.700)	6,620	-4.697 (>0.001)	6,166	1.313 (0.200)	5939	-1.078 (0.284)
Average distance to 3 grocery stores located in rural area 2020 (m)	26,714	50,134	-4.533 (<0.001)	50,367	-6.444 (<0.001)	43,266	-0.804 (0.428)	38,077	-2.567 (0.012)
Average distance to a department store 2020 (m)	950	3,429	-6.310 (<0.001)	2,777	-8.146 (<0.001)	2,484	-1.481 (0.149)	1,759	-3.149 (0.002)
Grocery shops in the municipality /1,000 residents 2020	0.66	1.96	-3.080 (0.005)	1.24	-3.702 (<0.001)	0.95	-2.375 (0.026)	0.77	-2.922 (0.004)
Average distance to a swimming place (m)	6,166	8,672	-1.354 (0.186)	7,888	-1.655 (0.101)	6,212	-1.231 (0.226)	7,376	-0.347 (0.729)
Average distance to a campfire site (m)	14,585	22,754	-1.392 (0.174)	16,995	-0.863 (0.390)	22,929	0.015 (0.988)	13,221	-1.063 (0.290)

The net cost of services in multi-local municipalities is higher for library services and community infrastructure services compared to control municipalities in the matched samples. Statistical tests with matched samples indicate that only these services incur higher costs due to lifestyle, making service provision more expensive in multi-local municipalities than in control municipalities. While the statistics do not directly explain the higher costs, the increased expenses for community infrastructure services are likely due to additional costs associated with seasonal housing, such as water supply, waste management, and energy supply. Although the differences in net costs were statistically significant, the overall impact is relatively small. On average, the cost of library and community services in multi-local municipalities was only €43.94 per resident higher than in the matched sample, representing approximately 0.6% of the total municipal costs. These small differences suggest that multi-local living does not pose a significant economic burden for municipalities.

The t-test results without matching indicate that access to services is lower in multi-local municipalities compared to other municipalities. In the matched samples, significant differences remain in the average distance to grocery shops and the number of commercial services relative to the population. This suggests that these differences are associated with multi-local living, as the average distances to the nearest three grocery shops are greater in strongly and moderately affected municipalities than in non-affected control municipalities. This finding implies that this lifestyle maintains a dispersed community structure, contradicting the assumption that multi-local living would enhance the accessibility of commercial services.

Conversely, multi-local living appears to sustain the availability of commercial services in multi-local municipalities, as there are proportionally more people in these municipalities compared to non-affected municipalities. The potential accessibility to recreational services was assessed by examining the average distances to the nearest maintained swimming place and campsite. For both variables, no differences were found between strongly and moderately affected and non-affected municipalities in either the unmatched or matched samples. Therefore, the accessibility of these recreational services is not affected by this lifestyle.

Housing markets

The effects of multi-local living on the prices and development of permanent and second homes were also tested using matching (Table 4). The results show that property prices are lower in multi-local municipalities compared to other municipalities, but this statistically significant difference disappears in the matched sample. Thus, this lifestyle does not seem to be associated with higher or declining property prices. However, in strongly affected municipalities, the mean actual price of properties for permanent housing located in sparsely populated areas was higher, and the actual price development was more positive than in their control municipalities. These positive indications of the effects of this lifestyle on housing markets are further supported by the higher prices of second homes in multi-local municipalities compared to their matched counterparts. A comparison between the average prices in strongly and moderately affected municipalities and their matched counterparts reveals a significant effect of multi-locality on second-home prices. The average price of second homes in affected municipalities was 28.7% higher than in control municipalities. Additionally, the average price per square meter of properties located in sparsely populated areas in multi-local municipalities was 8.3% higher than in the matched ones.

Table 4. Results of testing differences in property prices and price development. Statistically significant results are bolded in the table.

Variable	Without matching					Matched samples			
	Other municipalities (n=228)	Strongly multi-local municipalities (n=28)	Strongly multi-local and multi-local (n=78)		Control group for strongly multi-local municipalities (n=16)	Control group for multi-local municipalities (n=41)			
			Average	t-value (p-value)		Average	t-value (p-value)		
Mean price of built free-time property (€) 2017-2021	38,162	39,380	-0.270 (0.789)	36,538	0.506 (0.614)	28,725	-2.098 (0.045)	28,401	-2.249 (0.028)
Mean price of property 2020 (€/m3)	963.27	718.40	4.473 (<0.001)	681.36	6.562 (<0.001)	626.92	-1.278 (0.211)	687.90	0.161 (0.872)
Price development of property 2015-2020 (%)	-12.4	-16.8	2.948 (0.006)	-18.1	6.240 (<0.001)	-18.9	-1.001 (0.323)	-17.0	0.884 (0.379)
Mean actual price of property located in sparsely populated area 2020 (€/m3)	541.5	660.1	-2.575 (0.016)	582.97	-1.608 (0.111)	459.75	-3.505 (0.001)	538.54	-1.393 (0.168)
Actual price development of property located in sparsely populated area 2015-2020 (%)	-20.3	-18.4	-1.223 (0.230)	-20.2	-0.073 (0.942)	-23.4	-2.437 (0.023)	-20.4	-0.170 (0.866)
Average marketing time (d) of built properties	197.0	209.5	-0.883 (0.383)	218.0	-2.269 (0.024)	254.9	1.537 (0.140)	244.1	1.677 (0.098)
Number of properties for sale in Etuovi.com relative to the municipality's housing stock (%)	7.4	5.3	3.799 (<0.001)	5.0	6.533 (<0.001)	3.1	-3.434 (0.001)	4.6	-0.699 (0.486)
Asking price of built properties (€/m ²)	1,475.6	1,242.8	1.884 (0.068)	1,113.4	4.785 (<0.001)	1,162.1	-0.285 (0.778)	1082.6	-0.258 (0.797)
Construction year of built properties	1982	1980	0.971 (0.339)	1979	2.810 (0.005)	1978	-0.403 (0.690)	1976	-1.088 (0.281)
Average marketing time (d) of second homes	168.3	158.7	0.778 (0.441)	174.4	-0.740 (0.459)	198.2	1.389 (0.183)	184.7	0.808 (0.422)
Number of second homes for sale in Etuovi.com relative to the municipality's housing stock (%)	3.9	4.6	-1.389 (0.174)	4.2	-0.838 (0.402)	3.6	-1.458 (0.155)	3.6	-1.469 (0.145)
Asking price of second homes (€/m ²)	1,992.9	2,550.7	-4.708 (<0.001)	2,273.7	-3.307 (0.001)	1,729.7	-5.675 (<0.001)	1,760.6	-5.555 (<0.001)
Construction year of second homes	1978	1985	-3.020 (0.005)	1984	-4.645 (<0.001)	1979	-0.906 (0.378)	1979	-1.835 (0.078)

Statistics from the Etuovi.com advertisement data provide insights into the dynamics of housing markets for permanent housing and second homes in multi-local municipalities. Generally, without matching, multi-local municipalities have older building stock, lower asking prices for properties, and longer marketing times compared to other municipalities. However, these statistical significances disappear after matching. The data weakly indicate that the average marketing times for properties intended for permanent housing are shorter in multi-local municipalities than in control municipalities. The only variables that clearly reflect the effects of this lifestyle are the asking prices and the construction years of second homes. For both variables, affected municipalities stand out positively compared to the control group, indicating that in multi-local municipalities, the asking prices are higher and the buildings are newer.

Evaluating the socio-economic impacts of multi-locality on rural municipalities

The analysis revealed that multi-locality positively impacts property prices but negatively affects the net cost of certain services, service accessibility, and the quality of digital infrastructure (Table 5). In multi-local municipalities, telecommunications connections are less developed compared to other municipalities, leading to higher loads on these connections, especially during the summer. This finding concerns all rural areas with poor telecommunications connectivity (OECD 2020) as second-homes are often located in rural municipalities. Consequently, mobile networks in multi-local municipalities experience heavier loads during the summer months, reducing the ability of both seasonal and permanent residents to use digital infrastructure and related services. This also hampers efforts to increase multi-local living in municipalities with weak digital infrastructure.

Table 5. Summary of the main results of the effects of multi-local living on municipalities based on empirical evidence from matching analyses. Effects are described with scale:

--- (very negative effect), --, - / +, ++, +++ (very positive effect).

Category	Direction of the effect	Description of the effect	Interpretation
Digital infrastructure	--	The availability of the 4G mobile network is lower in multi-local municipalities compared to non-multi-local ones. Strongly multi-locality improves the availability of fixed broadband connection.	The digital infrastructure of multi-local municipalities is more prone to the burden caused by the multi-local population. The possibilities of the permanent population of the multi-local municipalities to use the digital infrastructure declines seasonally.
Net costs of services	-	Multi-locality increases community infrastructure and library expenses.	In multi-local municipalities, there is larger demand for library and community services, which increase the costs. In the costs of community services, multi-locality and the resulting decentralized community structure seem to increase the costs of service production, which cannot be fully covered by service charges.
Availability of grocery stores	+/-	In multi-local municipalities, the average distances to services are longer but the number of service facilities relative to the population is higher. In multi-local municipalities, the availability of stores has decreased more in than the availability of schools.	Multi-locality seems to reduce the physical accessibility of services, which may be due to the decentralizing effect of multi-locality on the community structure. However, the increased demand caused by the multi-local population seems to increase the number of grocery stores in municipal centres and thus improves the availability of these services in multi-local municipalities.

Housing markets	++	<p>Prices of free-time property are higher in multi-local municipalities, and the prices of property located in sparsely populated area are higher in strongly multi-local municipalities compared to non-multi-local ones. The prices of property located in sparsely populated area have developed less negatively in strongly multi-local municipalities than non-multi-local ones.</p>	<p>Multi-locality increases the demand and the value of free-time properties and properties located in sparsely populated areas where multi-locality is mainly targeted.</p>
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Our result corresponds with the earlier finding by Voutilainen and others (2023), who observed significant variations in mobile network download speeds in strongly multi-local municipalities compared to other areas. They suggested that these variations indicate a greater vulnerability in digital infrastructure availability. This, in turn, implies a weaker position and fewer development opportunities in technological acceleration and digitalization for these municipalities. Consequently, this represents a major challenge to benefitting from a place-independent society. In addition to overnight stay-related multi-locality, which is the focus of our article, daytime tourism — such as tourism without overnight stays — can also heavily load mobile phone networks during tourist seasons.

However, when interpreting the results, it is important to note that multi-local living itself does not directly cause the weaker digital infrastructure in these municipalities. The issue arises because human mobility has not been adequately considered in planning processes. Consequently, inadequate telecommunication infrastructure is the primary reason for vulnerability and spatial injustice in these areas, affecting the ability of residents to live, work, and operate. This inadequacy also impacts the opportunities of permanent residents, posing a threat to economic activity. Thus, these observations highlight the necessity of considering multi-locality in planning. This includes implementing policy measures on land use, coordinating multi-level governance, and addressing cross-sectoral interrelations to mitigate the effects of this lifestyle on spatial injustice (Alonsopérez *et al.* 2022).

The results support earlier research findings of the small positive effect of multi-location on services (Farstad 2011; Czarnecki & Sireni 2018) but do not support the views that this lifestyle contributes to the survival and profitability of local shops (Müller 1999; Larsson & Müller 2019). The results also indicated increased expenses for community planning, water, waste, and energy management; however, the overall effect of these on the municipal economy was limited. According to the findings, multi-local living did not improve the accessibility of grocery shops, such as the existence of small village shops, which may be affected by the decentralised community and service structure in these municipalities. However, our findings demonstrated that it increases the availability of commercial services, as the number of grocery shops in these municipalities was higher than in control municipalities. This suggests a positive effect on the availability of services in municipal centres.

Our analysis identified positive signs of multi-local living on the housing markets of second homes, which has also been observed in previous studies (Back *et al.* 2022). In multi-local municipalities, the demand for second homes leads to higher property values and prices and improves the dynamics of the housing markets. The results provided only limited support for the effects of this lifestyle on the increase of real estate prices (Brida *et al.* 2011; Adamiak *et al.* 2015), as a positive association between this lifestyle and property values was found only in strongly affected municipalities. This finding is

explained by the fact that properties registered as permanent homes are purchased also for the use of free-time housing (Back *et al.* 2022).

One solution to overcome the challenges of spatial justice would be to consider multi-local living in regional policy, particularly as part of rural policy, since the opportunities and burdens are oriented towards rural areas. Including this aspect in policy and decision-making would mean that the temporal populations of these regions would be better recognised and integrated into the planning of infrastructure and services, making it a more visible part of society. This inclusion would also diminish the bias in accounting for the development of permanent and temporary populations, potentially increasing spatial justice in rural areas by addressing the root cause of the problem: the lack of adequate infrastructure in multi-local municipalities. Currently, because temporary populations are not identified as users of infrastructure or services in rural areas, this lifestyle generates spatial injustice between permanent and temporary residents, leading to an inequitable distribution of resources and the consumption of limited resources.

When interpreting the results of this study from the matching methods, several methodological and data limitations must be considered. First, the conclusions assume no significant confounding factors associated with multi-local living. While assumption cannot be tested, the balanced nature of the data enhances the reliability of the results. It is important to note that the results from matching are more reliable than those without control variables, as they can reduce bias due to natural differences between municipality categories. Second, the data's availability and limitations restricted the use of other assessment methods. For example, there is no panel data on this lifestyle over an extended period. Additionally, the small number of municipalities limits statistical analysis, which was evident in the matching process, achieving better balance for moderately affected municipalities than for strongly affected ones. Therefore, conducting similar research with smaller spatial units would be desirable, as municipalities, being relatively large spatial units, can obscure some effects of this mobile lifestyle.

Conclusions: infrastructure challenges and economic opportunities of multi-local living

As multi-locality increases, the need for information in society related to this phenomenon also grows. The results demonstrated that this lifestyle, particularly second-home living, has a wide range of effects on municipalities, both positive and negative. The positive effects include the increased availability of commercial services and the dynamics in the second-home markets, which boost demand in these municipalities. Conversely, the negative aspects are related to the underdeveloped digital infrastructure in these municipalities, making them vulnerable and potentially overburdening local infrastructure, especially during the summer. Therefore, a key point for the future development is how the additional load on infrastructure from multi-local living is considered in planning. While these observations are specific to Finland, the results can be applied to other countries with high seasonal mobility. Notably, Nordic countries, Switzerland, Austria, Germany, and the UK are places where multi-local living has been observed (Overvåg & Berg 2011; Adamiak *et al.* 2015; Di Marino 2022), and where it is likely to have similar effects on municipalities. The effects can be similar in these developed societies, where this lifestyle requires relatively high wealth. The effects are also influenced by the strong seasonality of the examined lifestyle and the lack of official statistics about it.

The effects of multi-locality on spatial justice are particularly significant in rural areas where the permanent population is declining and aging (Rannanpää *et al.* 2022), infrastructure and services are scarce (OECD 2020), and mobile lifestyle focuses on leisure time and is therefore strongly seasonal, leading to peaks in the load of this lifestyle (Rannanpää *et al.* 2022). Poor broadband and transport connectivity are major challenges for rural municipalities aiming to benefit from a place-independent society (OECD 2020). These challenges also harm multi-local living and permanent housing in rural areas more broadly. The lack of digital infrastructure prevents rural areas from leveraging their significant competitive advantages over cities, such as housing opportunities, comfort in the living environment, and well-being enhanced by nature (Florida 2002).

From the perspective of rural areas, the need to consider multi-local living in policy and planning increases, especially if urbanisation and regional population concentration continue, while the popularity of multi-locality remains or even grows. Strengthening infrastructure and services is a crucial part of this development, as it would improve spatial justice and simultaneously exploit the development opportunities related to a place-independent society. In recent years, the rise in mobile lifestyles has been linked to globalisation, increased labour market flexibility, household wealth, and changes in family structures (Di Marino 2022), which may also lead to a growing interest in this lifestyle in the future, as has been observed over the past decades (Adamiak *et al.* 2017). Therefore, the relationship between temporary and permanent settlement should be monitored and analysed in the future, as it is a key factor in the effects on spatial justice.

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References

- Adamiak, C. (2017) Segmenting second home tourists in Finland to better explain their mobility and behavior. *E-Review of Tourism Research* 14(3/4).
- Adamiak, C., Vepsäläinen, M., Strandell, A., Hiltunen, M., Pitkänen, K., Hall, C., Rinne, J., Hannonen, O., Paloniemi, R. & Åkerlund, U. (2015) Second home tourism in Finland-Perceptions of citizens and municipalities on the state and development of second home tourism. [Report] Reports of Finnish Environmental Institute 22en/2015, Helsinki. <https://core.ac.uk/download/pdf/33735104.pdf>
- Adamiak C., Pitkänen, K. & Lehtonen, O. (2017) Seasonal residence and counterurbanization: the role of second homes in population redistribution in Finland. *GeoJournal* 82, 1035–1050. <https://doi.org/10.1007/s10708-016-9727-x>
- Alasalmi, J., Busk, H., Holappa, V., Huovari, J., Härmälä, V., Kotavaara, O., Lehtonen, O., Muilu, T., Vihinen, H. & Rusanen, J. (2020) Työn ja työvoiman alueellinen liikkuvuus ja monipaikkainen väestö. [Report] Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2020:12, Helsinki. <http://um.fi/URN:ISBN:978-952-287-928-8>
- Alonsopérez, M., Brida, J. & Rojas, M. (2022) Second homes: a bibliometric analysis and systematic literature review. *Journal of Tourism, Heritage & Services Marketing* 8(1), 16–26. <https://doi.org/10.5281/zenodo.6581499>
- Austin, P. (2011) An introduction to propensity score methods for reducing the effect of confounding in observational studies. *Multivariate Behavioral Research* 46(3), 399–424. <https://doi.org/10.1080/00273171.2011.568786>
- Back, A., Marjavaara, R. & Müller, D. K. (2022) The invisible hand of an invisible population: dynamics and heterogeneity of second-home housing markets. *International Journal of Tourism Research* 24, 536–549. <https://doi.org/10.1002/jtr.2520>
- Brida, J., Osti, L. & Santifaller, E. (2011) Second homes and the need for policy planning. *Tourismos* 6(1), 141–163. <https://doi.org/10.26215/tourismos.v6i1.200>
- Brock, G., Pihur, V., Datta, S. & Datta, S. (2008) cValid: an R package for cluster validation. *Journal of Statistical Software* 25(4), 1–22. <https://doi.org/10.18637/jss.v025.i04>
- Brookhart, M. A., Schneeweiss, S., Rothman, K. J., Glynn, R. J., Avorn, J. & Stürmer T. (2006) Variable selection for propensity score models. *American Journal of Epidemiology* 163(12), 1149–1156. <https://doi.org/10.1093/aje/kwj149>
- Czarnecki, A. & Sireni, M. (2018) Vapaa-ajan asumisen taloudellinen merkitys maaseutukuntien pysyville asukkaille. *Maaseudun Uusi Aika* 26(1), 5–18.
- Di Marino, M. (2022) Multilocality of living and working pre and post COVID-19 pandemic. *Kart og Plan* 115(2), 127–135. <https://doi.org/10.18261/kp.115.2.3>
- Diamond, A. & Sekhon, J. (2013) Genetic matching for estimating causal effects: a general multivariate matching method for achieving balance in observational studies. *The Review of Economics and Statistics* 95(3), 932–945. https://doi.org/10.1162/REST_a_00318

- Dittrich-Wesbuer, A., Kramer, C., Duchêne-Lacroix, C. & Rumpolt, P. (2015) Multi-local living arrangements: approaches to quantification in German language official statistics and surveys. *Tijdschrift Voor Economische En Sociale Geografie* 106(4), 409–24. <https://doi.org/10.1111/tesg.12160>
- Farbotko, C., Kitara, T., Dun, O. & Evans, C. (2022) A climate justice perspective on international labour migration and climate change adaptation among Tuvaluan workers. *Oxford Open Climate Change* 2(1), 1–15. <https://doi.org/10.1093/oxfclm/kgac002>
- Farstad, M. (2011) Rural residents' opinions about second home owners' pursuit of own interests in the host community. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography* 65(3), 165–174. <https://doi.org/10.1080/00291951.2011.598551>
- Finnish Consulting Group (2016) Mökkibarometri 2016. [Report] Saaristoasiain neuvottelukunta. Maa- ja metsätalousministeriö, Helsinki.
- Finnish Transport Infrastructure Agency (2023a) Päällysteiden kunto ja vauriot. <https://vayla.fi/kunnossapito/tieverkon-kunnossapito/paallysteiden-kunto>. 23.11.2023.
- Finnish Transport Infrastructure Agency (2023b) Digiroad — National Road and Street Database. <https://vayla.fi/en/transport-network/data/digiroad>. 24.11.2023.
- Finnish Transport Infrastructure Agency (2023c) Cost estimates of implemented road plans. Unpublished statistics.
- Florida, R. (2002) *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. Basic Books, New York.
- Greifer, N. (2023) cobalt: Covariate Balance Tables and Plots. <https://ngreifer.github.io/cobalt/>. 27.11.2024.
- Greinke, L. & Lange, L. (2022) Multi-locality in rural areas—an underestimated phenomenon. *Regional Studies, Regional Science* 9(1), 67–81. <https://doi.org/10.1080/21681376.2021.2025417>
- Hiltunen, M. (2007) Environmental impacts of rural second home tourism — case lake district in Finland. *Scandinavian Journal of Hospitality and Tourism* 7(3), 243–265. <https://doi.org/10.1080/15022250701312335>
- Hiltunen, M., Pitkänen, K., Vepsäläinen, M. & Hall, C. M. (2013) Second home tourism in Finland: current trends and eco-social impacts. In Roca, Z. (ed.) *Second Homes in Europe: Lifestyle Issues and Policy Responses*, 165–200. Routledge, London.
- Hiltunen, M. & Rehunen, A. (2014) Second home mobility in Finland: patterns, practices and relations of leisure oriented mobile lifestyle. *Fennia* 192(1), 1–22. <https://doi.org/10.11143/8384>
- Ho D., Imai K., King G. & Stuart, E. A. (2011) MatchIt: nonparametric preprocessing for parametric causal inference. *Journal of Statistical Software* 42(8), 1–28. <https://doi.org/10.18637/jss.v042.i08>
- Hoogendoorn, G. & Visser, G. (2010) The economic impact of second home development in small-town South Africa. *Tourism Recreation Research* 35(1), 55–66. <https://doi.org/10.1080/02508281.2010.11081619>
- Jain, A. K. & Dubes, R. C. (1988) *Algorithms for Clustering Data*. Prentice Hall, Englewood Cliffs.
- Jones, R., Moisiu, S., Weckroth, M., Woods, M., Luukkonen, J., Meyer, F. & Miggelbrink, J. (2019) Re-conceptualising territorial cohesion through the prism of spatial justice: critical perspectives on academic and policy discourses. In Lang, T. & Görmar, F. (eds.) *Regional and Local Development in Times of Polarisation. Re-thinking Spatial Policies in Europe*, 97–119. Palgrave Macmillan. https://doi.org/10.1007/978-981-13-1190-1_5
- Kauppila, P. (2020) Matkailullisen vapaa-ajan asumisen aluetaloudelliset vaikutukset: Hyrynsalmi, Kuhmo, Sotkamo ja Suomussalmi. [Report] Kajaanin ammattikorkeakoulun julkaisusarja B 101 / 2020. <http://www.theseus.fi/handle/10024/332971>
- Kujala, S., Hakala, O., Törmä, H., Rantanen, M., Czarnecki, A. & Hyryläinen, T. (2018) Etelä-Savon vapaa-ajan asumisen aluetaloudelliset vaikutukset nykytilanteessa ja tulevaisuuden skenaarioissa. [Report] Helsingin yliopisto, Ruralia-instituutti. <http://hdl.handle.net/10138/260557>
- Kuntaliitto (2021) Muita kuntataloustilastoja. <https://www.kuntaliitto.fi/talous/kuntatalouden-tilastot/muita-kuntataloustilastoja>. 23.11.2023.
- Larsson, L. & Müller, D. K. (2019) Coping with second home tourism: responses and strategies of private and public service providers in western Sweden. *Current Issues in Tourism* 22(16), 1958–1974. <https://doi.org/10.1080/13683500.2017.1411339>
- Lehtonen, O., Muilu, T. & Vihinen, H. (2019) Multi-local living — an opportunity for rural health services in Finland? *European Countryside* 11(2), 257–280. <https://doi.org/10.2478/euco-2019-0013>
- Maechler, M., Rousseeuw, P., Struyf, A., Hubert M. & Hornik, K. (2022) *cluster: Cluster Analysis Basics and Extensions*. R package version 2.1.4 — For new features, see the 'Changelog' file (in the package source) <https://CRAN.R-project.org/package=cluster>. 27.11.2024.
- Marcuse, P. (2010) Spatial justice: derivative but causal of social justice. In Bret, B., Gervais-Lambony, P., Hancock, C. & Landy, F. (eds.) *Justice et Injustices Spatiales*, 76–92. Presses Universitaires de Paris Nanterre, Paris. <https://doi.org/10.4000/books.pupo.420>

- Müller, D. (1999) *German Second Home Owners in the Swedish Countryside: on the internationalization of the leisure space*. Gerum Kulturgeografi 1999:2. Department of Social and Economic Geography. Umeå University, Umeå.
- National Land Survey of Finland (2023) Statistical information on real estate transactions. <https://www.maanmittauslaitos.fi/en/e-services/statistical-information-real-estate-transactions>. 27.11.2024.
- Nordberg, K. (2020) Spatial justice and local capability in rural areas. *Journal of Rural Studies* 78, 47–58. <https://doi.org/10.1016/j.jrurstud.2020.06.008>
- OECD (2020) *OECD Regions and Cities at a Glance*. OECD Publishing, Paris. <https://doi.org/10.1787/959d5ba0-en>
- Oliveira, J. A., Roca, M. N. O. & Roca, Z. (2015) Economic effects of second homes: a case study in Portugal. *Economics and Sociology* 8(3), 183–196. <https://doi.org/10.14254/2071-789X.2015/8-3/14>
- Ookla (2022) Ookla open data. <https://github.com/teamookla/ookla-open-data>. 9.5.2022.
- Overvåg, K. & Berg, N. G. (2011) Second Homes, Rurality and Contested Space in Eastern Norway. *Tourism Geographies* 13(3), 417–442. <https://doi.org/10.1080/14616688.2011.570778>
- Parhiala, K., Pitkänen, K., Strandell, A., Rehunen, A. & Suomela, T. (2020) Miten huomioida monipaikkainen elämä terveyspalveluiden järjestämisessä? [Report] Terveystien ja hyvinvoinnin laitos, Päätösten tueksi 1/2020, Helsinki. <https://www.julkari.fi/handle/10024/139058>
- Pitkänen, K. (2008) Second-home landscape: the meaning(s) of landscape for second-home tourism in Finnish Lakeland. *Tourism Geographies* 10(2), 169–192. <https://doi.org/10.1080/14616680802000014>
- Pitkänen, K. & Strandell, A. (2018) Suomalaisen maaseudun monipaikkaisen asumisen muodot ja tulevaisuuden kehitys. *Maaseudun Uusi Aika* 26(2–3), 6–23.
- Rannanpää, S., Antikainen, J., Aro, R., Huttunen, J., Hovi, S., Pitkänen, K., Strandell, A., Nurmio, K., Rehunen, A., Vihinen, H., Lehtonen, O., Muilu, T. & Weckroth, M. (2022) Monipaikkaisuus — nykytila, tulevaisuus ja kestävyys. [Report] Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2022:9, Helsinki. <https://julkaisut.valtioneuvosto.fi/handle/10024/163785>
- Reaktor (2023) Thinking to buy or sell an apartment? <https://kannattaakokauppa.fi/#/en/>. 28.11.2024.
- Rehunen, A., Pitkänen, K., Strandell, A. & Nurmio, K. (2022) Monipaikkaisuuden ja paikkariippumattomuuden vaikutukset alue- ja yhdyskuntarakenteeseen. *Yhdyskuntasuunnittelu* 59(4), 11–42. <https://doi.org/10.33357/ys.115567>
- Rosenbaum, P. & Rubin, D. (1983) The central role of propensity score in observational studies for causal effects. *Biometrika* 70(1), 41–55. <https://doi.org/10.1093/biomet/70.1.41>
- Saukkonen, P. & Majoinen, K. (2022) *Monipaikkaisuus kuntien voimavarana*. Kuntaliiton julkaisusarja. Uutta kunnista 6/2022, Helsinki.
- Scheiner, J. (2020) Mobilität: Wechselwirkungen mit Multilokalität. In Danielzyk, R., Dittrich-Wesbuer, A., Hilti, N. & Toppel, C. (eds.) *Multilokale Lebensführungen und räumliche Entwicklungen: ein Kompendium*, 166–174. Verl. D. ARL, Hannover.
- Sekhon, J. (2011) Multivariate and Propensity Score Matching Software with Automated Balance Optimization. *Journal of Statistical Software* 42(7), 1–52. <https://doi.org/10.18637/jss.v042.i07>
- Soja, E. (2010) *Seeking Spatial Justice*. University of Minnesota Press, Minneapolis. <https://doi.org/10.5749/minnesota/9780816666676.001.0001>
- Statistic Finland (2021) Population grid data 1 km x 1 km. https://www.stat.fi/org/avoindata/paikkatietoaineistot/vaestoruutuaineisto_1km_en.html. 27.11.2024.
- Statistics Finland (2022) Kuntien avainluvut. <https://www.stat.fi/tup/alue/kuntienavainluvut.html#?year=2021&active1=SSS>. 27.11.2024.
- Telia (2023) Crowd Insights analysoi ihmisvirtoja. <https://www.telia.fi/yrityksille/palvelut/teknologiat/crowd-insights>
- Traficom (2022a) Availability of fixed broadband in Finland. <https://tieto.traficom.fi/fi/node/11401?group=viestinta&limit=20&offset=0&query=&sort=created>. 9.5.2022
- Traficom (2022b) Availability of mobile network in Finland. <https://tieto.traficom.fi/fi/node/11401?group=viestinta&limit=20&offset=0&query=&sort=created>. 09.05.2024
- Traficom (2022c) Mobile subscription. 30.03.2022 <https://tieto.traficom.fi/fi/node/11401?group=viestinta&limit=20&offset=0&query=&sort=created>. 28.11.2024
- Vepsäläinen, M., Strandell, A. & Pitkänen, K. (2015) Muuttuvan vapaa-ajan asumisen hallinnan haasteet kunnissa. *Yhdyskuntasuunnittelu* 53(2), 13–38.
- Voutilainen, O., Korhonen, K. & Ovaska, U. (2021a) Kyläkauppatuki 2019–2021: Kyläkaupat monipalvelukeskuksina -kokeiluhankkeen toteutuksen ja vaikutusten arviointi. [Report] Luonnonvara- ja biotalouden tutkimus 46/2021. Luonnonvarakeskus, Helsinki. <http://urn.fi/URN:ISBN:978-952-380-235-3>

- Voutilainen, O., Korhonen, K., Ovaska, U. & Vihinen, H. (2021b) Mökkibarometri 2021. [Report] Luonnonvara- ja biotalouden tutkimus 47/2021. Luonnonvarakeskus, Helsinki. <http://urn.fi/URN:ISBN:978-952-380-237-7>
- Voutilainen, O., Lehtonen, O., Muilu, T. & Heiskanen, V. (2023) Riittävätkö mobiiliyhteydet monipaikkaisen maaseudun tarpeisiin? 04.04.2023 <https://hybridisuomi.fi/artikkelit/riittavatko-mobiiliyhteydet-monipaikkaisen-maaseudun-tarpeisiin/>. 13.4.2023.
- Weichhart, P. (2015) Residential multi-locality: in search of theoretical frameworks. *Tijdschrift voor Economische en Sociale Geografie* 106(4), 378–391. <https://doi.org/10.1111/tesg.12156>
- Willberg, E., Järvi, O., Väisänen, T. & Toivonen T. (2021) Escaping from cities during the COVID-19 crisis: using mobile phone data to trace mobility in Finland. *ISPRS International Journal of Geo-Information*, 10(2), 103. <https://doi.org/10.3390/ijgi10020103>
- Woods, M. (2023) Rural recovery or rural spatial justice? Responding to multiple crises for the British countryside. *The Geographical Journal*. <https://doi.org/10.1111/geoj.12541>
- Zickgraf, C. (2022) Relational (im)mobilities: a case study of Senegalese coastal fishing populations. *Journal of Ethnic and Migration Studies* 48, 1–18. <https://doi.org/10.1080/1369183X.2022.2066263>

Appendix 1. Variables used in the statistical analysis to detect the effects of multi-local living in municipalities; the sources; and the findings of previous studies.

Variable (category)	Description	Data source	According to previous studies, how multi-locality affects the variable (year of data)
Digital infrastructure (infrastructure)	4G and 5G connections, average download speed of mobile connections, and availability of broadband.	Finnish Transport Infrastructure Agency	Leads to vulnerability to the burden of multi-locals because of less developed telecommunications networks in rural areas (OECD 2020). Creates pressure on digital infrastructure, reduces the availability of 4G mobile networks, and decreases downloading speed (Voutilainen <i>et al.</i> 2023). (2021)
Roads in need of repair (infrastructure)	Data presenting the condition of road surfaces are based on a yearly updated inventory. Data were manipulated by calculating the proportion of roads in need of repair (%) in a municipality.	Finnish Transport Infrastructure Agency	Leads to an increased volume of traffic (Scheiner 2020). Municipal street networks and private roads especially suffer from maintenance backlog and are in urgent need of renovation investment (Finnish Transport Infrastructure Agency 2023a). Improves the maintenance of road networks and increases the need for maintenance (Adamiak <i>et al.</i> 2015; Vepsäläinen <i>et al.</i> 2017; Rehunen <i>et al.</i> 2022). (2011–2018)
Cost estimates of road construction plans (infrastructure)	The sum of cost estimates of road construction plans between 2002 and 2022. The data were manipulated by directing the cost estimates to the municipalities where the constructions were located.	Finnish Transport Infrastructure Agency	Improves the maintenance of road networks (Adamiak <i>et al.</i> 2015; Vepsäläinen <i>et al.</i> 2015; Rehunen <i>et al.</i> 2022). Roads are built and adjusted to the continuous increase in summer traffic (Larsson & Müller 2019). (2002–2022)
Net costs of traffic lanes (infrastructure)	Net costs of the maintenance of traffic lanes (€/resident).	The Association of Finnish Local and Regional Authorities	Increases the expenses of road maintenance (Adamiak <i>et al.</i> 2015; Vepsäläinen <i>et al.</i> 2015). (2019–2021)
Net costs of community infrastructure (infrastructure)	Net costs of the maintenance of traffic lanes (€/resident). Includes community planning, construction supervision, fire and rescue services, maintenance of the environment, traffic lanes, parks, and other common areas.	The Association of Finnish Local and Regional Authorities	Increases the need for controlled planning and land use management (Hiltunen 2007; Larsson & Müller 2019) and has some effect on the cleanliness of the environment and water system management (Czarnecki & Sireni 2018). (2019–2021)

Net costs of fire and rescue services (services)	Net costs of the fire and rescue services (€/resident).	The Association of Finnish Local and Regional Authorities	Has a minor effect on the security of the area (Czarnecki & Sireni 2018). Has only a little effect on fire and rescue services (Larsson & Müller 2019). (2019–2021)
Net costs of cultural activities (services)	Net costs of cultural activities (€/resident). Includes library services, museums and exhibitions, and activities related to theatre, music, dance, etc.	The Association of Finnish Local and Regional Authorities	Has a positive effect on cultural offerings of the municipality (Czarnecki & Sireni 2018). (2019–2021)
Net costs of sporting and outdoor activities (services)	Net costs of sporting and outdoor activities (€/resident). Includes construction and maintenance of sporting and outdoor facilities, arrangement of exercise guidance, support for civic activity related to sports and exercise, etc.	The Association of Finnish Local and Regional Authorities	Increases the demand for activities (Adamiak 2017) and has a positive effect on recreational and tourism services (Czarnecki & Sireni 2018). (2019–2021)
Average distances to swimming places and campsites (services)	Average distances to nearest maintained swimming place and nearest campsite from population grids located in the municipality.	University of Jyväskylä, LIPAS database	Improves the accessibility of recreational sites (Rehunen <i>et al.</i> 2022). (2022)
Average distances to grocery shops (services)	Average distances were calculated from population grids to the nearest shop located in the same municipality and to three shops located in rural areas.	Finnish Environment Institute, Liiteri database	Contributes to the survival and profitability of local shops (Müller 1999; Larsson & Müller 2019) and supports the accessibility and supply of services for the permanent population (Farstad 2011; Voutilainen <i>et al.</i> 2021a; Voutilainen <i>et al.</i> 2021b; Rehunen <i>et al.</i> 2022). Considered to diversify service provision of municipalities (Saukkonen & Majoinen 2022). (2020)
Average distance to three grocery shops located in rural areas (m) 2020	Average distances were calculated from population grids to the three nearest grocery shops located in rural areas (without regard to municipality borders).	Finnish Environment Institute, Liiteri database	

Average distances to department store (services)	Average distance to nearest department store located in rural areas from population grids. A department store is defined as a shop whose sales share of food items is less than 50%.	Finnish Environment Institute, Liiteri database	Supports accessibility and supply of services (Farstad 2011; Voutilainen <i>et al.</i> 2021a; Voutilainen <i>et al.</i> 2021b; Rehunen <i>et al.</i> 2022) and is considered to diversify service provision of municipalities (Saukkonen & Majoinen, 2022). (2020)
Grocery shops in the municipality /1,000 residents, 2020	Number of grocery shops relative to the population of the municipality.	Finnish Environment Institute, Liiteri database	
Average prices of second homes (housing markets)	Average realised total prices of built properties registered as second homes.	National land survey of Finland	Increases the prices of second homes (Back <i>et al.</i> 2022). (2017–2021)
Property prices (housing markets)	Average actual prices (€/m ²) of properties for permanent housing registered as permanent residents.	Reaktor Oy	
Average marketing time (housing markets)	Average marketing time (d) of properties for permanent housing and second homes	Etuovi.com	Increases property prices (Brida <i>et al.</i> 2011; Adamiak <i>et al.</i> 2015). Increases the prices of former primary residences acquired for secondary use (Back <i>et al.</i> 2022). (2015–2020)
Housing market dynamics (housing markets)	Number of properties for permanent housing for sale on Etuovi.com relative to the municipality's housing stock (%)	Etuovi.com	
Asking price (housing markets)	Asking price of properties for permanent housing and second homes (€/m ²)	Etuovi.com	
Construction year (housing markets)	Construction year of properties for permanent housing and second homes	Etuovi.com	

Appendix 2. Variables used in the matching.

1. **Population living in a high-density area:** The share (%) of the population living in a high-density area. A high-density area is defined as a group of buildings with more than 200 residents where the distance between buildings is no greater than 200 meters. Data source: Population structure, Statistics Finland. Year: 2021.
2. **Population change:** The change in population as a percentage (%) during the previous year. Data source: Population structure, Statistics Finland. Year: 2021.
3. **The share of foreigners:** The share of the population whose nationality is other than Finnish as a percentage (%) of all inhabitants. Data source: Population structure, Statistics Finland. Year: 2021.
4. **Population over 65 years old:** The share of the population aged over 65 years as a percentage (%) of all inhabitants. Data source: Population structure, Statistics Finland. Year: 2021.
5. **Population living in rental apartments:** The share of housing units living in rental apartments as a percentage (%) of all housing units. Data source: Dwellings and housing conditions, Statistics Finland. Year: 2021.
6. **Employment rate:** The share of the population aged 18–64 years employed as a percentage (%) of all inhabitants aged 18–64 years. Data source: Employment, Statistics Finland. Year: 2021.
7. **Jobs in processing work:** The share of jobs in processing work as a percentage (%) of all jobs. Data source: Employment, Statistics Finland. Year: 2020.
8. **Jobs in service work:** The share of jobs in service work as a percentage (%) of all jobs. Data source: Employment, Statistics Finland. Year: 2020.
9. **Distance to the nearest large city:** Distance (km) to the closest city with a population of over 200,000. Data source: Open geographic data, Statistics Finland. Year: 2022.