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The moving parts of life: a meso-level analysis of interregional migration patterns after life course events

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Abstract

This study analyzes interregional migration patterns associated with eight different non-overlapping life course events. Count-data regression models are applied to analyze the response of migration flows across life-event group to meso-regional push and pull factors, and results are used for migration profiling and as input for regional policy and planning. While interregional migration flow data related to life-events are generally not publicly available from statistical offices, we present a way to construct origin–destination migration flow matrices from Danish register data on migration, economic and social events at the household level. Our findings corroborate theoretical model predictions and prior evidence that migration across life-event groups responds heterogeneously to regional labor market conditions, with interregional migrants in the transition from job-qualifying education to work responding most strongly to local economic signals. Over the life cycle, interregional migration after family transitions such as forming a legally recognized partnership, child-bearing, and the “empty nest” phase are comparably stronger influenced by regional housing market conditions, local population structures and public service provision or place-based amenities. We also show that estimates for mixed migration groups experiencing multiple simultaneous events typically fail to detect associations between migration and regional context conditions, which highlights the methodological advantage of utilizing non-overlapping event group migration data for theory testing, demographic modeling and informing regional policies.

JEL Classification C23 · J10 · J61 · R23

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1 Introduction

Interregional migration is a crucial indicator reflecting and shaping economic, demographic, and social dynamics in a country. Net population inflows typically signal regional attractiveness (Niedomysl 2010), whereas persistent out-migration can trap regions in structural decline, undermining labor markets, public services and infrastructure (Diemer et al., 2022). Understanding factors behind individual migration decisions and aggregate spatial trends is therefore vital for regional planning and policymaking. This paper provides a novel meso-level analysis of interregional migration flows, focusing on the role of regional push and pull factors associated with regional socio-economic conditions and place-based amenities across eight non-overlapping life course events.¹ The importance of life-course events for decision-making has long been emphasized in economics, sociology, and demography, particularly in relation to intertemporal choices. A connection between life events and migration was first established by Rossi (1955) and has since been further developed by scholars, such as Chen and Rosenthal (2008), Whisler et al. (2008), Falkingham et al. (2016), Horowitz and Entwisle (2021), and Spring et al. (2024).

To capture local variation but avoid the difficulty of linking individual-level explanations to broader spatial patterns, we employ a meso-regional perspective that uses finely grained sub-municipal regions as units of observation. Our analysis is thus grounded between micro-level studies that focus on individual or household-level motives for migration and macro-regional investigations seeking to explain particularly where and how much migration occurs after a life event. One of our unique contributions is that of building a novel data set that constructs event group-specific interregional migration flow matrices, where event groups are non-overlapping. As inputs we use detailed registers for the full population of Danish residents categorized into eight distinct life course events happening at the household level. Dyadic regression models are then estimated to measure the response of life event-specific migration flows to macro-regional push and pull factors and test for response differences across categories. This has an immediate policy-relevance: Understanding factors influencing the intensity of education- or retirement-related migration and the resulting spatial clustering of specific population groups can help regional planners to assess the demand of public infrastructure and local amenities for a ‘youth bulge’ or ‘graying’ region (Schaffar et al. 2019) and design corrective policy measures such as spatially targeting tax schemes.

We analyze eight key life course events: (i) starting a job qualifying education, (ii) graduation and entering the labor market, (iii) forming a legally recognized partnership, (iv) having children, (v) divorce, (vi) last children leaving home (“empty nest”), (vii) retirement, and (viii) widowhood. A key advantage of our approach generating interregional migration flows based on register data for over 5.1 million Danish residents living in approx. 2.5 million households is that we can examine and compare multiple, uniquely defined life events within a unified macro-regional framework. This contrasts with prior studies that focus on aggregate or age-specific

¹ The terms interregional and internal migration are used synonymously here.

migration flows across regions (e.g., Millington 2000; Mitze and Reinkowski 2011; De Jong et al. 2016; Bernard and Vidal 2023; Ševčíková et al. 2024).

Estimation results point to varying associations between regional context factors and migration across life events. Effect heterogeneity tests confirm that economic/labor market conditions influence migration that typically take place in early life phases which differ from family events later in life. That is, local labor market conditions, migration costs (proxied by geographical distance), housing market conditions, public service provision (e.g. tuition fees for pre-school education), and place-based amenities (e.g., share of summer houses as a proxy for recreational factors, share of student population proxying certain cultural and consumption amenities) matter differently across life events. Recreational amenities attract empty-nesters and retiring households, whereas newly formed couples and young families move to neighborhoods with affordable housing, high-quality pre-school education and low crime rates. Based on results from an extended model comprising region specific policy interventions, we give an illustrative example for the use of event group-specific migration data for policy analysis taking a point of departure in a tax exemption reform (“commuter tax allowance”) that was established in Denmark.

The remainder of the paper is structured as follows: Sect. 2 reviews empirical work linking migration to life course events; Sect. 3 presents the empirical identification strategy; Sect. 4 describes the data, and stylized facts; Sect. 5 discusses the estimation strategy, presents results and analyses effect heterogeneity together with a policy application; Sect. 6 concludes and discusses limitations.

2 Literature review: life events and internal migration

2.1 Micro–macro trade-off in migration research

Interregional migration research can be broadly classified into individual-level (micro) and aggregate-level (macro) approaches to study factors that influence migration flows. Choosing a modeling approach is typically associated with a trade-off: individual analyses explain why people migrate by focusing on decision-making and motivations, whereas aggregate analyses explain where migration occurs and how much movement takes place. Micro-level studies rooted in life-course and socio-demographic frameworks provide rich understanding of the behavioral and individual determinants of internal moves (Dias et al. 2025). For example, survey-based research demonstrates how personal characteristics such as age, education, and employment status shape decisions to relocate within a country, and how these decisions are tied to life events like leaving the parental home or changing jobs (Clark and Withers 2007). Moreover, micro studies enhance causal inference, permitting researchers to evaluate how specific circumstances such as job loss or household formation trigger internal migration (Kley 2010).

In contrast, meso- or macro-level approaches examine patterns of internal migration at the population and regional scale, capturing where and how much movement occurs across a country using aggregated origin-destination matrices and census data. Meso- and macro-level studies are distinguished according to

the spatial granularity of the regions used as units of observation. These studies are particularly valuable for analyzing the structural context of internal migration, linking spatial mobility to regional labor markets, housing availability, and demographic pressures (e.g., Naveed et al. 2017; Mitze 2019). Meso and macro approaches also enable researchers to detect life-course specific migration trends at scale, such as peak mobility during early adulthood and reduced mobility in later life, patterns that emerge clearly only when large populations and cohort dynamics are considered (Bell et al. 2015). This makes meso- and macro-regional approaches particularly advantageous for migration research focused on demographic modeling and planning, as they allow researchers and planners to analyze how life-course processes translate into population-level mobility patterns across regions.

Linking individual-level (micro) data to regional aggregates often creates statistical identification challenges, because multiple micro-level observations share the same regional context. This clustering can induce correlated errors within regions, leading to biased standard errors and invalid inference if not properly accounted for (Raudenbush and Bryk 2002). Moreover, combining individual- and regional-level data can mask individual heterogeneity, causing bias and potential misestimation of effects when micro-level variation is conflated with regional characteristics (Wakefield 2009). These challenges are particularly relevant in migration research, where individual decisions are nested within spatial units, motivating the use of meso-/macro-regional approaches that rely on consistent area-level aggregates from micro data to support reliable modeling of population-level migration patterns (Mulder and Malmberg 2014). While we focus on a meso-regional analysis (details on data will be given in Sect. 3), in what follows, we next summarize prior evidence from micro-, meso- and macro-level studies linking life events and migration for a thorough review of the state-of-the-art in this research field.

2.2 Migration studies covering multiple life events

Several studies have examined the importance of life events for migration, focusing on different aspects. One strand considers life events as triggers: Horowitz and Entwisle (2021) find that school completion and marriage strongly influence adult migration, while Clark (2013) shows that partnership formation is the most significant driver of moves in Australia (HILDA survey). Falkingham et al. (2016) use English life history data (ELSA) to examine five potential triggers (childbirth, new partner, union dissolution, becoming unemployed or inactive, and starting a new job) and find that partnership formation or dissolution correlates more strongly with mobility than others.

Recent research adds the perspective of subjective well-being, showing that migration often reflects opportunity-driven choices rather than responses to adverse conditions. Erlinghagen et al. (2021) find that effects vary by social and economic status in German SOEP data, while Tunstall et al. (2015) and the scoping review by Narayan and Chakraborty (2024) show that migration following difficult life events can harm mental health during transitions such as school-to-work or work-to-retirement. Spring et al. (2024) highlight that adverse events such as divorce, job

loss, or onset of chronic illness often trigger long-distance moves, including return migration or relocation toward family. While these micro-level studies establish a strong link between life events and migration, they largely overlook regional context factors.

A second strand explicitly considers regional characteristics in shaping life-course migration. Chen and Rosenthal (2008) show that young, highly educated households migrate toward regions with strong business environments, whereas near-retirement couples prefer areas with consumer amenities. Whisler et al. (2008) demonstrate life-event-specific responses to climate and quality-of-life factors, particularly for college graduates and empty-nesters. Impicciatore and Panichella (2019) find that regional context is an essential trigger linking migration to individual life chances in Italy, with northern regions acting as “escalator regions” for upward mobility. Similarly, Chen et al. (2022) show that rural–urban migration patterns in China reflect the interplay between life events and demographic, socio-economic, and hometown characteristics. Overall, these studies emphasize that life events interact with regional factors to shape internal migration, highlighting the importance of approaches that combine both individual and contextual dimensions.

2.3 Migration studies with focus on a single life event

2.3.1 Education, graduation and labor market entry

Geographical mobility linked to education and graduation has two main dimensions.² The first concerns migration at the start of education. Studies show that the inflow of first-time students is influenced by educational quality, expenditures, admission rates, local incomes, and distance, as illustrated by Kyung (1996) for New York. Ribar (2015), using Australian HILDA data, highlights financial hardship, nutrition, and well-being as factors for leaving the parental home. Other contributions, including Mak and Moncur (2003), Alm and Winters (2009), and Cooke and Boyle (2011), examine first-semester location choices, while Dotzel (2017) emphasizes the role of natural amenities for US college migration.

The second dimension deals with graduation and entry into the labor market. Kodrzycki (2001) identifies employment opportunities, income levels, and local amenities as key drivers of graduate migration in the USA. Faggian et al. (2007) and Kazakis and Faggian (2017) distinguish different study-to-work pathways, showing salary premiums for repeat migrants. Corcoran et al. (2010) highlight the influence of personal characteristics, degree subjects, and job attributes on graduate migration in Australia, while Iammarino and Marinelli (2015) focus on job matching in Italy. Perales (2017) notes that job satisfaction drives long-distance, work-motivated moves in the UK and Australia. Winters (2017) and Liu et al. (2017) show that major-specific earnings and wages are decisive for US graduate mobility, while Détang-Dessendre et al. (2008) report similar patterns for France. Rowe et al. (2017) underline the advantages of metropolitan destinations for school-to-work transitions.

² See also Tuckman (1970), McHugh and Morgan (1984), Dotti et al. (2013) and Faggian et al. (2017).

2.3.2 Changes in family status

Household and family characteristics play a central role in shaping migration decisions. Early work by Kaluzny (1975) identified key determinants including age, gender, homeownership, family size, life-cycle dynamics, income, life expectancy, and education, while Mincer (1977), using U.S. Current Population Survey data (1966–1971), emphasized the influence of family employment and educational structure. Litwak and Longino (1987) emphasized different stages of migration related to retirement and health issues of elderly. Subsequent research highlights the growing importance of family-linked migration, with Kofman (2004) and Cooke (2008) showing that individual moves often reflect family decisions and the synchronization of household life cycles. Mulder and Wagner (1993) and Smits et al. (2004) further demonstrate how marriage and divorce shape migration, accounting for personal characteristics, distance, household education, spouse's occupation, and number of children. Children themselves also influence mobility: Long (1972) finds that school-age children constrain moves, whereas Bushin (2009) emphasizes children's agency in migration through interviews. Decisions of family and individual migration has furthermore been shown to have different effect on employment, poverty and income (De Jong et al. 2008). Local amenities, particularly school quality, also attract families, as shown by Marré and Rupasingha (2020). Finally, Van den Berg et al. (2021) underline the value of integrating multiple data sources, such as Dutch registers, to capture the interplay between migration and family reconstruction. Together, these studies highlight that migration decisions are embedded within household structures, life-course events, and the availability of family-relevant resources.

2.3.3 Empty nest and retirement

Later-life migration often relates to “leaving the nest” or retirement. Early studies on empty-nest migration, such as Young (1975) using Melbourne survey data, and later contributions by Aquilino (1991) and Avery et al. (1992) using U.S. surveys, focus on family structures and dynamics, including intergenerational co-residence and parental income, though precise migration triggers remain unclear. Retirement migration has received substantial attention, with Wiseman and Roseman (1979) introducing a typology emphasizing housing, amenities, services, and kinship. Chevan and Rose Fischer (1979) and Biggar et al. (1984) analyze personal, family, and socio-economic factors using U.S. Census data, while Conway and Houtenville (2001) highlight fiscal aspects, such as public services, taxes, and climate. Spatial preferences vary with age: older retirees favor smaller towns, whereas younger retirees prefer urban areas (De Jong et al. 2016). Health considerations are central, with Lovegreen et al. (2010) and Wilmoth (2010) examining self-rated health and daily living activities before and after moves, and Dorfman and Mandich (2015) emphasizing local healthcare alongside recreational and natural amenities. Other studies underline the importance of natural features and local amenities for retirement migration (Duncombe et al. 2003; Rappaport 2007; Sharma 2012).

Overall, the literature shows that migration is strongly influenced by life-course events, including education, labor market entry, family formation and retirement. Mobility patterns differ across life course stages and are shaped by individual/household characteristics together with regional push and pull context factors, such as local amenities, labor markets, housing opportunities, and public services.

3 Data, variables and stylized facts

We employ Danish population register data combined with registers on education, tax, and labor market activities, to define mutually exclusive life event groups with and without migratory movements during the period 2007–2012. We rely on population rather than sample data primarily due to data availability. Crucially, the large number of observations enables us to apply a rigorous definition of event groups, ensuring that no household within a given group experiences multiple events during the observation period. This allows for precise identification of migration effects associated with each non-overlapping life event across space and minimizes bias arising from confounding events. Our data is organized in such a way that migration flow matrices are based on individual counts (persons) with events being identified at the household level. According to the Danish Civil Registration System (CPR), a household consists of all individuals living at the same residential address who share common living arrangements. Individual persons and households are linked through a unique household ID. Eight unique life events between 2007 and 2012 are defined through the logical conditions:

1. **Education:** At least one household member starts a labor-market qualifying formal education $\wedge$ individuals in household migrate to region i from j .
2. **Graduation:** At least one household member graduates from formal education $\wedge$ individuals in household migrate to region i from j .
3. **Partnership:** Two adult individuals initially constituting different households join into one household through marriage or legally recognized cohabitation $\wedge$ individuals in new household migrate to region i from j .
4. **Children:** One or more newborn children enter household $\wedge$ individuals in household migrate to region i from j .
5. **Divorce:** Two adult individuals initially constituting the same household split into two separate households $\wedge$ at least one new household migrates to region i from j .
6. **Empty nest:** Last child leaves household $\wedge$ individuals in household migrate to region i from j .
7. **Retirement:** At least one adult household member retires from labor market $\wedge$ individuals in household migrate to region i from j .
8. **Widowhood:** One adult household member dies $\wedge$ individuals in household migrate to region i from j .

Some clarifications: The start of an education refers to an educational program (Danish: *erhvervskompetencegivende uddannelse*) that provides formal qualifications directly relevant for entering the labor market. When the student is moving out of the parental home, they are recorded as forming a new household at the new address. In

this case, the event is measured at the level of the newly formed household. Parents are counted as “empty nesters”, when the last child leaves the parental household. Students are considered to graduate if they finalize a formal education according to the Danish Education Register (UDDA, *Uddannelsesregisteret*) and are first registered in the Danish Labor Market Registers (AMR, *Arbejdsmarkedsregisteret*). The cases of partnership and divorce imply that two households merge into one (and vice versa) if the partner moves in (out). In the case of partnership formation, we treat the merged household with household members having the same address as point of departure for studying associated migratory movements. In the case of divorce, migration leads to a new household to be created. We then include both the old and the new household in the event group. Finally, a person is counted as retired if a person receives public pensions or early retirement benefits while not being listed in the AMR register. In case of widowhood, the surviving partner’s status in a household with partnership status is updated to widow/widower when a spouse dies (recorded in the CPR as a death date).

Applying these logical conditions to the Danish population of approx. 5.1 million persons grouped into approx. 2.5 million households, Table 1 shows the number of persons in households subject to one of the eight life events and the share of migrants in these life event groups. That is, 210,348 people started a job qualifying education, of whom 141,625 (67.3%) migrated across municipal boundaries. The life event most strongly associated with migration is having children (74.9%), while retirement (13.7%) and the last child leaving home (22.5%) show the lowest migration shares in the total event group. Overall, the chosen categorization of events ensures that a sufficient number of households with non-overlapping life events can be assigned to one of the eight event groups, allowing clear identification of migration effects. A distinct advantage of estimating separate migration models for each life event is that it reduces the risk of running an estimation bias stemming from latent group heterogeneity with respect to age, income, education, nationality

Table 1 Number of registered persons and share of migrants in each event groups

Event group	Registered persons	Migrants	Share of Migrants per event group (in %)
Education	210,348	141,625	67.3
Graduation	213,524	119,184	55.8
Partnership	234,152	89,473	38.2
Children	177,572	132,690	74.7
Divorce	195,319	130,573	66.9
Empty nest	411,455	92,496	22.5
Retirement	161,763	22,217	13.7
Widowhood	67,773	18,232	26.9
Mixed events	413,127	279,924	67.8
No event	3,023,744	757,981	25.1
Total Population	5,108,777	1,784,395	34.9

Calculated on the basis of register data from Statistics Denmark (2016)

and household type among other factors. One limitation is that both life events and migratory movements are measured at an annual scale. We assume that migratory movements that happen in the same and later years are associated with the timing of a specific event during the sample period.

Our meso-level approach seeks to use finely granulated regions as units of observation in order to bridge individual migration processes and broader spatial patterns of mobility. In this logic, individual migration data are aggregated to migration flow matrices between sub-municipalities (parishes) located in the 98 Danish municipalities (LAU1 level). Within each municipality, we group sub-municipalities into the following four categories to control for differences in settlement structure as a latent influencing factor of migration flows:³

- Settlements with 100,000 or more inhabitants,
- Between 10,000 and under 100,000 inhabitants,
- Between 1,000 and under 10,000 inhabitants,
- Less than 1,000 inhabitants.

Out of the possible $(98 \times 4) \times ((98 - 1) \times 4) = 152,096$ origin–destination sub-municipal pairs, we observe actual migration flows for 67,860 sub-municipal pairs because some municipalities lack certain settlement types (e.g., urban areas with 100,000 or more inhabitants as specific settlement structure).

When joining migration data and regional context factors, we adopt a nested modeling framework as suggested in Stillwell and Thomas (2010), Thomas et al. (2015), and Bell et al. (2015). This allows us to combine relevant information on settlement and population structures at the local neighborhood (sub-municipal) level with additional covariates observed at the broader municipal level (see Fig. 1). This

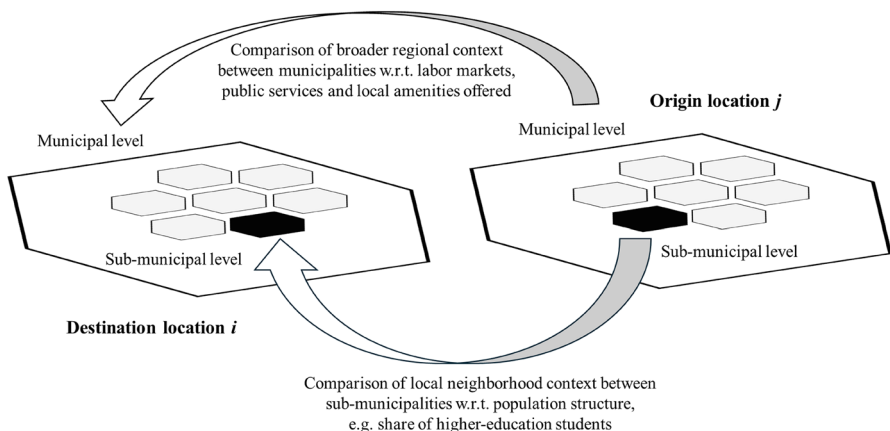


Fig. 1 Nested modeling approach for regional context factors of interregional migration. *Source:* Own figure

³ In Denmark, administrative units below the level municipalities are also referred to as parishes (*sogne*).

is important as certain regional factors such as job search, public infrastructure and services etc. are typically evaluated at the municipal level and, once these comparisons between municipalities have been made, the prospective migrant choose the optimal location within a municipality based on neighborhood characteristics. We argue that ignoring local settlements structures within municipalities may constitute an estimation bias from latent observations.

Table 2 provides an overview of covariates, grouped into: (i) labor and housing market (e.g., unemployment, income differences, sectoral employment, housing prices, share of rental housing in housing stock), (ii) public services and local amenities (kindergarten tuition, crime rates, share of summer houses, education level of local population, student shares in local population), and (iii) gravitational factors (distance, administrative LAU1 borders and island dummies, and population size). As the table shows, only migration as outcome variable together with the two regional context factors of population size and population structure, e.g. the share of higher education students in total population, are measured at the sub-municipal level, while all other context factors compare regional differences at the municipal level.

Choosing municipalities as unit of observation for local labor market conditions and public service provision is important as Danish municipalities have extensive autonomy and fiscal power, making them directly relevant to migration decisions. Municipalities levy their own income taxes and provides several social services including childcare, primary schooling, elderly care and related social services, local health and cultural facilities. While Danish municipalities are geographically small by international standards (with an average population of around 60,000 and max. 650,000), they still contain significant socially and spatially diverse neighborhoods (see Nabolags Atlas 2025), why we adhere to the nested modeling approach outlined above.

Denmark is generally considered a country with a moderate to high level of internal geographic mobility in a European comparison. According to Danmark Statistik (2023) around 5–6% of the population moves between municipalities each year compared to 4–5% in Sweden and 3–4% in Germany as Denmark's immediate neighboring countries. Figure 2 shows the migration balance for the 98 Danish municipalities for a specific event group as difference between gross in- and out-migration flows. A positive balance indicates net in-migration. Migration associated with starting a job-qualifying education concentrates in the largest urban areas such as Copenhagen, Aarhus, and Aalborg (Panel A), with large universities and university colleges (here proxied by the share of students in local population).⁴ For the transition from education to work (Panel B), Copenhagen remains attractive, while the university-towns Aarhus and Aalborg experience net out-migration into surrounding areas. Migration associated with having children (Panel C) amplifies this trend, whereas retirement flows favor coastal municipalities in Zealand (around Copenhagen) and several

⁴ For reference, Fig. A1 in the appendix offers a map of Denmark and the ten largest cities. Figure A2 reports internal migration flows across and within municipalities for the period 2006–2024. For our estimation period 2007–2012 a moderate effect of the global financial crisis on migration patterns can be observed but no structural break (see Fig. A2).

Table 2 Variable descriptions and summary statistics for the nested migration model

Variables	Mnemonic	Name	Level	Mean	S.D	Min	Max
Migration by event groups	MIG _{ij} ^{Education}	Gross migration to <i>i</i> from <i>j</i> (event group: education)	Sub-Municipal	1.58	10.81	0	679
	MIG _{ij} ^{Graduation}	Gross migration to <i>i</i> from <i>j</i> (event group: graduation)	Sub-Municipal	1.09	7.25	0	348
	MIG _{ij} ^{Partner}	Gross migration to <i>i</i> from <i>j</i> (event group: partnership)	Sub-Municipal	1.24	7.13	0	493
	MIG _{ij} ^{Children}	Gross migration to <i>i</i> from <i>j</i> (event group: offspring)	Sub-Municipal	0.72	6.59	0	830
	MIG _{ij} ^{Divorce}	Gross migration to <i>i</i> from <i>j</i> (event group: divorce)	Sub-Municipal	0.97	6.8	0	267
	MIG _{ij} ^{Empty Nest}	Gross migration to <i>i</i> from <i>j</i> (event group: empty nest)	Sub-Municipal	0.16	1.15	0	62
	MIG _{ij} ^{Retire}	Gross migration to <i>i</i> from <i>j</i> (event group: retirement)	Sub-Municipal	0.76	4.39	0	215
	MIG _{ij} ^{Widow}	Gross migration to <i>i</i> from <i>j</i> (event group: widowhood)	Sub-Municipal	0.11	1.17	0	58
	MIG _{ij} ^{Mixed}	Gross in-migration to region <i>i</i> from <i>j</i> (event group: mixed events)	Sub-Municipal	2.66	18.34	0	1016
	MIG _{ij} ^{No event}	Gross in-migration to region <i>i</i> from <i>j</i> (event group: no event)	Sub-Municipal	5.61	33.43	0	1779
Labor market, housing market conditions	<i>D.unemp_{ij}</i>	Difference in unemployment rate between <i>i</i> and <i>j</i> (in logs)	Municipal	0	0.43	-1.39	1.39
	<i>D.income_{ij}</i>	Difference in disposable income levels between <i>i</i> and <i>j</i> (in logs)	Municipal	0	0.2	-1.06	1.06
	<i>D.industry_share_{ij}</i>	Difference in industrial employment share between <i>i</i> and <i>j</i> (in logs)	Municipal	0	0.52	-1.69	1.69
	<i>D.house_price_{ij}</i>	Difference of average house price per square meter (in logs)	Municipal	0	0.47	-1.47	1.47
	<i>D.rental_share_{ij}</i>	Difference in percentage share of rental housing (in logs)	Municipal	0	0.84	-3.38	3.38
Public services, local amenities	<i>D.summer_house_{ij}</i>	Difference in relative density of summer housing (in logs)	Municipal	0	2.25	-7.67	7.67
	<i>D.theft_rate_{ij}</i>	Difference in thefts pr. 1,000 persons (in logs)	Municipal	0	0.51	-2.49	2.49

Table 2 (continued)

Variables	Mnemonic	Name	Level	Mean	S.D	Min	Max
Gravity factors	$D.childcare_{ij}$	Difference in average price for kindergarten tuition (in logs)	Municipal	0	0.18	-0.78	0.78
	$D.pop_ \%_ mid_ edu_{ij}$	Difference in population share with upper secondary education (in logs)	Sub-Municipal	0	0.21	-0.83	0.83
	$D.pop_ \%_ high_ edu_{ij}$	Difference in population share with tertiary education (in logs)	Sub-Municipal	0	0.37	-1.63	1.63
	$D.stud_ \%_ mid_ edu_{ij}$	Difference in student share in upper secondary education (in logs)	Sub-Municipal	0	0.39	-1.51	1.51
	$D.stud_ \%_ high_ edu_{ij}$	Difference in student share in tertiary education (in logs)	Sub-Municipal	0	0.94	-3.94	3.94
	$geodist_{ij}$	Geographic distance between municipalities (in logs)	Municipal	4.66	0.88	0.75	6.07
	$neighbor_{ij}$	Binary dummy = 1 if municipalities i and j with common territorial border	Municipal	0.05	0.21	0	1
	$island_{ij}$	Binary dummy = 1 if municipality i (j) constitutes an isolated island	Municipal	0.03	0.17	0	1
	pop_{ij}	Population level in region i (j) (in logs)	Sub-Municipal	9.38	1.27	3.81	12.32

Suffix “D” indicates relative regional differences, e.g., $D.y_{ij} = (y_i - y_j)$. All variables are calculated from register data provided by Statistics Denmark combined with regional data from Statistikbanken.dk and Noegletal.dk

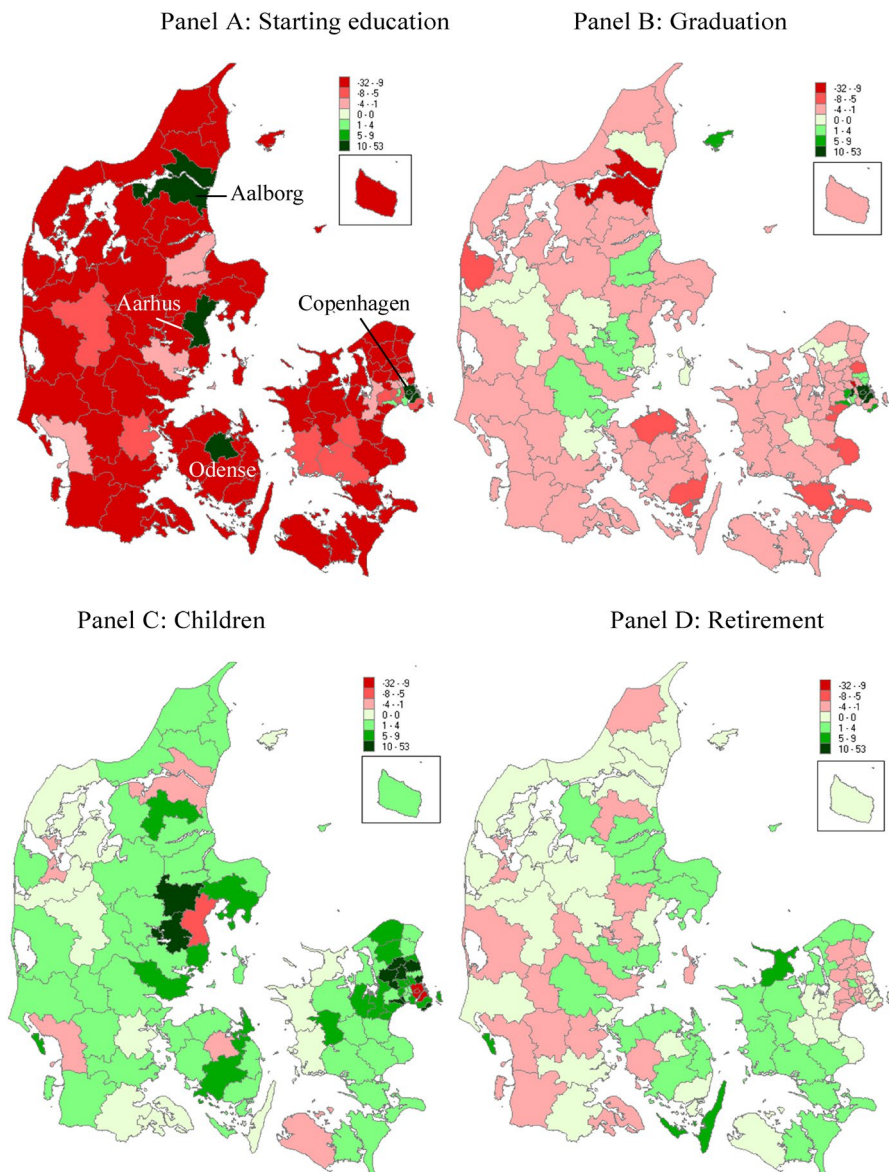


Fig. 2 Spatial distribution of migratory patterns for selected event groups (2007–2012). Geo maps report the net in-migration induced municipal population change per 1,000 inhabitants. *Source:* Own figures based on register data from Statistics Denmark (2016)

smaller islands. The picture shown in Fig. 2 already points to a spatial dynamic population process that varies across life events.⁵

In extension to Fig. 2, interregional gross migration flows by selected groups are highlighted in Fig. 3. As such, Panel A of Fig. 3 shows that entering the job market is associated with a strong spatial concentration pattern with large urban municipalities gaining population. Dominant migration flows also bridge longer spatial distances in Denmark. This is different from migration patterns following the event of having newborns in the household. As Panel B of Fig. 3 shows, dominant migration flows partly reverse the spatial concentration trend as people move into the hinterlands of larger urban agglomerations. However, comparing Panel B to Panel A also shows that the magnitude of children-related migration is smaller compared to entering the labor market and also the average distance of migratory movements is smaller.

4 Empirical specification

We base our empirical analysis on the human capital approach to migration developed by Sjaastad (1962), in which migration decisions arise from individuals or households comparing expected utility gains between origin and destination regions net of migration costs. At the same time, based on the above stylized facts, our framework incorporates elements of gravity-based approaches to migration by acknowledging that migration flows are shaped not only by individual cost–benefit considerations but also by spatial opportunity structures, such as regional population size, economic attractiveness, and distance-related frictions (Bröcker and Mitze, 2021, Cavalleri et al. 2021). Migration outcomes thus emerge from the interaction between individual-level incentives and spatial interaction mechanisms that structure the likelihood and direction of moves across regions.

At the micro-level, migration occurs when the discounted benefits of moving exceed its direct and indirect costs. Utility differences are assumed to reflect regional characteristics that vary across life events. Early-life migration is therefore primarily shaped by economic considerations, particularly expected income and employment prospects, typically proxied by regional income differentials and employment probabilities in line with the framework of Harris and Todaro (1970). Our meso-regional analysis builds directly on these micro-level behavioral foundations by aggregating individual decision mechanisms to the regional level. Migration flows are thus

⁵ Results for the remaining event groups and reference groups can be found in Fig. A3 and A4 in the online appendix. The appendix also reports results from spatial autocorrelation tests (Moran's I) for the net migration rates as shown in the figures (see Table A1). The degree of spatial association is, tough, low to moderate and varies across groups. We conclude from these results that there is little relative gain from extending the model to a spatial regression approach besides the standard gravity-type mechanisms outlined in Sect. 4.

Panel A: Graduation



Panel B: Children

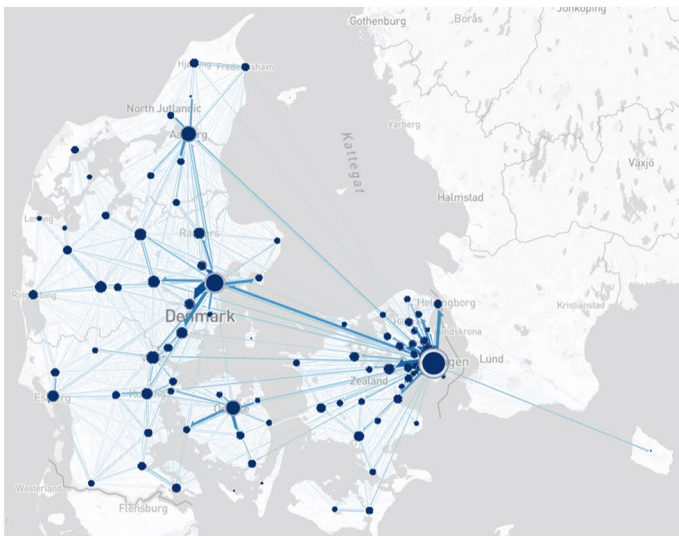


Fig. 3 Network presentation of migration flows by selected life-event groups. Flow maps are created using the flowmap.city app. Network flow presentations for all event groups can be viewed here: <https://app.flowmap.city/public/f6e2e44a-3c2a-45cf-ad22-64b8cda78fab> and are included in the appendix. *Source:* Own figures based on register data from Statistics Denmark (2016)

interpreted as the aggregate outcome of individual utility-maximizing decisions, allowing regional labor market conditions and other contextual factors to be analyzed while remaining conceptually grounded in microeconomic migration theory.

Several studies have applied the Sjaastad (1962)/Harris-Todaro (1970) approach for regional analyses, focusing on interregional labor market disparities (Massey et al. 1994; Puhani 2001; Etzo 2008; Kurekova 2011; Jauer et al. 2019; Mitze and Dall Schmidt 2015; Mitze 2019). Other factors considered include regional human capital endowments and knowledge intensive activities (Borjas 1987; Korpi and Clark 2015; Brugiavini et al. 2025), housing rigidity and house prices (Gabriel et al. 1992; Potepan 1994; Bitter 2008; Cavalleri et al. 2021; Dickey and Magante 2024), and region-specific amenities (Knapp and Graves 1989; Biagi et al. 2011; Sarra and Del Signore 2010; Meister et al. 2022).

We use this labor market-focused literature as starting point to specify an empirical migration equation, which incorporates life event-specific heterogeneities in the following manner

$$\begin{aligned}
 MIG_{ij,t(1)-t(0)}^e = & A \times \underbrace{\left[\frac{Unemp_{i,t(0)}}{Unemp_{j,t(0)}} \right]^{\gamma_1^e} \times \left[\frac{Income_{i,t(0)}}{Income_{j,t(0)}} \right]^{\gamma_2^e}}_{\text{Labor market factors}} \times \underbrace{\left[\frac{H_{i,t(0)}}{H_{j,t(0)}} \right]^{\Omega^e}}_{\text{Housing market factors}} \times \underbrace{\left[\frac{A_{i,t(0)}}{A_{j,t(0)}} \right]^{\Theta^e}}_{\text{Further local amenities}} \\
 & \times \underbrace{\left[Cost_{ij,t(0)}^{\delta_1^e} \right]}_{\text{Migration cost factor}} \times \underbrace{\left[Pop_{i,t(0)}^{\delta_2^e} \times Pop_{j,t(0)}^{\delta_3^e} \right]}_{\text{Population size factor}} \\
 & \underbrace{\hspace{10em}}_{\text{Gravitational forces}}
 \end{aligned} \tag{1}$$

where $MIG_{ij,t(1)-t(0)}^e$ denotes gross migration flows to region i from j during the period $t(1) - t(0)$ associated with life event group e . A is a constant term, $Unemp_{i,t(0)}$ and $Unemp_{j,t(0)}$ are unemployment rates in region i and j at time $t(0)$ with γ_1^e capturing the effect of relative unemployment on migration for event group e . In line with neoclassical migration theory, $\gamma_1^e < 0$ is expected: A higher unemployment increase in i relative to j reduces migration to i (from j). Similarly, $Income_{i,t(0)}$ and $Income_{j,t(0)}$ denote average (disposable) income in i and j at time $t(0)$; γ_2^e measures the effect of relative income differences on migration for event group e . In line with neoclassical migration theory, $\gamma_2^e > 0$ is expected: higher income in i relative to j increases migration to i from j . Both γ_1^e and γ_2^e are anticipated to be larger for life events linked to job qualification and labor market entry than other life course events.

Regional attractiveness is not only based on local labor market features, which is why we include housing market conditions ($\mathbf{H}_{i,t(0)}$, $\mathbf{H}_{j,t(0)}$) as well as further local amenities ($\mathbf{A}_{i,t(0)}$, $\mathbf{A}_{j,t(0)}$) in Eq. (1) to account for the plurality of migration determinants subject to a specific life events (with Ω^e and Θ^e being coefficient vector for event group e). The direction and magnitude of migration response to these factors is a priori unclear and shall be explored empirically. A proxy for direct moving costs based on the geographical distance between regions ($Cost_{ij,t(0)}$) is added for which we expect $\delta_1^e < 0$: increasing cost lowers the migration flow to i from j . A population size factor composed of population levels in i and j ($P_{i,t(0)}$, $P_{j,t(0)}$) is included to capture the link between migration and municipal size (Poot, et al., 2016). Geographical distance and population levels are commonly referred to as gravitational forces in migration models (Bröcker and Mitze, 2021).

We are particularly interested in testing heterogeneity across different event groups. To do so, we apply a series of pairwise Wald-type χ^2 -tests for event groups $n, m \in e = 1, \dots, 8$ with the null hypothesis $H_0 : \Psi^n = \Psi^m$ with $\Psi^n = \{\gamma_1^n, \gamma_2^n, \Omega^n, \Theta^n, \delta_1^n, \delta_2^n, \delta_3^n\}$ and analogously for Ψ^m . A rejection of the null hypothesis of coefficient equality indicates that the migration responses to included variables significantly differ across event groups. This approach provides a formal test of life-event-specific regional migration profiles associated with regional contexts and heterogeneity associated with different life-course transitions.

Origin–destination flow models are widely used in population studies, regional science, and labor economics (e.g., Cushing and Poot 2003), ranging from log-linear regressions to nonlinear count data models. While log-linear specifications are common, count data models are preferable when many origin–destination pairs exhibit zero or very small flows (Devillanova and Garcia-Fontes 2004). We conduct pre-estimation tests to guide model choice: assessing (log) normality of the dependent variable to select between OLS and count models, performing a Likelihood Ratio test for over-dispersion to choose between Poisson and negative binomial (NegBin) specifications, and applying a Vuong (1989) test to evaluate standard versus zero-inflated models.

Applied to the migration equation shown in Eq. (1), a (zero-inflated) NegBin model of event group-specific gross migration flows to region i from j can then be written as (with lower case letters being log transformations as $u_{i,t(0)} = \log(Unemp_{i,t(0)})$ and $y_{i,t(0)} = \log(Income_{i,t(0)})$)

$$\begin{aligned} \mu_{ij,t(1)-t(0)}^e = & \exp [\gamma_{1,e}(u_{i,t(0)} - u_{j,t(0)}) + \gamma_{2,e}(y_{i,t(0)} - y_{j,t(0)}) + \Omega^e(h_{i,t(0)} - h_{j,t(0)}) \\ & + \Theta^e(a_{i,t(0)} - a_{j,t(0)}) + \delta_1^e c_{ij,t(0)} + \delta_2^e p_{i,t(0)} + \delta_3^e p_{j,t(0)}] + u_{ij}^e \end{aligned} \quad (2)$$

$$\begin{aligned} \text{probit}(\pi_{ij,t(1)-t(0)}^e) = & \beta_{1,e}(u_{i,t(0)} - u_{j,t(0)}) + \beta_{2,e}(y_{i,t(0)} - y_{j,t(0)}) + \Lambda^e(\mathbf{h}_{i,t(0)} - \mathbf{h}_{j,t(0)}) \\ & \Phi^e(\mathbf{a}_{i,t(0)} - \mathbf{a}_{j,t(0)}) + \theta_1^e c_{ij,t(0)} + \theta_2^e p_{i,t(0)} + \theta_3^e p_{j,t(0)} + \varepsilon_{ij}^e \end{aligned} \quad (3)$$

Equation (2) specifies the Negative Binomial (NegBin) model linking the conditional mean of the migration outcome $\mu_{ij,t(1)-t(0)}^e$ defined as $E(\mu_{ij}^e | \mathbf{Z}_{ij,t(0)}) = \mu_{ij}$

to the set of regressors $\mathbf{Z}_{ij,t(0)} = \{(u_{i,t(0)} - u_{j,t(0)}), (y_{i,t(0)} - y_{j,t(0)}), (\mathbf{h}_{i,t(0)} - \mathbf{h}_{j,t(0)}), (\mathbf{a}_{i,t(0)} - \mathbf{a}_{j,t(0)}),$

$c_{ij,t(0)}, p_{i,t(0)}, p_{j,t(0)}\}$. As $MIG_{ij,t(1)-t(0)}^e$ is assumed to have non-negative integer values, the exponential of the independent variables is taken to ensure that $MIG_{ij,t(1)-t(0)}^e$ is zero or positive. Equation (3) shows the binary component for excessive zero

migration flows with $\text{probit}(\pi_{ij,t(1)-t(0)}^e)$ being the probability of zero counts, which

is modeled based on the same regressors with coefficients $\beta_1^e, \beta_2^e, \Lambda^e, \Phi^e, \theta_1^e, \theta_2^e, \theta_3^e$. Residuals u_{ij}^e and ε_{ij}^e follow $\exp(u_{ij}^e) \sim \text{Gamma}(1/\tau, \tau)$ and $\varepsilon_{ij}^e \sim N(0, \sigma^2)$ with τ capturing overdispersion. Both components are estimated via Maximum Likelihood (see Mwalili et al. 2008).

5 Empirical results

5.1 Estimation results and migration profiles by life events

Table 3 reports the estimation results from our nested migration modeling approach (NegBin specification, Eq. (2)).^{6, 7} While columns I–VIII show event group-specific migration responses to variations in regional context factors, columns IX and X provide reference results for Danish interregional migrants with mixed events comprising two or more overlapping life course events or no event. All ten groups constitute the full population of approx. 5.1 million Danish residents. A first noteworthy finding is that the estimated coefficients show a considerable degree of heterogeneity in the migration response to regional context factors across groups. This is formally supported by pairwise Wald tests for coefficient inequality in Table 4. The table summarizes rejection rates of coefficient equality for pairwise comparisons between event groups, with detailed results in Tables A3–A20 of the online appendix. Migration heterogeneity is particularly pronounced for event groups with a significant role played by economic/labor market conditions, which typically take place in early life phases (e.g., we observe a 94% rejection rate when comparing migration responses due to education and partnership formation). At later stages, migration responses become somewhat more homogeneous (e.g., Table 4 only reports a moderate 44% rejection rate comparing migration subject to the empty nest phase and retirement).

When it comes to the interpretation of results, there are two ways of categorizing the estimated coefficients. The first is by regional context factors as shown in Fig. 4. The figure underline the observation of migration response heterogeneity in a condensed manner by ranking the migration response to regional context factors across life events. As Panels A and B show, local labor market differences are particularly relevant for migration associated with graduation and entering into the labor market: Higher disposable income differences between regions i and j increase gross migration to i from j for graduates (Panel B), while relative higher regional unemployment in i compared to j significantly reduces gross migration to i . These estimates provide empirical support to the theoretical predictions of neoclassical migration models. Comparing the estimation results with other event groups and the two reference groups (mixed, no event) makes it further clear that precise data are needed to test migration theories. For the latter two groups—different from theoretical model predictions—no labor market association of interregional migration can be identified.

Another way of categorizing the results is to create migration profiles by event group. This is done in Table 5 by summarizing statistically significant positive and

⁶ Pre-estimation tests on skewness, kurtosis, and normality (Shapiro-Francia) in Table A2 of the online appendix reject normality. Consequently, we estimate the migration equation using count data models to account for nonlinearities and the large fraction of zero flows.

⁷ Table 3 also presents the results of post-estimation tests for estimator choice. In all cases, the reported LR-test rejects the null hypothesis that dispersion parameter τ is equal to zero, which favors the NegBin over a Poisson model. In addition, the significant z-statistic of reported Vuong (1989) test indicates that the NegBin specification should be estimated in a two-part model as shown in Eqs. (2) and (3) why it has been implemented here.

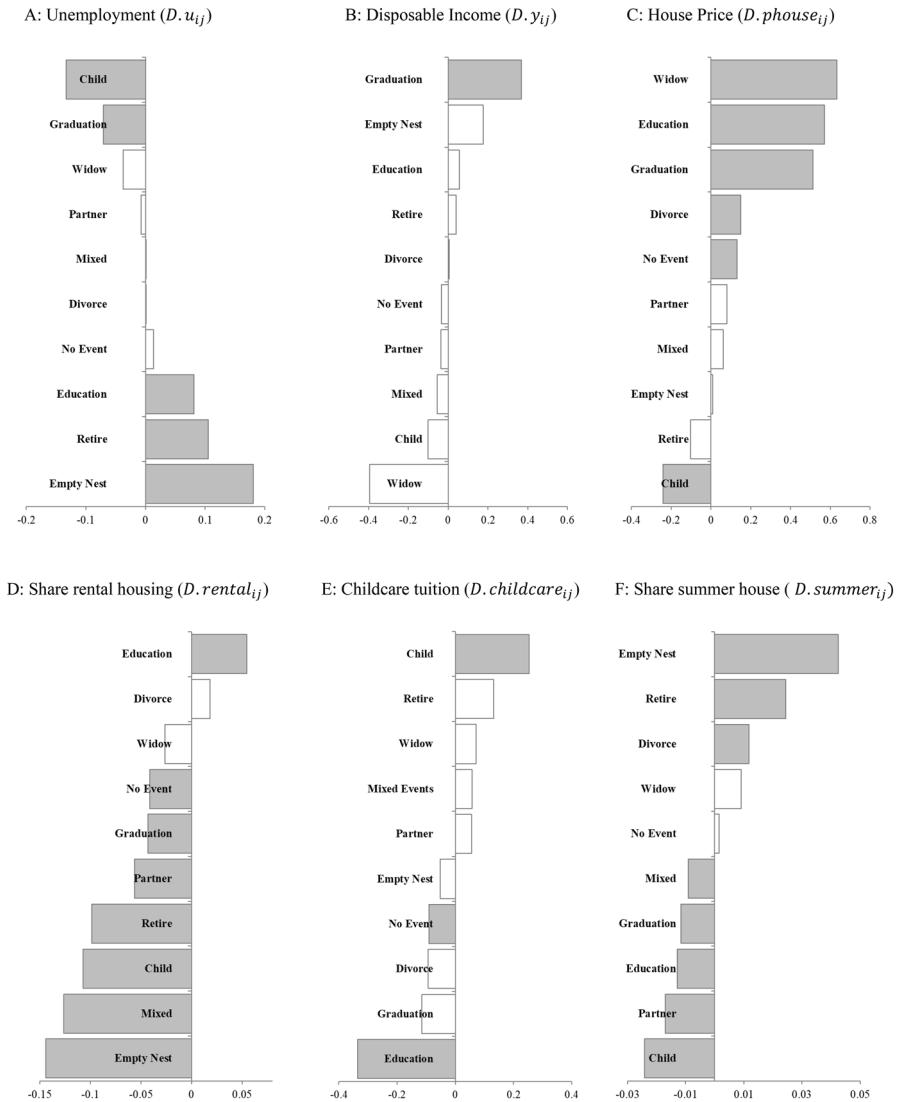


Fig. 4 Migration profiles for regional context factors. Solid bars indicate statistically significant coefficients estimates with $p < 0.05$. See Table 3 for details

negative migration factors associated with differences in regional context factors. The table ranks the relative importance of regional context factors for each migration group on the basis of standardized coefficients (reported in Table A22 in the online appendix). The percentage measures in Table 5 thereby show how much each variable contributes to the overall change in migration, given its typical variation in the data. On average, regional context factors explain up to one third of the explained variation in interregional migration flows, while the standard gravitational

Table 3 Estimation results for interregional migration flows and regional context factors by life event groups

Event group	(I) Education	(II) Graduation	(III) Partner	(IV) Child	(V) Divorce	(VI) Empty Nest	(VII) Retire	(VIII) Widow	(IX) Mixed Events	(X) No Event
$D.unemp_{ij}$	0.0815*** (0.0286)	-0.0705*** (0.0312)	-0.00740 (0.0248)	-0.133*** (0.0450)	0.00114 (0.0311)	0.181*** (0.0652)	0.105*** (0.0308)	-0.0374 (0.0741)	0.001 (0.0265)	0.013 (0.0200)
$D.income_{ij}$	0.0568 (0.0951)	0.369*** (0.103)	-0.0373 (0.0791)	-0.101 (0.142)	0.00473 (0.0997)	0.176 (0.195)	0.0391 (0.101)	-0.395* (0.214)	-0.051 (0.0831)	-0.033 (0.0689)
$D.industry_share_{ij}$	-0.245*** (0.0343)	-0.213*** (0.0371)	0.00750 (0.0285)	0.356*** (0.0519)	0.0414 (0.0362)	0.0643 (0.0717)	0.0903*** (0.0367)	0.108 (0.0792)	-0.032 (0.0284)	-0.006 (0.0229)
$D.house_price_{ij}$	0.571*** (0.0540)	0.513*** (0.0591)	0.0807* (0.0467)	-0.240*** (0.0849)	0.150*** (0.0583)	0.00816 (0.125)	-0.102* (0.0570)	0.634*** (0.143)	0.062 (0.0463)	0.132*** (0.0364)
$D.rental_share_{ij}$	0.0548*** (0.0177)	-0.0429*** (0.0190)	-0.0560*** (0.0145)	-0.107*** (0.0264)	0.0181 (0.0183)	-0.144*** (0.0357)	-0.0984*** (0.0186)	-0.0260 (0.0400)	-0.126*** (0.0146)	-0.041*** (0.0113)
$D.summer_house_{ij}$	-0.0128*** (0.00482)	-0.0116*** (0.00517)	-0.0170*** (0.00400)	-0.0241*** (0.00722)	0.0118*** (0.00505)	0.0425*** (0.0101)	0.0244*** (0.00512)	0.00913 (0.0114)	-0.009*** (0.0039)	0.001 (0.0031)
$D.theft_rate_{ij}$	-0.0613* (0.0366)	-0.146*** (0.0400)	-0.0917*** (0.0314)	-0.0178 (0.0564)	0.0981*** (0.0394)	0.0845 (0.0805)	0.0595 (0.0388)	-0.0243 (0.0926)	0.052* (0.0296)	0.039* (0.0231)
$D.childcare_{ij}$	-0.335*** (0.0554)	-0.115* (0.0589)	0.0560 (0.0459)	0.253*** (0.0828)	-0.0928 (0.0576)	-0.0513 (0.119)	0.132*** (0.0585)	0.0707 (0.137)	0.058 (0.0448)	-0.090*** (0.0346)
$D.pop_ \%_mid_edu_{ij}$	-1.124*** (0.0903)	-0.371*** (0.0966)	0.645*** (0.0743)	1.073*** (0.135)	-0.364*** (0.0923)	-0.278 (0.185)	-0.111 (0.0912)	0.0127 (0.203)	0.115 (0.0717)	-0.086 (0.0558)
$D.pop_ \%_high_edu_{ij}$	0.599*** (0.0586)	0.172*** (0.0637)	-0.132*** (0.0490)	0.190*** (0.0896)	0.129*** (0.0602)	0.0247 (0.122)	-0.0468 (0.0596)	0.527*** (0.134)	-0.087* (0.0473)	0.193*** (0.0361)
$D.stud_ \%_mid_edu_{ij}$	0.815*** (0.0595)	0.313*** (0.0649)	-0.160*** (0.0511)	-0.200*** (0.0931)	0.120* (0.0641)	0.158 (0.131)	0.0686 (0.0628)	0.687*** (0.147)	-0.125*** (0.0470)	0.186*** (0.0374)

Table 3 (continued)

Dep. Var.: $mig_{ijt(1)-t(0)}^e$	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)
$D_{stud_}\%_{high_edu_{ij}}$	0.214*** (0.0200)	-0.149*** (0.0217)	0.0151 (0.0173)	-0.0541* (0.0307)	-0.0642*** (0.0217)	-0.0402 (0.0447)	0.0207 (0.0217)	-0.134*** (0.0510)	0.102*** (0.0162)	-0.046*** (0.0113)
$geodist_{ij}$	-1.275*** (0.0115)	-1.414*** (0.0122)	-1.477*** (0.00956)	-1.581*** (0.0173)	-1.535*** (0.0119)	-1.613*** (0.0238)	-1.314*** (0.0121)	-1.532*** (0.0260)	-1.240*** (0.0831)	-1.366*** (0.0689)
$neighbor_{ij}$	-0.235*** (0.0396)	-0.343*** (0.0408)	-0.687*** (0.0304)	-0.488*** (0.0554)	-0.445*** (0.0383)	-0.580*** (0.0696)	-0.332*** (0.0420)	-0.356*** (0.0770)	-0.168*** (0.0326)	-0.268*** (0.0278)
$island_i$	0.162*** (0.0760)	0.543*** (0.0907)	0.432*** (0.0779)	0.507*** (0.1510)	0.253*** (0.0872)	0.651*** (0.1870)	0.639*** (0.0818)	0.499*** (0.1880)	0.205*** (0.0686)	0.305*** (0.0684)
$island_j$	1.145*** (0.114)	0.502*** (0.104)	0.279*** (0.0710)	0.197 (0.1280)	0.727*** (0.0833)	0.569*** (0.1660)	0.804*** (0.0723)	0.674*** (0.1980)	0.417*** (0.1200)	0.353*** (0.0630)
pop_i	1.528*** (0.0127)	1.245*** (0.0131)	0.952*** (0.0097)	1.034*** (0.0176)	0.922*** (0.0116)	0.820*** (0.0228)	0.866*** (0.0118)	0.793*** (0.0250)	1.244*** (0.0109)	0.882*** (0.0092)
pop_j	1.133*** (0.0120)	1.251*** (0.0129)	1.003*** (0.0096)	1.156*** (0.0178)	0.931*** (0.0120)	0.885*** (0.0231)	0.898*** (0.0120)	0.780*** (0.0248)	1.196*** (0.0114)	0.845*** (0.0089)
Obs	67,860	67,860	67,860	67,860	67,860	67,860	67,860	67,860	67,860	67,860
τ	0.00438 (0.0180)	0.202*** (0.0186)	-0.363*** (0.0192)	0.959*** (0.0235)	0.165*** (0.0195)	1.074*** (0.0370)	0.377*** (0.0191)	0.809*** (0.0417)	-0.230*** (0.0179)	-0.286*** (0.0143)
LR-test ($\tau = 0$)	52,666.2***	37,592.3***	22,407.7***	19,040.2***	28,948.7***	1461.9***	18,696.1***	3500.1***	8506.5***	18,558.9***
Vuong test z-statistic (ZINB vs. NegBin)	7.502***	9.294***	9.229***	34.64***	11.56***	21.77***	12.49***	7.841***	8.336***	10.37***

Heteroskedasticity-robust standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. A constant term is included in the regressions but not reported here

Table 4 Summary of rejection rates for coefficient equality of variables in migration model across event groups

	Education	Graduation	Partner	Child	Divorce	Widow	Empty nest	Retire
Education	–							
Graduation	78%	–						
Partner	94%	72%	–					
Child	83%	61%	56%	–				
Divorce	83%	72%	50%	61%	–			
Widow	72%	78%	72%	67%	67%	–		
Empty nest	67%	78%	50%	56%	50%	56%	–	
Retire	78%	67%	67%	56%	50%	61%	44%	–

Rejection rates are calculated on the basis of pairwise Wald tests for coefficient equality for all variables included in the NegBin specification of the migration model. Detailed test results can be found in Tables A3–A20 in the supplementary appendix. For further details on the test setup see main text

factors (population and distance) explain about two thirds of this variation (see Table A23 for details).

For households having children, migration is negatively correlated with interregional unemployment differences showing the largest coefficient across event groups (see Panel A of Fig. 4). However, other negative associations such as housing market conditions (i.e., a relatively higher house prices and higher shares of rental housing across Danish LAU1 regions) and local amenities also matter. Especially population structures explain a larger part of the estimated migration response for the group having newborns in the household (see Table 5). Taken together, the results shown in Fig. 4 and Table 5 underline a pattern of moving into suburban neighborhoods and hinterlands with affordable housing and quality pre-school education for the event of having children in household. It is also noteworthy that households having children positively respond to the average price for childcare tuition in a municipality as an indicator of the quality of public services in a region (Panel E of Fig. 3 and Table 5). Only for the retirement group, we also observe a positive association with childcare tuition, which potentially points to the role of inter-generational family migration. All other event groups show an insignificant or negative migration response to higher childcare tuition prices. We take this as another indication for the fact that precisely defined migration groups are essential for the identification of relevant context factors.

Several other event groups show a complex migration pattern: Migration flows for the event groups education, retirement, and empty nest are positively correlated with unemployment rates (Panel A of Fig. 3). For the group of migrants starting a job-qualifying education this is predominately associated with a movement to larger urban areas, which have relatively higher unemployment rates compared to smaller municipalities in the Danish economic geography. Finding a positive correlation between migration for this event group as well as with higher house prices and a higher share of rental housing underlines this interpretation. The most important regional context factor for this event group is the share secondary and tertiary

Table 5 Migration profiles by event groups and relative contribution of regional context factors

Event group	Positive migration factor (relative importance in %)	Negative migration factor (relative importance in %)
Education	Share secondary and tertiary students in local pop. (8%) House prices and share of rental housing (5%) Share of population with tertiary education level (3%) Unemployment rate (1%)	Share of population with secondary education level (4%) Share of industrial employment (2%) Average price for childcare (1%) Share of summer houses (1%)
Graduation	House prices (5%) Share of population with tertiary education level (3%) Share of secondary students in local population (2%) Disposable income level (1%)	Share of tertiary students in local population (3%) Share of industrial employment (2%) Share of population with secondary education level (2%) Theft level (2%) Share of rental housing and summer houses (2%) Unemployment rate (1%)
Partner	Share of population with secondary education level (3%)	Share of population with tertiary education level (1%) Share of secondary students in local population (1%) Share of rental housing and summer houses (2%) Theft level (1%)
Child	Share of pop. with secondary and tertiary education level (6%) Share of industrial employment (4%) Average price for childcare (1%)	House prices, share of rental housing and summer houses (5%) Share of secondary and tertiary students in local population (3%) Unemployment rate (1%)
Divorce	House prices and share of summer houses (3%) Share of population with tertiary education level (1%) Theft level (1%)	Share of population with secondary education level (2%) Share of tertiary students in local population (1%)
Empty Nest	Share of summer houses (3%) Unemployment rate (2%)	Share of rental housing (3%)
Retire	Share of summer houses (1%) Unemployment rate (1%) Share of industrial employment (1%) Average price for childcare (1%)	Share of rental housing (2%)
Widow	House prices (6%) Share of secondary students in local population (6%) Share of population with tertiary education level (4%)	Share of tertiary students in local population (3%)

Based on results from Table 3 for statistically significant coefficients estimates with $p < 0.05$. Relative importance is measured as the contribution of the individual variable's standardized coefficients to the total explained variation in migration flows. For details see Table A22 and A23 in the online supplementary appendix

students in the local population, which explains about 8% of the observed variation in migration flows for this event group (Table 5).

For “empty nest” and retirement migration the positive response to regional unemployment differences tells another story. Here, migration profiles show that these groups move to peripheral areas with relatively weak labor markets but attractive recreational amenities proxied by a high share of summer houses in the local housing stock. Both groups show a tendency of moving out of municipalities with a high share of rental housing. When assessing these migration profiles it has to be mentioned, though, that the identified correlations are useful for categorizing event-specific migration but should not be interpreted as strict causal links at the regional aggregate level.

If we take a closer look at mobility costs proxied by geographical distance between municipalities, Table 3 confirms that greater distance between i and j reduces migration, as predicted by gravity models of migration. Distance decay is significant for all groups, but Wald tests reject equality across groups (Table A15). The decay is smallest for education and retirement migrants, reflecting relatively high shares of long-distance moves, either to educational institutions or attractive retirement locations, consistent with the positive correlation between retirement migration and summer house density. The estimation results also show a depopulation trend from municipalities constituting an isolated island. Binary Probit regression results for zero migration flows (Table A21, online appendix) support the count data findings.

5.2 Illustrative policy analysis: commuter tax allowances

The event-group-specific migration approach can be used to analyse different policy interventions, such as taxes and the relocation of state jobs, from a migration perspective that differs from that of previous studies (Lauridsen and Skak 2020; Madsen et al. 2020; Sandholt Jensen et al. 2025). We illustrate the use of event group-specific migration data for one such policy analysis. In 2004, a tax exemption reform (“commuter tax allowance”) was established in Denmark, so that citizens in certain “outlying” (*udkant*) or peripheral municipalities were allowed a more generous tax reduction for long-distance transport to work (Skatteministeriet 2024). A total of 50 municipalities were selected for this treatment based on criteria such as low economic growth, long commuting distances, and generally lower income levels of the regional population. The intention of the reform was to counter a depopulation trend from out-migration in these regions by attracting younger citizens, couples and families. By reducing commuter costs and thus increasing net disposable income for citizens in these regions it should become more attractive to continue living or migrating to these regions in combination with increased commuting to work. Preliminary evidence has shown that this policy induced more commuting and increased tax-deductible income in treated municipalities (Lauridsen and Skak 2020) but no evidence is yet available for a potential positive population effect.

To provide such evidence, we extend the regression model presented in Table 3 by adding dummy variables to the migration equation that indicate if regions i and

j are subject to the tax exemption reform, i.e. the binary dummies take a value of 1 if the (origin and/or destination) region is treated by the tax reform and is zero otherwise. Table 6 presents the coefficients and the difference in coefficient for the included dummy variables. For the latter, variations arrive from two alternatives: (1) the destination region i is treated but the origin region j is not, (2) the origin region j is treated but the destination region i is not (otherwise the difference of the two dummies is always zero). The extension of the migration model hence allows to test for the relative strength of push and pull effects from the policy; however, since the policy is already in place for our estimation sample 2007–2012, the estimated results cannot be interpreted in a rigorous causal “with-without” manner as pre-treatment difference between municipalities are not considered.

As the results in Table 6 show, the coefficient for origin regions subject to the tax allowance scheme is positive and statistically significant, indicating that regions subject to the tax allowance scheme experience higher out-migration *ceteris paribus*. At the same time, in-migration is higher in municipalities subject to the tax allowance scheme as well. When comparing the coefficient difference of the dummies in a net perspective, the reported Incidence Rate Ratio tells us by what factor migration flows increase when the destination is treated instead of the origin (and vice versa). For the event group of migrants starting a job-qualifying education, this implies that migration flows to i from j are about 17% higher when the destination municipality is treated (and respectively lower when the origin region is treated). While this speaks in favor of the tax allowance scheme as a positive population factor for treated regions, Table 6 shows that for all other event groups the coefficient differences are either statistically insignificant or negative (for migrants in the targeted event groups of graduates and couples).

Taken together, these results indicate that the special tax allowance scheme for outlying and peripheral municipalities cannot stop depopulation in these municipalities in absolute terms, i.e., region subject to this scheme still lose population through out-migration. As outlined above, however, the estimated correlations

Table 6 Event group-specific migration responses to a commuter tax allowance

Event group	$commuter_tax_i$	$commuter_tax_j$	$D.commuter_tax_{ij}$	Incidence Rate Ratio (IRR)
Education	0.466*** (0.0327)	0.309*** (0.0274)	0.157*** (0.0427)	1.17
Graduation	0.370*** (0.0342)	0.460*** (0.0309)	−0.090** (0.0460)	0.91
Partner	0.339*** (0.0255)	0.414*** (0.0253)	−0.075** (0.0359)	0.93
Child	0.254*** (0.0460)	0.241*** (0.0519)	0.013 (0.0694)	1.01
Divorce	0.433*** (0.0328)	0.431*** (0.0317)	0.002 (0.0456)	1.00
Empty nest	0.324*** (0.0658)	0.459*** (0.0688)	−0.135 (0.0953)	0.87
Retire	0.507*** (0.0308)	0.545*** (0.0317)	−0.038 (0.0442)	0.96
Widow	0.454*** (0.0758)	0.624*** (0.0692)	−0.170* (0.1026)	0.84

The Incidence Rate Ratio has been calculated as $IRR = \exp(D.commuter_tax_{ij})$. Other covariates included in the migration model as shown in Table 3. Heteroskedasticity-robust standard errors are reported in parentheses

should only very carefully be interpreted as “treatment” effects in a strict causal sense, since we cannot model the “with-without” case properly in the light of treatment endogeneity.⁸

An alternative use of our meso-level migration modeling approach is as a life-event-augmented satellite module for large-scale population projection models such as LINE (Local Intersectoral and Interregional Economic Model) in Denmark (Madsen & Jensen-Butler 2004). By explicitly modeling migration as a sequence of individual life events, this framework captures the behavioral and life-course drivers of internal moves in a way that traditional aggregate models cannot, providing a more behaviorally grounded foundation for projections. This approach has been applied, e.g., in Madsen et al. (2020), who use event-based population projections until 2030 to illustrate the potential impact of alternative policy interventions, including relocating state employment and education capacity between regions, on regional population levels, age structures, and local labor markets.

6 Conclusion

In this paper, we have adopted a comprehensive life-event perspective to examine the role of regional context factors for interregional migration flows in Denmark. By leveraging detailed register data covering the entire Danish population and their household associations, we have constructed migration flow matrices for eight mutually exclusive life-event groups, capturing labor market transitions, family status changes, and residential mobility. This life-event focused approach allows us to systematically evaluate group-specific migration responses to regional conditions, revealing that analyses based on aggregate migration data that mix multiple life events may obscure important heterogeneity and lead to misleading conclusions when testing theoretical predictions from migration models and conducting policy-based scenario analyses.

Our findings highlight substantial variation in how regional attraction factors relate to migration across life-event groups. For example, individuals entering job-qualifying education tend to move to urban areas with high peer density and rental housing availability; graduates respond primarily to labor market signals; households with children relocate to hinterlands offering affordable housing and high-quality pre-school options; and later-life movers, including empty-nesters and retirees, are drawn to areas with higher homeownership rates and a high summer house density. Distance sensitivity also varies across life stages, with education and retirement-related moves often covering longer distances. While our regression-based analysis does not allow for strict causal claims, it provides rich insights into specific migration profiles across life events and illustrates how regional context factors

⁸ To do so we would need to have information on how strong out-migration was in outlying and peripheral municipalities, which differ in terms of their regional characteristics to non-treated regions, prior to policy introduction (implying that the introduced tax allowance scheme could have slowed down the observed out-migration trend). Given a territorial reform in Denmark in 2006, such pre-treatment data is unfortunately not available.

contribute to migration-induced demographic change, with implications for spatially targeted policy interventions, such as the Danish tax allowance reform for peripheral regions or the relocation of state jobs.

Taken together, the contribution of this study lies in its meso-regional approach, which disentangles migration behaviors across key stages of the life course pointing to the relative role of labor markets, the housing market, public services and further local amenities for different life transitions. A limitation of our approach, though, is that linking and comparing different life events in a unified modeling framework lacks the possibility to study individual events in greater depth. Building on this framework, future research should thus explore this limitation by, for instance, distinguishing between positive and adverse events, or sequential combinations of transitions over the life course. Combined with the results presented here, this can deepen our understanding of the interplay between individual life trajectories and regional factors, supporting regional policymakers to anticipate, plan, and tailor interventions for diverse population needs, supporting sustainable economic, social, and demographic development.

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Declarations

Conflict of interest The authors confirm that there have been no involvements that might raise the question of bias in the work reported or in the conclusions, implications, or opinions stated.

Declaration of generative AI use During the preparation of this work, the authors used ChatGPT (OpenAI) to improve the language, clarity, and structure of the manuscript. All outputs were critically reviewed and revised by the author(s), who take full responsibility for the content of the published article.

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