Social Inclusion
2026 • Volume 14 • Article 11543
https://doi.org/10.17645/si.11543

cogitatio

ARTICLE

Open Access Journal

Twin Transition Attitudes and Regional Left-Behindness: Unpacking the Drivers of Interregional Migration Intentions

Anastasia Panori [1], Elli Papastergiou [1], Tuomas Väisänen [2,3], Milad Malekzadeh [2,3], and Olle Järv [2,4]

[1] School of Spatial Planning and Development, Aristotle University of Thessaloniki, Greece
[2] Department of Geosciences and Geography, University of Helsinki, Finland
[3] Helsinki Institute of Urban and Regional Studies (Urbaria), University of Helsinki, Finland
[4] Department of Geography, University of Tartu, Estonia

Correspondence: Anastasia Panori (apanori@plandevel.auth.gr)

Submitted: 16 October 2025 **Accepted:** 28 January 2026 **Published:** 25 February 2026

Issue: This article is part of the issue "Digital Transition and New Forms of Spatial Inequality" edited by Tiit Tammaru (University of Tartu), Kadi Kalm (University of Tartu), and Rūta Ubarevičienė (Lithuanian Centre for Social Sciences), fully open access at https://doi.org/10.17645/si.i468

Abstract

This article investigates how individual attitudes toward the green and digital transitions, collectively referred to as the twin transition, and expressions of regional left-behindness shape EU interregional migration intentions across different life domains. The study disaggregates migration intentions by motive, work, education, quality of life, and retirement, to better understand the interplay between personal values and regional structural conditions. The findings reveal that while traditional socio-demographic characteristics remain strong predictors of work-related migration intentions, green and digital attitudes significantly influence relocation intentions for education and quality-of-life reasons. Notably, individuals with strong green values are more likely to express intentions to move for quality-of-life reasons. Rural areas, in this case, are aligned with ecological lifestyles, whereas digital attitudes correlate with urban settlement preferences and, for retirees, confidence in relocating to digitally connected rural regions. Expressions of regional left-behindness, such as economic decline, demographic ageing, and weak connectivity, act as structural push factors that differentially affect migration intentions. The analysis suggests that twin transition values function as behavioural primers which, combined with structural push or pull factors, guide individual intentions and reveal how unequal capacities to adapt to digital and green transitions shape migration intentions.

Keywords

digital transformation; green transition; left-behind areas; migration; twin transition

1. Introduction

The green and digital transformations, collectively known as the "twin transition," are rapidly reshaping Europe's economic and social landscapes in ways that are both transformative and uneven (International Labour Organization, 2018; World Economic Forum, 2025). While these shifts promise new opportunities in innovation, sustainability, and employment, they also present considerable challenges for regions already facing structural disadvantages, economic stagnation, and demographic decline (OECD, 2021). In this changing landscape, migration emerges as both a response to and a driver of regional inequalities. Even though it allows individuals to seek better opportunities, it could also accelerate the marginalisation of left-behind regions by depleting them of skilled labour.

Moreover, the twin transition shapes policy priorities and plays a growing role in defining regional attractiveness (Angelidou et al., 2022; Komninos et al., 2023). Twin transition policies aimed at decarbonisation and digital innovation offer new pathways for left-behind regions to reposition themselves as viable destinations for mobile populations, through investments in digital infrastructure, environmental quality, and smart services (García Fernández & Peek, 2023; Gómez-Carmona et al., 2023). Regions with strong embeddedness in the twin transition, characterised by access to natural amenities, low exposure to environmental stressors, and high digital connectivity, are increasingly attractive not only to remote workers but also to other mobile groups such as students, families, and retirees (OECD, 2023). This highlights the mix of economic, social, and environmental factors intersecting with life-course dynamics and driving migration decisions.

In this context, the study aims to address two interrelated questions at the intersection of migration and structural transformation in Europe. First, it explores how individual attitudes toward the green and digital transitions shape intentions to migrate across EU regions. As labour markets and regional futures are being reconfigured at an unprecedented pace, personal perceptions of opportunity, risk, and inclusion may play a pivotal role in shaping interregional migration choices. Second, it investigates how different dimensions of left-behindness, including economic stagnation, limited accessibility to services and amenities, and high levels of poverty, affect interregional migration intentions across a range of motives, such as work, education, quality-of-life, and retirement. Together, these questions aim to unpack the complex and uneven ways in which structural change interacts with personal agency and place-based disadvantage.

The remainder of this article is as follows. Section 2 develops the theoretical framework connecting our key terms: green and digital transition, left-behind areas, and migration, and how they link to each other. Section 3 presents the data and the methodological issues followed in the empirical analysis, whereas Section 4 illustrates the key findings. Finally, Sections 5 and 6 discuss our findings in relation to previous studies and highlight their policy relevance, as well as potential limitations and future research.

2. Background

2.1. Green and Digital Transitions and Changing Patterns of Migration

Migration is frequently conceptualised as an investment in utility maximisation, typically captured through income gains (Ivlevs, 2015). Economic drivers such as wage disparities, GDP per capita, price levels, and job

opportunities are central in this perspective (Albert & Monras, 2017; Borjas, 2001). Beyond these drivers, individual characteristics have long been central to theoretical accounts of migration, with factors such as gender, age, education, and family status identified as important determinants of mobility, alongside broader economic conditions (Boterman & Bridge, 2023; Faggian et al., 2007; Fratesi, 2014; Lu et al., 2025).

However, recent findings show that the influence of economic factors diminishes once certain thresholds are reached, pointing to the limits of purely economic explanations (Suppa et al., 2023). Attention has therefore shifted to non-economic factors. Local amenities, including education, healthcare, transport, and lifestyle options, are shown to strongly shape relocation choices (Faggian & Royuela, 2010; Florida, 2003; Glaeser et al., 2001). Environmental conditions, such as climate, air quality, or exposure to extreme weather events, also act as decisive push or pull factors (Beine & Parsons, 2015; Chi & Marcouiller, 2013). Moreover, subjective well-being (SWB) is increasingly recognised as a driver of migration, with individuals relocating in pursuit of life satisfaction as much as income, reflecting lifestyle preferences, quality-of-life expectations, or perceived social fairness (Ivlevs, 2015; Otrachshenko & Popova, 2012).

The expanded differential urbanisation model (Geyer & Kontuly, 1993) integrates these insights by distinguishing between productionist motives, driving less affluent groups toward large cities for economic opportunities, and environmentalist motives, leading more affluent groups toward smaller towns or rural areas in pursuit of higher living standards. While this framework captures key dynamics, contemporary challenges, such as rising housing costs in metropolitan centres, complicate these patterns, often displacing lower-income or younger groups (Rodríguez, 2024; Sarkar, 2018). Nonetheless, this dual lens remains useful for analysing how ongoing structural changes, including the twin transition, intersect with individual characteristics and contextual factors to reshape migration decisions.

The green transition is reconfiguring both economic structures and spatial dynamics across Europe. Policies such as the European Green Deal aim to decarbonise entire sectors, shift consumption and production systems, and reshape labour markets (European Commission, 2020). These transformations are likely to generate new migration flows, as opportunities in green innovation and clean industries attract skilled workers to dynamic regions. At the same time, the decline of carbon-intensive sectors risks displacing workers in "brown" industries, intensifying outward migration from structurally weaker areas (Shapiro & Metcalf, 2023). Whether the green transition results in net job creation or destruction remains contested (Botta, 2019), but its uneven impacts may deepen territorial divides and exacerbate regional inequalities unless mitigated by proactive policy frameworks (Rodríguez-Pose & Bartalucci, 2024).

In parallel, the digital transition is also reshaping the geography of work and migration. On one side, emerging technologies are reinforcing the concentration of highly skilled labour in innovation hubs, further strengthening already dynamic regions (Akerman et al., 2015; Kerr et al., 2016). On the other hand, digitalisation is loosening the traditional link between residence and workplace, enabling remote work, digital nomadism, and multilocal lifestyles (Foth et al., 2016; Hannonen et al., 2024). These developments function as both push and pull factors: While digital assets and vibrant ecosystems help regions retain and attract populations, lagging areas risk entrenchment in disadvantage through widening digital divides and reduced competitiveness (Lythreatis et al., 2022; Matli & Wamba, 2023). In this sense, the twin transition functions as a powerful filter, enabling some regions to thrive while exposing others to new forms of left-behindness.

2.2. Connecting Green and Digital Transitions to the Different Types of Left-Behindness

Although the twin transition is expected to amplify new and old forms of migration, access to the opportunities driving these shifts remains highly uneven across regions. In left-behind areas, migration is shaped not only by individual aspirations or policy incentives but also by deep-rooted structural constraints and regional conditions (Fiorentino et al., 2024; Velthuis et al., 2025), extending beyond economic stagnation to social, political, environmental, and cultural dimensions, forming a complex web of factors (Pike et al., 2024). Such multi-level left-behindness significantly influences intention to relocate, positioning it as a critical intermediary between the twin transition and patterns of migration.

The term "left-behind" reflects a lack of capacity to adapt to and benefit from major transition processes, such as economic restructuring or shifts in dominant growth models (MacKinnon et al., 2022; Velthuis et al., 2023). Left-behind regions often struggle to remain competitive, with local characteristics, such as industrial path-dependence, infrastructure, and institutional capacity, playing a critical role in shaping their ability to retain and attract residents (Velthuis et al., 2023). Patterns of depopulation in such areas are frequently rooted in historical processes such as deindustrialisation, suburbanisation, and demographic ageing, which continue to exert long-term effects on local development trajectories (Franklin, 2021). Empirical evidence suggests that different dimensions of left-behindness have distinct effects on population decline and migration intentions, highlighting the need to understand migration as a place-contingent response to multi-scalar disadvantage (Karp et al., 2022).

Connecting the two concepts is critical. First, the green transition is expected to generate indirect spatial effects by increasing factor mobility and redistributing economic and social assets (Rodríguez-Pose & Bartalucci, 2024). This runs the risk of concentrating innovation, employment, and technological investment in already prosperous regions equipped with the skills, infrastructure, and institutional readiness to absorb green growth, while leaving left-behind regions struggling to capitalise on these opportunities. The resulting outmigration of skilled workers, driven by mismatches in local labour markets and the absence of green-sector opportunities, can further reinforce regional disparities and amplify political discontent in areas already feeling excluded from transition-related benefits (Fratesi & Rodríguez-Pose, 2016). At the same time, the environmental benefits of certain declining or rural regions, such as proximity to nature, lower pollution, along with lower cost of living, may also attract eco-migrants or retirees seeking sustainable lifestyles, showing that left-behindness can create selective forms of attractiveness alongside exclusion (Curry et al., 2001; Steinführer et al., 2024).

Similarly, the digital transition is double-edged. While the digitalisation of services, including e-health and e-governance, has the potential to enhance access and improve quality of life in remote or underserved areas (Salemink et al., 2017), the benefits are not always accessible. Rural communities often lack the necessary digital infrastructure, skills, or trust to fully engage with dematerialised services (Löfving et al., 2022). This limits their capacity to leverage digital technologies for development, thereby reinforcing left-behindness and migration outflows. However, demographic decline and low density in such areas can also open "opportunity spaces" for digitally empowered newcomers, including remote workers, returnees, and lifestyle migrants. These groups can act as agents of revitalisation by supporting local services, reusing housing stock, and contributing new forms of social capital (Tietjen & Jørgensen, 2016). These positive effects are not automatic and depend on local receptiveness, which can provide conditions for new inflows reshaping local trajectories.

3. Data and Methodology

Our study combines a novel dataset created in the context of a recent Horizon Europe project (MOBI-TWIN) focusing on examining changing patterns of interregional migration triggered by the twin transition, considering life satisfaction and individual characteristics, as well as a set of secondary data sources to introduce the regional dimension and the focus on left-behind areas (Väisänen et al., 2024; Velthuis et al., 2023). A schematic representation of the connection between these elements is given in Figure 1.

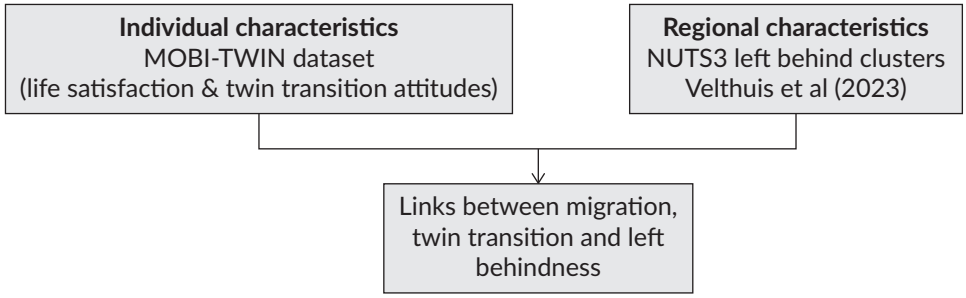

Figure 1. Combined data sources for investigating the links between interregional migration intentions, twin transition, and left-behindness.

The MOBI-TWIN dataset was developed using a quantitative research design, incorporating survey methods and stakeholder engagement (Väisänen et al., 2024), to examine interregional migration intentions at the NUTS3 level. The survey assessed citizens' intentions in relation to various life events, forms of migration, regional attractiveness factors, and determinants of (im)mobility. It predominantly comprised closed-ended questions, offering response options including multiple-choice items and Likert scale questions. Data collection was conducted online between November and December 2023, yielding an initial 11,622 responses. The process was facilitated through the SurveyMonkey platform, employing a non-random quota sampling approach to ensure the fulfilment of predetermined quotas at both EU and country levels. Data were collected through two channels, Dynata and the Prolific platform, with measures in place to ensure no duplication in the final sample. Dynata targeted specific demographic quotas within each country, while the Prolific platform was leveraged to access a broader participant pool and expedite data collection. Quotas were established for age, gender, and education, with adjustments made to ensure demographic balance across countries. After data cleaning and geocoding survey responses with the open-source geocoder Photon (Komoot, 2024), which assigned NUTS3 regional codes to respondents, the final dataset used in this study comprises 6,861 fully completed and valid responses reflecting individuals reporting high or very high migration intentions and covering 12 EU member states (Austria, Belgium, Germany, Denmark, Greece, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal). Due to limited data availability for the left-behind clusters, the analysis was restricted to these 12 countries. Post-stratification weighting has been applied to improve the reliability of statistical inferences drawn from a quota sample by aligning the sample distribution with known population characteristics.

Next, the left-behind regional clusters developed by Velthuis et al. (2023) were employed to categorise NUTS3 EU regions based on the degree and nature of left-behindness. This methodology incorporates a comprehensive set of variables to capture various dimensions of left-behindness, encompassing economic, demographic, social, and accessibility factors. By assessing regions across these dimensions, Velthuis et al.

(2023) developed a composite index at the NUTS3 level to classify them. This enabled us to identify distinct groups of regions based on shared left-behindness characteristics, providing deeper insights into the spatial distribution and heterogeneity of regional disparities within the EU.

The key dependent variable in our analysis (MIGR_INT) captures migration intentions among respondents who reported a high or very high likelihood of moving to another EU region. First, respondents indicated the probability of changing their place of residence on a five-point scale (where 1 = *very low* and 5 = *very high*). From the full sample of 6,861 individuals reporting high or very high migration intentions, we identify the main relocation motive and estimate separate models for each motive-specific group. In these models, the dependent variable is coded as a binary indicator where 1 represents individuals whose primary motive corresponds to the one examined in that model, and 0 otherwise. For example, in the model examining work-related migration intentions, the dependent variable equals 1 for the 1,267 respondents who selected work as their main reason, and 0 for the remaining respondents in the high-intention sample. This approach enables comparison of how socio-demographic characteristics, subjective factors, twin-transition attitudes, and regional conditions differentiate types of high migration intentions, rather than predicting whether individuals intend to migrate at all.

As the objective is not to estimate the probability of migration itself but to examine how individual and regional characteristics differentiate between motives among high-intention respondents, a multilevel linear regression model (MLM) provides an appropriate and transparent analytical framework. The MLM specification accommodates the hierarchical structure of the data, individuals nested within regions, allowing control for unobserved regional heterogeneity while estimating individual-level effects.

For the empirical analysis, we estimate the following specification using an MLM linear regression model:

$$\begin{aligned}\text{MIGR\_ INT}_{ij} = a + b_1\text{DEM}_i + b_2\text{LIFESAT}_i + b_3\text{PREV\_ EXP}_i + b_4\text{PREFS}_i + b_5\text{TIMING}_i \\ + b_6\text{TT\_ ATTITUDE}_i + b_7\text{LEFTBEHIND}_j + \varepsilon_{i,j}\end{aligned}$$

Where i represents each individual ($i = 1,\ldots,N$); j denotes the NUTS3 region of residence for each individual; DEM_i accounts for various demographic attributes, namely age, gender, educational attainment, and whether the individual has children; LIFESAT_i represents the level of life satisfaction for individual i; PREV_ EXP_i indicates whether the individual has experienced short- or long-term migration within the past five years; PREFS_i captures individual preferences regarding the timing of movement and the type of area they wish to relocate to; TIMING_i refers to their intention to move in the short- or long-run; and TT_ ATTITUDE_i reflects each individual's attitudes toward aspects related to the twin transition, both green and digital. To incorporate an MLM perspective in our analysis, we include LEFTBEHIND_{ij}, which characterises the predominant type of left-behindness in the NUTS3 region j where individual i resides. The model also includes an error term ε and a constant α. We estimated our MLM model using an ordinal least squares (OLS) regression.

Table 1 summarises the rationale for selecting the independent variables used in the empirical analysis. Detailed descriptions and data sources for each variable are provided in Table A1 in the Supplementary File. Starting with individual demographic characteristics, first, we aim to control for the effect of gender. The gender dimension has been very often highlighted as a significant factor for triggering migration variations (Faggian et al., 2007). Specifically, gender disparities within the labour market, characterised by

wage gaps, occupational segregation, and uneven access to economic opportunities, can directly shape an individual's migration choices. Women often face limitations in economic empowerment, which may prompt them to seek better prospects in other regions. In some cases, women's migration between regions is driven by the pursuit of employment opportunities that align with their skills and aspirations. However, women can also face unique challenges, such as the need to balance career aspirations with caregiving responsibilities, which can affect their willingness and ability to migrate (Palchykov et al., 2013). Second, age is a critical factor affecting migration outcomes, often indicating a U-shaped relationship with increased migration typically higher in younger and older ages and lower in middle age (Lu et al., 2025). Third, educational level is included in our model as a significant aspect of migration. Evidence suggests that a higher educational level is linked with increased probability of migration (Fratesi, 2014). This can be supported by neoclassical theory, which posits that tertiary education typically provides individuals with specialized knowledge, critical thinking abilities, and advanced skills valued in the job market, opening doors to higher-paying jobs, career advancement opportunities, and greater social mobility; consequently, highly skilled individuals who invest more in education also seek higher returns through their wages, thereby increasing the likelihood of migrating to places with higher average salaries (Faggian et al., 2019). Finally, family status in relation to having children or not offers an additional individual characteristic included in our analysis, as parenthood increases the importance of quality-of-life factors when considering migration decisions (Boterman & Bridge, 2023).

Table 1. Summary of the determinants of migration intentions used for the empirical analysis.

Variable name	Expected impact	References
Individual characteristics		
Gender (FEMALE)	Gender differences may influence migration intentions; women may exhibit distinct migration patterns driven by labour-market disparities, caregiving roles, and opportunity structures. Direction may vary depending on context.	Faggian et al. (2007); Palchykov et al. (2013).
Age (AGE/AGE^2)	Non-linear (U-shaped) effect: Higher likelihood of migration at younger and older ages, lower in middle age.	Lu et al., (2025).
Educational level (EDU_TER)	Positive effect: Higher education increases migration probability due to higher expected returns, skill-matching opportunities, and mobility-enabling resources.	Faggian et al. (2019); Fratesi (2014).
Family status (CHILDREN)	Having children may reduce migration intentions due to increased place-dependence, though quality-of-life considerations may also drive selective relocation.	Boterman and Bridge (2023).
Subjective factors		
Life satisfaction (LIFESAT)	Lower life satisfaction increases likelihood of considering migration, acting as a push factor.	Stawarz et al. (2022).
Previous experience (PREV_EXP)	Positive effect: Prior migration experience lowers barriers and increases probability of future mobility.	Gubert and Senne (2016); Williams et al. (2018).
Preferences (PREFS_X)	Preferences for specific destination types (urban/rural) influence long-term migration intentions; alignment between preferences and perceived regional attributes increases likelihood of relocation.	Berry and Glaeser (2005); Venables (2006).
Time horizon (TIMING_X)	Migration likelihood varies across temporal horizons; intentions generally strengthen over longer planning periods.	

Table 1. (Cont.) Summary of the determinants of migration intentions used for the empirical analysis.

Variable name	Expected impact	References
Twin transition attitudes		
Digital attitudes (DIGITAL_ATT)	Mixed but systematic effect: Positive attitudes towards digitalisation may increase migration intentions toward digitally advanced regions, while individuals perceiving digital divides or lagging digital environments may be more likely to leave less competitive regions. Digitalisation also enables remote work and multilocal lifestyles, loosening the constraint of physical proximity to workplaces.	Akerman et al. (2015); Foth et al. (2016); Hannonen et al. (2024); Kerr et al. (2016); Lythreatis et al. (2022); Matli and Wamba (2023).
Green attitudes (GREEN_ATT)	Positive effect: Stronger pro-environmental attitudes increase the likelihood of migrating to greener, more sustainable regions, particularly those progressing faster in the green transition. Conversely, lack of green infrastructure may push individuals away from lagging regions.	Connor et al. (2024).
Regional characteristics		
Regional left-behindness (LEFT_BEHIND_X)	Higher levels of left-behindness in origin regions expected to increase migration intentions (push effect); effects vary across types of left-behindness.	Connor et al. (2024); Fiorentino et al. (2024); Velthuis et al. (2023).

Beyond individual characteristics, we include a range of other factors such as life satisfaction, prior migration experience, preferences regarding the type of destination (urban or rural), and intentions to move in the short or long term. Literature identifies life satisfaction as a potential driver of migration decisions, suggesting that lower levels may prompt individuals to relocate in search of better living conditions (Stawarz et al., 2022; Waibel, 2019). Previous experience seems to be a critical factor for increasing the opportunity to migrate (Gubert & Senne, 2016; Williams et al., 2018), whilst individual preferences for different residential settings, such as urban or rural areas, may act as triggers for long-term movements (Berry & Glaeser, 2005; Venables, 2006).

Finally, our model incorporates a range of regional characteristics indicating the type of left-behindness prevalent in each region, as measured by Velthuis et al. (2023). While studies have begun to explore how different forms of left-behindness influence migration decisions (Connor et al., 2024; Fiorentino et al., 2024), this dimension remains underexamined in the literature. Incorporating these variables, our model seeks to address this gap and contribute to a deeper understanding of the central research question of this article.

Table 2 presents the main descriptive statistics of the independent variables, whilst Figure 2 presents the matrix of raw correlation coefficients among all variables included in the empirical model. The figure illustrates the extent to which multicollinearity may be a concern and demonstrates the relative independence of the explanatory factors. The correlations across most variables are low, indicating that the included predictors capture distinct dimensions of individual characteristics, attitudes, and regional contexts. Regarding regional context, we operationalise left-behindness using the categorical LEFT_BEHIND indicator and select LEFT_BEHIND_3, representing regions with relative economic and demographic stability, as the reference category.

Table 2. Descriptive statistics of the independent variables (6,861 observations).

Variable	Min	Median	Mean	Max	*SD*
FEMALE	0.00	1.00	0.51	1.00	0.50
AGE	18.00	34.00	37.27	81.00	13.84
AGE^2	324.00	1,156.00	1,580.00	6,561.00	1,204.20
EDU_TER	0.00	0.00	0.28	1.00	0.45
CHILDREN	0.00	0.00	0.24	1.00	0.42
LIFESAT	1.00	7.00	6.61	10.00	1.90
PREV_EXP	0.00	0.00	0.29	1.00	0.45
PREFS_U	0.00	0.00	0.45	1.00	0.50
PREFS_R	0.00	0.00	0.27	1.00	0.45
INT_MOVE_LONG	0.00	0.00	0.38	1.00	0.48
INT_MOVE_SHORT	0.00	0.00	0.08	1.00	0.27
DIGITAL_ATT	1.00	3.50	3.48	5.00	0.84
GREEN_ATT	1.00	4.09	4.04	5.00	0.66
LEFT_BEHIND_1	0.00	0.00	0.05	1.00	0.23
LEFT_BEHIND_2	0.00	0.00	0.19	1.00	0.39
LEFT_BEHIND_3	0.00	0.00	0.20	1.00	0.40
LEFT_BEHIND_4	0.00	0.00	0.30	1.00	0.46
LEFT_BEHIND_5	0.00	0.00	0.11	1.00	0.31
LEFT_BEHIND_6	0.00	0.00	0.15	1.00	0.36

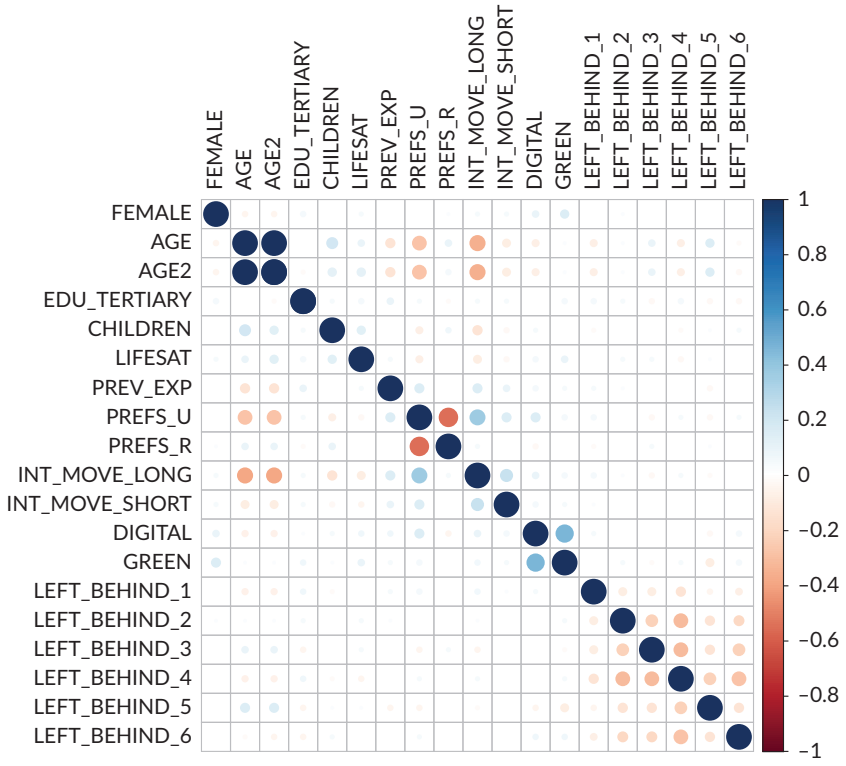

Figure 2. Correlation matrix of independent variables.

4. Results

Our models reveal how different factors influence interregional migration intentions across four distinct motives, namely work, study, quality of life, and retirement (Table 3). Starting with work-related migration intentions, findings indicate that these are shaped more by individual socio-demographic characteristics and regional disadvantage rather than attitudes toward the twin transition. Specifically, younger and high-skilled individuals are significantly more likely to express an intention to move for employment-related reasons. Past migration experience is also positively associated with this motive. Satisfaction with life emerges as a key predictor, as individuals reporting low scores are considerably more inclined to express intention to move in pursuit of work opportunities. Gender differences are also evident, with women less likely than men to migrate for employment, possibly reflecting unequal caregiving responsibilities or structural labour market barriers. In geographical terms, intended destinations are predominantly urban areas, while rural regions are less frequently considered, underscoring persistent urban–rural disparities in perceived employment opportunities. Respondents intending to migrate for work are also more likely to report a desire to move within shorter time horizons, suggesting greater urgency. Interestingly, attitudes toward green and digital transitions do not significantly influence work-related interregional migration intentions. Despite their centrality in current policy discourse, they appear to play a limited role in shaping relevant decisions, at least at the attitudinal level. However, regional context matters. Using the above-described regional clusters (numbering follows Velthuis et al., 2023, for consistency), individuals located in areas characterised by economic stagnation and disconnection (Cluster 6) show a higher propensity to migrate for work, indicating that perceived "left-behindness" acts as a strong push factor. On the contrary, those in regions associated with long-term economic prosperity (Cluster 1) or high-growth trajectories (Cluster 2) exhibit a higher degree of immobility.

Second, results suggest that education-related migration intentions are strongly shaped by age and regional context. As expected, younger individuals, particularly students, show the highest likelihood of intending to migrate. These intentions are typically directed toward urban areas, where higher education institutions are concentrated, reinforcing the established urban-centric geography of educational opportunity. Twin transition factors reveal interesting contrasts. While digital transition attitudes do not significantly influence the intention to migrate to another region for study, stronger green transition attitudes are associated with higher migration intentions. Regional characteristics also play a crucial role. Individuals residing in economically prosperous areas (Cluster 1) exhibit a higher likelihood of study-related migration intentions. In contrast, those from regions facing economic decline and de-industrialisation (Cluster 4) demonstrate a negative correlation with education-related migration intentions.

Third, migration intentions motivated by quality-of-life considerations tend to be more prevalent among older individuals and families, reflecting life-course stages where environmental, lifestyle, and well-being factors become more central. Respondents who report low satisfaction with their current living conditions are significantly more likely to express a desire to relocate for quality-of-life reasons, highlighting a strong push factor. Unlike work- or study-related migration, quality-of-life migration is predominantly directed toward rural areas, with urban destinations less commonly cited. This pattern reflects stated destination orientations rather than realised migration flows and suggests a growing preference for quieter, less congested environments that may offer cleaner air, access to nature, and improved conditions for family life or retirement. Importantly, this type of migration is typically framed as a long-term intention, reflecting

gradual decision-making processes often tied to major life changes or future planning. Attitudes toward the twin transition are differentially associated with this motive. Stronger green transition attitudes correlate positively, suggesting that individuals who value environmental sustainability seek regions that align with their lifestyle and ecological preferences. In contrast, stronger digital transition attitudes are linked to a lower probability of intentions to move for quality-of-life reasons, indicating a preference among digitally oriented individuals to remain in areas with robust technological infrastructure, which are often, though not exclusively, urban. Regarding regional characteristics, residents of economically prosperous (Cluster 1) and high-growth regions (Cluster 2) exhibit higher migration intentions, reflecting a capacity to convert resources into lifestyle changes. Meanwhile, those living in regions facing demographic decline and ageing (Cluster 5) are more likely to remain immobile, indicating a possible strong attachment to their place.

Finally, retirement-related interregional migration intentions are observed, as expected, among older individuals whose children are over 18, indicating a life stage with reduced caregiving responsibilities and greater residential flexibility. These intentions are oriented towards rural areas, with urban destinations less frequently mentioned, reflecting preferences for quieter, more natural environments that may offer a slower pace of life and lower cost of living. Unlike other forms, in the case of retirement-related interregional movements previous migration experience is negatively associated with retirement-related movement, suggesting that those who have relocated earlier in life may prefer to settle down rather than move again in later years. Twin transition attitudes present a notable contrast with other migration intention motives. Higher digital transition attitudes are positively associated with retirement-related migration intentions, which reflect a growing segment of digitally literate retirees who feel empowered by connectivity and digital services to relocate to less urbanised areas without sacrificing access to information or essential services. In terms of regional dynamics, residents of high-growth regions (Cluster 2) are less likely to express intentions to move for retirement, likely due to the continued availability of services, infrastructure, and supportive environments that meet their needs. In contrast, individuals in regions experiencing demographic decline and ageing (Cluster 5) are more likely to express retirement-related migration intentions.

Table 3. Factors influencing permanent migration based on the four estimated models.

Dependent variable: Intention to migrate (REASON)	(1) Reason: Work		(2) Reason: Study		(3) Reason: Quality of life		(4) Reason: Retirement	
Individual characteristics								
FEMALE	−0.028	***	0.001		0.005		−0.007	
	(0.007)		(0.004)		(0.009)		(0.006)	
AGE	−0.005	***	−0.015	***	0.004	***	0.009	***
	(0.002)		(0.001)		(0.002)		(0.001)	
AGE^2	0.000		0.001	***	0.001	***	0.001	***
	(0.001)		(0.001)		(0.001)		(0.001)	
EDU_TERTIARY	0.056	***	−0.011	**	−0.010		0.001	
	(0.008)		(0.005)		(0.010)		(0.006)	
CHILDREN	0.002		0.002		0.042	***	−0.029	***
	(0.009)		(0.005)		(0.011)		(0.007)	

Table 3. (Cont.) Factors influencing permanent migration based on the four estimated models.

Dependent variable: Intention to migrate (REASON)	(1) Reason: Work		(2) Reason: Study		(3) Reason: Quality of life		(4) Reason: Retirement	
Subjective factors								
LIFESAT	−0.004	**	−0.001		−0.004	*	0.001	
	(0.002)		(0.001)		(0.002)		(0.002)	
PREV_EXP	0.040	***	−0.001		−0.004		−0.021	***
	(0.009)		(0.005)		(0.011)		(0.007)	
PREFS_U	0.158	***	0.027	***	0.199	***	0.103	***
	(0.010)		(0.005)		(0.012)		(0.008)	
PREFS_R	0.061	***	0.002		0.261	***	0.140	***
	(0.009)		(0.005)		(0.011)		(0.007)	
TIMING_LONG	0.029	***	0.010	*	0.088	***	−0.011	
	(0.010)		(0.005)		(0.012)		(0.008)	
TIMING_SHORT	0.044	***	0.008		−0.004		−0.012	
	(0.016)		(0.008)		(0.019)		(0.012)	
Twin transition attitudes								
DIGITAL_ATT	0.002		−0.004		−0.019	***	0.017	***
	(0.005)		(0.003)		(0.006)		(0.004)	
GREEN_ATT	−0.003		0.008	**	0.056	***	0.001	
	(0.006)		(0.003)		(0.007)		(0.005)	
Regional characteristics								
LEFT_BEHIND_1 Long-term economic prosperity	−0.041	***	0.024	***	0.052	***	−0.005	
	(0.014)		(0.008)		(0.017)		(0.011)	
LEFT_BEHIND_2 High growth	−0.023	**	0.002		0.043	***	−0.019	**
	(0.011)		(0.006)		(0.013)		(0.009)	
LEFT_BEHIND_4 Economic decline & deindustrialisation	−0.010		−0.011	*	−0.003		−0.010	
	(0.011)		(0.006)		(0.013)		(0.008)	
LEFT_BEHIND_5 Demographic decline and ageing	−0.003		0.003		−0.062	***	0.020	**
	(0.013)		(0.007)		(0.016)		(0.010)	
LEFT_BEHIND_6 Disconnected, high poverty	0.029	**	0.002		−0.015		−0.017	
	(0.014)		(0.008)		(0.017)		(0.011)	
Constant	0.250	***	0.350	***	−0.194	***	−0.331	***
	(0.042)		(0.023)		(0.051)		(0.033)	
Observations	6,861		6,861		6,861		6,861	
Adjusted-R^2	0.1373		0.0898		0.1360		0.1034	
AIC	5,596.22		−2,693.29		8,464.47		2,258.52	
BIC	5,732.89		−2,556.62		8,601.14		2,395.19	
Weights	YES		YES		YES		YES	
p-value	0.000		0.000		0.000		0.000	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; standard errors in parentheses.

5. Discussion

This study explores the possible role of the twin transition in spatial inequalities by examining how individual attitudes toward green and digital transformations, along with expressions of regional left-behindness, shape interregional migration intentions. Although the green and digital transitions are central to EU policy frameworks, such as the European Green Deal and the Digital Compass (García Fernández & Peek, 2023; Gómez-Carmona et al., 2023; Muench et al., 2022), there remains a significant gap in understanding how they shape individual decisions regarding relocation. Our results suggest that the influence of digital and green attitudes on individual migration intentions varies significantly depending on the reason behind the relocation intention, such as work, study, quality of life, or retirement.

When considering work-related migration intentions, the impact of green and digital attitudes is limited. Instead, traditional socio-demographic characteristics such as age, educational level, and prior migration experience remain the most robust predictors of work migration intentions, as suggested by previous research (Fratesi, 2014; Lu et al., 2025; Williams et al., 2018). While the twin transition may be structurally reshaping labour markets, individual-level intentions around work-related migration are not (yet) strongly influenced by personal attitudes toward it. Student long-term migration intentions present a different picture, as green attitudes indicate a positive link with the intention to relocate for educational purposes, consistent with findings that environmentally oriented values can shape educational choices (Golbazi et al., 2020).

When examining migration intentions related to quality of life, twin transition values carry greater explanatory weight. Individuals with strong green attitudes are more likely to express intentions to relocate for quality-of-life reasons. Rural areas may be perceived as offering environmentally attractive conditions and opportunities for sustainable living, but our results do not test an interaction between these factors. This finding resonates with emerging research on "green lifestyle migration" (Forde, 2020). Conversely, individuals with high digital attitudes tend to remain in their areas, mostly urban, where digital infrastructures and services are more robust. Finally, retirement migration intentions are positively and significantly linked to digital attitudes as well as rural areas. This relates to previous studies indicating that digital literacy, reflected in confidence navigating online services and maintaining remote connections, enables older individuals to consider rural living without fear of isolation (Ji, 2024; Nguyen et al., 2022).

Our findings also suggest that expressions of left-behindness, rooted in economic decline, deindustrialisation, demographic decline and ageing, lack of connectedness, and high poverty (Pike et al., 2024; Velthuis et al., 2023), function as structural push factors for migration intentions. Individuals residing in economically lagging regions are more likely to express intentions to migrate for work, reflecting the constraints and limited opportunities in economic and demographic "deserts" (Rodríguez-Pose, 2018). In contrast, those in economically dynamic regions are more inclined to stay, benefiting from place-based advantages such as service provision, cultural amenities, and employment access (Florida, 2003; Glaeser et al., 2001). Yet, these expressions of left-behindness affect different types of migration intentions unequally. While high economic stagnation, expressed through high poverty and lack of connectedness, prompts work-related migration intentions, it appears to suppress student migration, particularly in deindustrialising or declining areas. Migration intentions triggered by quality-of-life aspirations, in turn, are more prevalent among those living in prosperous regions who possess the resources and digital capacities to

act on lifestyle preferences. On the contrary, individuals in ageing and demographically shrinking regions tend to report lower migration intentions, pointing to deep-rooted place attachment, economic precarity, or limited digital access as potential constraints.

Taken together, these findings have important implications for regions experiencing stagnation, depopulation, or broader forms of left-behindness. The differentiated effects of green and digital attitudes on migration intentions suggest that the twin transition can either exacerbate or mitigate existing territorial divides, depending on how regions position themselves. Left-behind regions are unlikely to retain or attract populations solely by competing with dynamic regions on labour-market performance alone. Instead, targeted and place-specific strategies are required. Strengthening digital infrastructures can reduce perceived isolation, create remote-work opportunities, and expand e-services, enabling both working-age individuals and retirees to envision viable futures locally. Investing in environmental assets, sustainable mobility, and high-quality public places can appeal to individuals with strong green preferences, particularly those motivated by quality-of-life considerations. Such improvements can support a healthier and more livable environment, which, along with affordable housing policies, can encourage residents to stay and potential newcomers to settle. Place-specific strategies that incorporate the twin transition in ways that respond to local needs and leverage existing assets and social capital in left-behind regions hold the potential to, at least partially, counterbalance the economic and social imbalances in these regions, supporting quality of life and well-being. Notably, this approach can uphold the "freedom to stay" (Letta, 2024), enabling people to live and sustain a decent, high-quality livelihood in their communities.

6. Conclusions

This study contributes to a deeper understanding of how individual attitudes toward the green and digital transitions, alongside structural dimensions of regional left-behindness, shape interregional migration intentions across a range of motives. While socio-demographic factors remain central to explaining intentions to move for work or study, attitudes toward environmental and technological change increasingly influence quality-of-life- and retirement-related migration intentions, especially among individuals seeking alignment between personal values and living environments. The differentiated role of twin transition attitudes, more influential in lifestyle-oriented moves than economically driven ones, suggests that migration decisions are not solely practical but also deeply embedded in subjective values, aspirations, and perceived quality of life. At the same time, the study highlights the persistent influence of left-behindness in conditioning the intention to move. Economic stagnation, demographic decline, and disconnection from core services and infrastructures act as powerful push factors for some forms of migration, especially work-related.

However, several limitations should be acknowledged. First, the reliance on self-reported intentions rather than actual migration behaviour introduces uncertainty regarding the translation of stated preferences into action. Second, the attitudinal measures of green and digital transitions, while informative, may not fully capture the complexity or salience of these transitions in individual decision-making. Third, longitudinal data would be needed to trace how attitudes and conditions evolve alongside actual migration patterns. Finally, an additional limitation is that cross-country differences are not examined in detail, although national institutional settings, welfare regimes, and labour-market structures may influence both the formation of left-behind clusters and the mechanisms linking attitudes to mobility intentions.

Future research should build on these findings by addressing both methodological and conceptual gaps. Migration reflects not only individual aspirations but also structural asymmetries between regions with differing capacities to adapt to transitions. Understanding how these asymmetries shape the geography of opportunity will be crucial for anticipating future inequality trends. Moreover, new forms of mobility beyond permanent migration, such as circular, temporary, or hybrid movements, are likely to play an increasingly important role in regional attractiveness and should be systematically examined. Finally, extending the analysis beyond Europe could offer comparative insights into how different institutional settings influence the co-evolution of migration and the twin transition on a global scale.

Acknowledgments

The authors would like to thank the anonymous reviewers for their careful reading of the manuscript and for their constructive and insightful comments, which significantly helped to improve the clarity, rigour, and overall quality of the article. Views and opinions expressed in this article are, however, those of the authors only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Funding

All authors acknowledge the financial support received from the EU Horizon Project MOBI-TWIN (Grant Agreement No. 101094402). This work was also supported by the Research Council of Finland (Flagship of Advanced Mathematics for Sensing Imaging and Modelling, FAME, grant number 359182).

Conflict of Interests

The authors declare no conflict of interests.

LLMs Disclosure

ChatGPT was used solely for language polishing. All generated outputs were critically reviewed, revised, and approved by the authors.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

References

Akerman, A., Gaarder, I., & Mogstad, M. (2015). The skill complementarity of broadband internet. *The Quarterly Journal of Economics*, *130*(4), 1781–1824.

Albert, C., & Monras, J. (2017). *Immigrants' residential choices and their consequences* (Discussion Paper Series CPD 07/17). Centre for Research and Analysis of Migration.

Angelidou, M., Politis, C., Panori, A., Barkratsas, T., & Fellnhofer, K. (2022). Emerging smart city, transport and energy trends in urban settings: Results of a pan-European foresight exercise with 120 experts. *Technological Forecasting and Social Change*, *183*, Article 121915.

Beine, M., & Parsons, C. (2015). Climatic factors as determinants of international migration. *The Scandinavian Journal of Economics*, *117*(2), 723–767.

Berry, C. R., & Glaeser, E. L. (2005). The divergence of human capital levels across cities. *Papers in Regional Science*, *84*(3), 407–444.

Borjas, G. J. (2001). Does immigration grease the wheels of the labor market? *Brookings Papers on Economic Activity*, *2001*(1), 69–133.

Boterman, W. R., & Bridge, G. (2023). The transition to parenthood in urban space: Continuity and disruption of embodied experience and spatial practice. *Social & Cultural Geography*, *24*(7), 1165–1184.

Botta, E. (2019). *A review of "transition management" strategies: Lessons for advancing the green low-carbon transition* (OECD Green Growth Papers 2019/04). OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/04/a-review-of-transition-management-strategies_29dfddb6/4617a02b-en.pdf

Chi, G., & Marcouiller, D. W. (2013). Natural amenities and their effects on migration along the urban–rural continuum. *The Annals of Regional Science*, *50*, 861–883.

Connor, D. S., Berg, A. K., Kemeny, T., & Kedron, P. J. (2024). Who gets left behind by left behind places? *Cambridge Journal of Regions, Economy and Society*, *17*(1), 37–58.

Curry, G. N., Koczberski, G., & Selwood, J. (2001). Cashing out, cashing in: Rural change on the south coast of Western Australia. *Australian Geographer*, *32*(1), 109–124.

European Commission. (2020). *The European Green Deal Investment Plan and Just Transition Mechanism explained*. https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_20_24/QANDA_20_24_EN.pdf

Faggian, A., McCann, P., & Sheppard, S. (2007). Some evidence that women are more mobile than men: Gender differences in UK graduate migration behavior. *Journal of Regional Science*, *47*(3), 517–539.

Faggian, A., Modrego, F., & McCann, P. (2019). Human capital and regional development. In A. Capello & P. Nijkamp (Eds.), *Handbook of regional growth and development theories* (pp. 149–171). Edward Elgar Publishing. https://www.elgaronline.com/edcollchap/edcoll/9781788970013/9781788970013.00015.xml

Faggian, A., & Royuela, V. (2010). Migration flows and quality of life in a metropolitan area: The case of Barcelona-Spain. *Applied Research in Quality of Life*, *5*, 241–259.

Fiorentino, S., Glasmeier, A. K., Lobao, L., Martin, R., & Tyler, P. (2024). 'Left behind places': What are they and why do they matter? *Cambridge Journal of Regions, Economy and Society*, *17*(1), 1–16.

Florida, R. (2003). Cities and the creative class. *City & Community*, *2*(1), 3–19.

Forde, E. (2020). *Living off-grid in Wales: Eco-villages in policy and practice*. University of Wales Press.

Foth, M., Forlano, L., & Bilandzic, M. (2016). Mapping new work practices in the smart city. In H. Friese, M. Nolden, & M. Schreiter (Eds.), *Handbuch Soziale Praktiken und Digitale Alltagswelten*. Springer. https://doi.org/10.1007/978-3-658-08460-8_33-1

Franklin, R. S. (2021). The demographic burden of population loss in US cities, 2000–2010. *Journal of Geographical Systems*, *23*(2), 209–230.

Fratesi, U. (2014). The mobility of high-skilled workers—Causes and consequences. *Regional Studies*, *48*(10), 1587–1591.

Fratesi, U., & Rodríguez-Pose, A. (2016). The crisis and regional employment in Europe: What role for sheltered economies? *Cambridge Journal of Regions, Economy and Society*, *9*, 33–57.

García Fernández, C., & Peek, D. (2023). Connecting the smart village: A switch towards smart and sustainable rural-urban linkages in Spain. *Land*, *12*(4), Article 822.

Geyer, H. S., & Kontuly, T. (1993). A theoretical foundation for the concept of differential urbanization. *International Regional Science Review*, *15*(2), 157–177.

Glaeser, E. L., Kolko, J., & Saiz, A. (2001). Consumer city. *Journal of Economic Geography*, *1*(1), 27–50.

Golbazi, M., El Danaf, A., & Aktas, C. B. (2020). Willingness to pay for green buildings: A survey on students' perception in higher education. *Energy and Buildings*, *216*, Article 109956.

Gómez-Carmona, O., Buján-Carballal, D., Casado-Mansilla, D., López-de-Ipiña, D., Cano-Benito, J.,

Cimmino, A., Poveda-Villalón, M., García-Castro, R., Almela-Miralles, J., Apostolidis, D., & Drosou, A. (2023). Mind the gap: The AURORAL ecosystem for the digital transformation of smart communities and rural areas. *Technology in Society*, *74*, Article 102304.

Gubert, F., & Senne, J. N. (2016). *Is the European Union attractive for potential migrants? An investigation of migration intentions across the world* (Working Paper No. 188). OECD Publishing. http://doi.org/10.1787/5jlwxbv76746-en

Hannonen, O., Åkerlund, U., & Pitkänen, K. (2024). Recent developments in second home research: Has the Covid-19 pandemic spurred a re-thinking of second home mobilities? *Scandinavian Journal of Hospitality and Tourism*, *24*(2), 173–198.

International Labour Organization. (2018). *World employment social outlook 2018: Greening with jobs*. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40dgreports/%40dcomm/%40publ/documents/publication/wcms_628654.pdf

Ivlevs, A. (2015). Happy moves? Assessing the link between life satisfaction and emigration intentions. *Kyklos*, *68*(3), 335–356.

Ji, N. Y. (2024). Return to the countryside: An ethnographic study of young urbanites in Japan's shrinking regions. *Journal of Rural Studies*, *107*, Article 103254.

Karp, D. N., Bagchi-Sen, S., & Rogerson, P. (2022). Not all shrinking places are similar: The variegated nature of population decline in the United States. *Applied Geography*, *138*, Article 102581.

Kerr, S. P., Kerr, W., Özden, Ç., & Parsons, C. (2016). Global talent flows. *Journal of Economic Perspectives*, *30*(4), 83–106.

Komninos, N., Kakderi, C., Panori, A., & Psycharis, Y. (2023). Three conditions for liveable cities: Geographical inclusion, carbon neutrality and transport innovation. In L. F. Girard, K. Kourtit, & P. Nijkamp (Eds.), *The future of liveable cities* (pp. 55–78). Springer.

Komoot. (2024). *Photon* (Version 0.5.0) [Computer software]. https://github.com/komoot/photon

Letta, E. (2024). *Much more than a market: Speed, security, solidarity—Empowering the single market to deliver a sustainable future and prosperity for all EU citizens*. European Commission. https://european-research-area.ec.europa.eu/documents/letta-report-much-more-market-april-2024

Löfving, L., Kamuf, V., Heleniak, T., Weck, S., & Norlén, G. (2022). Can digitalization be a tool to overcome spatial injustice in sparsely populated regions? The cases of Digital Västerbotten (Sweden) and Smart Country Side (Germany). *European Planning Studies*, *30*(5), 917–934.

Lu, J., Zhou, S., & Xu, Y. (2025). How spatial fixity of individual daily activities evolves in the long-term: A life course and multi-scale behavior explanation. *Applied Geography*, *178*, Article 103609.

Lythreatis, S., Singh, S. K., & El-Kassar, A. N. (2022). The digital divide: A review and future research agenda. *Technological Forecasting and Social Change*, *175*, Article 121359.

MacKinnon, D., Kempton, L., O'Brien, P., Ormerod, E., Pike, A., & Tomaney, J. (2022). Reframing urban and regional 'development' for 'left behind' places. *Cambridge Journal of Regions, Economy and Society*, *15*(1), 39–56.

Matli, W., & Wamba, S. F. (2023). Work from anywhere: Inequalities in technology infrastructure distribution for digit workers. *Digital Transformation and Society*, *2*(2), 149–162.

Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M., & Scapulo, F. (2022). *Towards a green & digital future: Key requirements for successful twin transitions in the European Union*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/977331

Nguyen, H. T., Baldassar, L., & Wilding, R. (2022). Lifecourse transitions: How ICTs support older migrants' adaptation to transnational lives. *Social Inclusion*, *10*(4), 181–193.

OECD. (2021). *The inequalities–environment nexus: Towards a people-centred green transition* (OECD Green Growth Papers 2021/01). OECD Publishing. https://doi.org/10.1787/ca9d8479-en

OECD. (2023). *Rethinking regional attractiveness in the new global environment*. OECD Publishing. https://doi.org/10.1787/a9448db4-en

Otrachshenko, V., & Popova, O. (2012). *Life (dis)satisfaction and the decision to migrate: Evidence from Central and Eastern Europe* (FEUNL Working Paper Series No. 570). SSRN. https://doi.org/10.2139/ssrn.2176104

Palchykov, V., Kertész, J., Dunbar, R., & Kaski, K. (2013). Close relationships: A study of mobile communication records. *Journal of Statistical Physics*, *151*, 735–744.

Pike, A., Béal, V., Cauchi-Duval, N., Franklin, R., Kinossian, N., Lang, T., Leibert, T., MacKinnon, D., Rousseau, M., Royer, J., Servillo, L., Tomaney, J., & Velthuis, S. (2024). 'Left behind places': A geographical etymology. *Regional Studies*, *58*(6), 1167–1179.

Rodríguez, Á. M. (2024). Social inequality and residential segregation trends in Spanish global cities. A comparative analysis of Madrid, Barcelona, and Valencia (2001–2021). *Cities*, *149*, Article 104935. https://doi.org/10.1016/j.cities.2024.104935

Rodríguez-Pose, A. (2018). The revenge of the places that don't matter (and what to do about it). *Cambridge Journal of Regions, Economy and Society*, *11*(1), 189–209.

Rodríguez-Pose, A., & Bartalucci, F. (2024). The green transition and its potential territorial discontents. *Cambridge Journal of Regions, Economy and Society*, *17*(2), 339–358.

Salemink, K., Strijker, D., & Bosworth, G. (2017). Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas. *Journal of Rural Studies*, *54*, 360–371.

Sarkar, S. (2018). Urban scaling and the geographic concentration of inequalities by city size. *Environment and Planning B: Urban Analytics and City Science*, *46*(9), 1627–1644. https://doi.org/10.1177/2399808318766070

Shapiro, A. F., & Metcalf, G. E. (2023). The macroeconomic effects of a carbon tax to meet the US Paris Agreement target: The role of firm creation and technology adoption. *Journal of Public Economics*, *218*, Article 104800.

Stawarz, N., Becker, O. A., & Rüger, H. (2022). Work-related internal migration and changes in mental and physical health: A longitudinal study using German data. *Health & Place*, *75*, Article 102806.

Steinführer, A., Osterhage, F., Tippel, C., Kreis, J., & Moldovan, A. (2024). Urban–rural migration in Germany: A decision in favour of 'the rural' or against 'the urban'? *Journal of Rural Studies*, *111*, Article 103431.

Suppa, D., D'Acunto, S., & Schettino, F. (2023). An empirical investigation on the determinants of international migration. *Peace Economics, Peace Science and Public Policy*, *29*(4), 373–400.

Tietjen, A., & Jørgensen, G. (2016). Translating a wicked problem: A strategic planning approach to rural shrinkage in Denmark. *Landscape and Urban Planning*, *154*, 29–43.

Väisänen, T., Malekzadeh, M., Havusela, M., Inkeröinen, O., & Järv, O. (2024). *Complete MOBI-TWIN dataset* [Data set]. Zenodo. https://doi.org/10.5281/zenodo.14228377

Velthuis, S., Royer, J., Le Petit-Guerin, M., Cauchi-Duval, N., Franklin, R., Leibert, T., MacKinnon, D., & Pike, A. (2023). *Locating 'left-behindness' in the EU15: A regional typology* (Beyond Left Behind Places Project Working Paper 03/23). Centre for Urban and Regional Development Studies, Newcastle University.

Velthuis, S., Royer, J., Le Petit-Guerin, M., Cauchi-Duval, N., Franklin, R., Leibert, T., MacKinnon, D., & Pike, A. (2025). Regional varieties of 'left-behindness' in the EU15. *Regional Studies*, *59*(1), Article 2417704.

Venables, A. J. (2006). *Shifts in economic geography and their causes* (CEP Discussion Paper No 767). Centre for Economic Performance, London School of Economics and Political Science.

Williams, A. M., Jephcote, C., Janta, H., & Li, G. (2018). The migration intentions of young adults in Europe: A comparative, multilevel analysis. *Population, Space and Place*, *24*(1), Article e2123.

World Economic Forum. (2025). *Future of jobs report 2025*. https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

About the Authors

Anastasia Panori is an assistant professor of regional analysis and policy in the School of Spatial Planning and Development of the Aristotle University of Thessaloniki. Her research focuses on regional policies for the green and digital transition and computational methods for regional analysis.

Elli Papastergiou is a doctoral researcher in the School of Spatial Planning and Development of the Aristotle University of Thessaloniki. Her research focuses on the relationship between urban green spaces and subjective well-being, with particular emphasis on their implications for urban planning and policy.

Tuomas Väisänen is a geographer and a post-doctoral researcher in the Digital Geography Lab at the University of Helsinki. His research interests focus on GIScience, urban multilingualism, mobility, and segregation, using Python, PostgreSQL, QGIS, and big data.

Milad Malekzadeh is a post-doctoral researcher in the Digital Geography Lab at the University of Helsinki. His research interests focus on GIS, mobility systems, and spatial data science, using predictive modelling and optimisation algorithms for informing urban planning decisions.

Olle Järv is a university researcher in the Digital Geography Lab at the University of Helsinki. He is interested in how big data, such as mobile phone and social media data, can be used to examine individual spatial mobilities and behaviour, and how this can be interpreted in spatial planning and policy.