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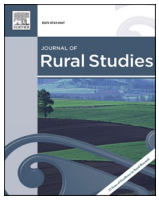

Running to stand still? Finding levers to address population shrinking in the Northern Territory of Australia

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ABSTRACT

Population shrinkage in rural Europe has echoes with demographic trends in Northern Australia, where some areas have experienced low growth or shrinkage for around a decade due to negative internal migration outcomes. Despite targeted policies to stimulate long-term growth, regions in Northern Australia struggle to attract and retain the 'right' sort of populations. Emblematic of this, the Northern Territory, Australia's most sparsely settled jurisdiction, had 32 successive quarters of negative internal migration leading up to the COVID pandemic and exchanges a fifth of its population each year through migration, births and deaths. It imports large numbers of early-career aged workers, most of whom leave in their 30s or early 40s. Constant inflows of new residents with a considerable risk of near-future out-migration sees the population 'Running to stand still,' with upticks in jobs and economic activity leading to future poor migration outcomes. Governments are interested in economic levers for internal migration and in this study, we analyse long-term data for key macroeconomic variables for the Northern Territory to ascertain their significance as leading correlates for improved net interstate migration. We find residential property prices are most significant but, against perceptions, jobs vacancies do not positively influence internal migration outcomes. The results emphasises the Northern Territory Government's limited volition to turn-around migration through its own macroeconomic settings, leaving it subject to external conditions. Constraints in economic levers mean other facets for attraction and retention, such as qualitative elements like quality education, lifestyle facilities, enhancing social networks and promoting the Territory as a place for multi-residence workers or retirees need to be considered in developing a holistic approach to population stagnation.

1. Introduction

Although this special issue is focused on population challenges for rural areas of Europe, parallels to rural and remote regions elsewhere can provide a basis for devising policies and pathways towards stronger, more connected, resilient and prosperous rural areas within Europe. Indeed, these are the aims embedded in the Action Plan of the European Union's long-term vision for rural areas (European Union, 2021). This plan bears echo to an ambitious Australian national policy to facilitate economic and population growth in the northern half of the country. Labelled 'Our North, Our Future' (see Australian Government, 2015), this policy features a multi-billion-dollar investment fund and has the aim of quadrupling the population of the region from 2015 to the year 2060. It identifies the small and slowly growing population as the key impediment to expanding economic growth across the north (Australian Government, 2014, p. 109), calling for transformational and rapid growth to quadruple the population size from one to four million. Unfortunately, the policy was enacted at a time when population growth in the region was transitioning from above-average to its 'resting state' of low growth and subsequently has been shrinking in some areas (Taylor et al., 2022).

As for Northern Australia, low growth or shrinkage in the European rural context has persisted and is perceived as a 'wicked problem' (as so described by Tietjen and Jørgensen, 2016) in need of remission. Shrinkage is a demographic process which sees regions losing population over the long-term. Grasland et al. (2008), for example, proposed the term only be applied to population loss over a generation; thus negating short-term fluctuations in populations and embodying the complex interaction or culmination of past and recent trends in fertility and migration, as well as intervening economic and other shocks or structural changes.

Interest in rural European population shrinkage has stimulated

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studies, projects and investments under the three broad umbrellas: a.) describing, analysing and specifying trends and themes conveying the extent of the issue (for example Copus et al., 2021; Piras and Grunfelder, 2020), b.) advocating for the value of rural areas to raise awareness and stimulate action (such as Membretti et al., 2022), and c.) policy and other initiatives aimed at rectifying the issue (for example Government of Newfoundland and Labrador, 2023). The diminishing ability of rural areas to attract and retain both internal and overseas derived residents has also encouraged studies addressing the 'so what' aspect of rural shrinkage. Some European scholars have called for changed societal perspectives on 'the problem' from the standpoint of accepting the process and adapting to it, rather than striving against it (for example OECD, 2020). Furthermore, some rural residents themselves might agree with this tenet, on the basis of observations about the impacts from population growth on rural amenity, quality of life and natural assets (Crommelin et al., 2022; Hunter et al., 2005; Saint Onge et al., 2007).

These diverse perspectives raise the contestable question of what would constitute a 'solution' for those regions who wish to transition from the long-term observed trends and metrics to something different? For governments of sub-national jurisdictions in Australia (its States and Territories), one priority is to maintain or increase jurisdictional share of national population to maintain financial transfers from the national pool of Goods and Service Taxes. At the local government level, authorities are generally pro-growth because it equates with a broader financial base via residential rates levies. However, for residents and other interest groups, factors like amenity, biodiversity, environmental conditions and lowering population churn can be of primary concern, with growth a potential obviation to these. With environmental impacts from human causes becoming more noticeable, Tietjen and Jørgensen (2016) have argued that, in the European rural context, the alternative and desired set of conditions will be heavily influenced by the unique and complex historical, social and economic factors observable at the very local scale. This perspective was likewise proffered by scholars examining sparsely populated areas in Australia and elsewhere, in arguing for the importance of understanding local diversity and dynamicism in the demography and economies of rural and remote regions (for example, Carson et al., 2011; Karacsonyi and Taylor, 2022), as well as the role of history in 'locking-in' demographic trends such as a male bias, extreme population churn, and a reliance on certain age groups for in-migration and economic functioning (Dyrting et al., 2020; Martel et al., 2013; Saxinger et al., 2016).

In all cases, governments are pivotal for the population and economies of rural areas (Huskey and Taylor, 2016). Revenue transfers per capita tend to be higher for rural residents, in compensation for the higher costs associated with distance, costs of production and salaries. Moreover, the government sector is often a prominent industry of employment in rural areas (Carson et al., 2011). Consequently, governments look to reduce transfers to rural areas by facilitating growth from within. This is certainly the chief aim of present-day policy for developing Northern Australia which aims to significantly grow the economy and population of the north. With just 5 % of the national population (1.1 million residents), but covering over half of the nation's landmass, much of Northern Australia is very sparsely populated. While there are three comparatively large cities in the north – Townsville (population 198,000), Cairns (172,000) and Darwin (the capital city of the jurisdiction of the Northern Territory at 150,000 residents) (ABS, 2023), into which an increasing share of the population is residing, the areas outside these are extremely sparsely populated.

As for parts of Europe, most parts of Australia's north have experienced prolonged periods of population stagnation or decline, commencing at the end of the large 'mining boom', which ran from 2003 to 2012, and precipitated national and regional economic and population growth in many parts of the rural north (Taylor et al., 2022). Since then, the prevailing trend has been of low growth, stagnation or, in some areas, decline; despite intermittent periods of stronger economic growth in some areas therein.

Rural development literature demonstrates the north of Australia is far from alone in the challenge of redressing low growth or shrinkage (for example, Finlay and Haan, 2024). However, one point of difference is the extent of population sparsity for Northern Australia. Karacsonyi and Taylor (2022) found sparsity itself was the principal factor for its prevailing economic and demographic conditions. The Northern Territory, for example, comprising the middle section of northern Australia and the focus of this study, is the fifth sparsest sub-national aerial unit on the planet, with the four most sparsely populated all being ice-encrusted jurisdictions. The study above finds that stable and sustained growth requires regions in the north like the Northern Territory to 'become' less remote and less isolated. In practice, this means not only growing population size but also addressing the dynamics of growth and the factors impeding growth, including social and infrastructure constraints. Dynamics of growth in the Northern Territory sees it importing significant numbers of early-career workers from the rest of Australia whose probability of leaving is high due to their stage in life and the career trajectories they follow (Dyrting et al., 2020). In fact, combining births, deaths and migration sees on average a fifth of the Northern Territory's population replaced each year. This creates extensive costs for the economy, businesses, governments, and others in replacing staff, as well as the loss of social and institutional capital.

Despite these predominant demographic characteristics above, Northern Australia's populations do feature some stable cohorts including the significantly sized First Australian population of Aboriginal and Torres Strait Islander peoples who comprise approximately 20 % of its total population. In the Northern Territory this is one-third. Ageing is also built-into the Northern Territory's long-term population dynamics (known as structural ageing) with many anticipated to leave as they approach or move into post-workforce ages. . Out-migration probabilities for Indigenous people in the Northern Territory are low and, for those who do leave, return migration probabilities are far higher than for others (Taylor and Dyrting, 2019). This is in stark contrast to the those who migrate into the Northern Territory from another State or Territory and are in the high-churn early-career cohort. This group constitutes 60 % of all in-migration from the rest of Australia and it is this cohort which drives internal migration outcomes (Dyrting et al., 2020; Martel et al., 2013).

As with shrinking regions in Europe, market forces alone, such as increasing jobs, are unlikely to counter the pervasive demographic and economic drivers of decline in Northern Australia. Consequently, policy interventions become necessary—particularly when the prevailing political view favours reversing shrinkage and promoting growth. This growth-oriented stance is also observed in the political discourse in the Northern Territory by current and past governments. ESPON (2017, p. 7) identified three broad types of policy responses to shrinkage in Europe in recent decades: take no action, attempt to stimulate population growth, or accept decline and manage its consequences. In practice, the choice of response will depend on internal political dynamics, which are not always aligned with the most effective strategies. Ideally, policy responses should be grounded in robust research, a sound understanding of the demographic and economic factors contributing to shrinkage, evidence of what has successfully mitigated such trends elsewhere, and thorough evaluations of past initiatives within the same region.

In the context of the Northern Territory, the intersectionality of geographic sparsity, population stagnation or decline, and economic constraints raises a critical question: are there macroeconomic levers capable of disrupting the persistent pattern of low population growth by addressing net interstate migration outcomes? A key indicator of success would be a shift in internal migration trends from net negative to net positive, given that this is the primary driver of population change. Although successive governments have focused on job creation as a strategy to stimulate growth, this approach relies on attracting populations who are unlikely to stay long-term because they are a group who are already mobile and seek to progress their career through a move

to the Northern Territory (Dyrting et al., 2020). Attracting mobile residents results in the Territory effectively 'running to stand still'. Population gains in one year are frequently offset by high levels of out-migration in subsequent years, leading to stagnation or low growth. This is consistent with findings by Dyrting et al. (2020, p. 444), who reported that only 51 % of Australian-born early-career residents intended to remain in the Territory two years after arrival. This high turnover underscores the need to identify economic and policy levers to improve net internal migration outcomes, with a focus on attracting and retaining demographic groups beyond the early-career cohort, to increase the share with a greater likelihood of longer-term settlement.

To identify the macroeconomic factors associated with shifts in internal migration outcomes in the Northern Territory, this analysis draws on fifty years of internal migration data for the region. The Northern Territory, situated in the central portion of Australia's northern landmass, epitomises the difficulties of achieving consistent and broad-based economic and demographic growth in Northern Australia. These challenges persist despite periods of rapid, though often volatile, growth and reflect the Northern Territory's historical performance (Taylor and Carson, 2017). Over most quarters and years, population statistics for the Northern Territory reveal strong net increases from natural population growth, modest gains from overseas migration, but substantial losses due to net internal migration. Addressing this persistent internal migration deficit is therefore central to shifting the Territory's demographic trajectory from one of stagnation or marginal growth toward sustained and stable population growth year-on-year.

2. Fundamentals of population growth in the Northern Territory of Australia

Population growth rates in the Northern Territory are primarily driven by Net Internal Migration (NIM) - the balance between individuals migrating to the Territory from other Australian jurisdictions and those leaving for elsewhere in the country. Historically, periods of negative NIM, which have characterised much of the past four decades, have corresponded with low or negative population growth. Conversely, when NIM turns positive, population growth rates tend to surge. These shifts do not follow a cyclical pattern; instead, the data reveal distinct eras marked by clusters of either net positive or net negative years. These eras vary both in magnitude (the degree of net migration gain or loss) and in duration, with no apparent consistent pattern in the length or scale.

Fig. 1 illustrates four decades of Northern Territory NIM and population growth data for the Northern Territory. NIM outcomes are represented by the coloured bars, with blue indicating year(s) of net positive migration and orange indicating net negative migration. The absolute NIM values are in the left-hand vertical axis, while the population growth rate—depicted by a black line—corresponds to the right-hand vertical axis. All data reflect the situation during the year to 30 June the preceding year.

Fig. 1 highlights the Territory experiences prolonged net negative migration eras, punctuated by much shorter periods of net positive migration. Notably, during negative NIM eras, the annual population losses often exceed the gains experienced during positive years, contributing significantly to stagnating or declining population growth. The most recent negative era began in 2009–2010 and persisted through to the onset of the COVID-19 pandemic. During the pandemic, reduced out-migration resulted in a brief period of net positive NIM. However, this respite was short-lived. The negative trend resumed, culminating in record losses in 2017–2018, 2018–2019, and again in 2022–2023, before a large net negative of almost 4000 in 2023–2024 where the Territory lost approximately 2.5 % of its total non-Indigenous population through net internal migration alone.

To address these ongoing demographic challenges, the Northern Territory Government has implemented a number of population policies over the past decades. These efforts have largely centred on job creation as the primary strategy to drive economic growth and attract new residents. The underlying assumption is that increasing employment opportunities will directly lead to population growth. For instance, the 2018–2028 Population Policy (Northern Territory Government, 2021) aimed to create 21,000 jobs over ten years, with the goal of increasing the population by 2,600 people annually (Human Resources Directorate, 2018). However, the assumption of job vacancies being a pre-cursor for population growth has not been empirically tested, along with other macroeconomic factors. As a result, the opportunity to develop more targeted, evidence-based policy responses that draw on validated drivers of population change, and in particular NIM, may have been overlooked.

The Northern Territory consistently attracts a high number of interstate migrants in their twenties, many of whom subsequently depart in their early to mid-thirties. As illustrated in Fig. 2, this age-related migration pattern has remained a defining feature of the Territory's demographic dynamics for at least the past fifty years. The heatmap visualises NIM by single-year age groups from 1979 to 2023, using colour to convey both direction and intensity—blue for net positive NIM and red for net negative NIM, with the extent of saturation indicating the intensity or magnitude of the net gain (blue) or loss (red). The horizontal axis also includes a colour-coded representation of the overall NIM direction for all ages (single year) in each year of the fifty-year tiume-series. The heat map echoes the era-based categorisation shown in Fig. 1 but in fine grained detail showing the reliance over the entire period on

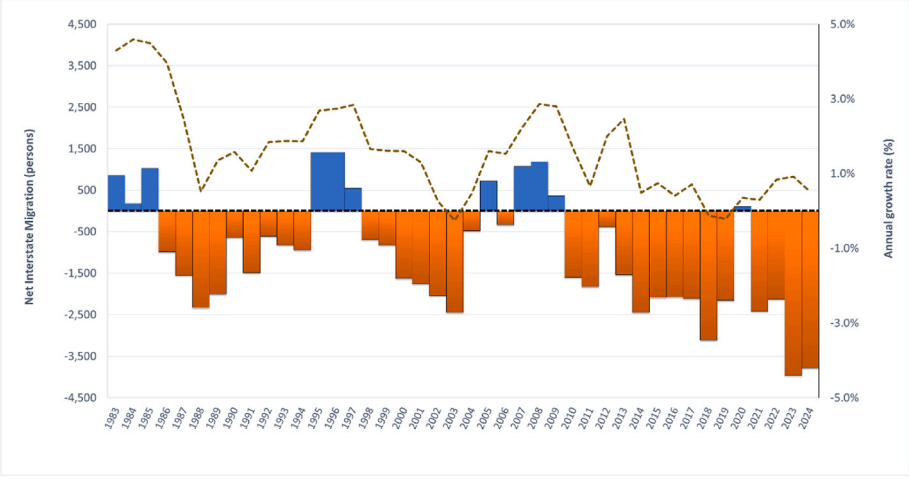

Fig. 1. Northern Territory NIM and annual population growth rate, 1983 to 2024. *Source*: Based on ABS data (ABS, 2024a,b). *Note*: Data are for the year to 30 June.

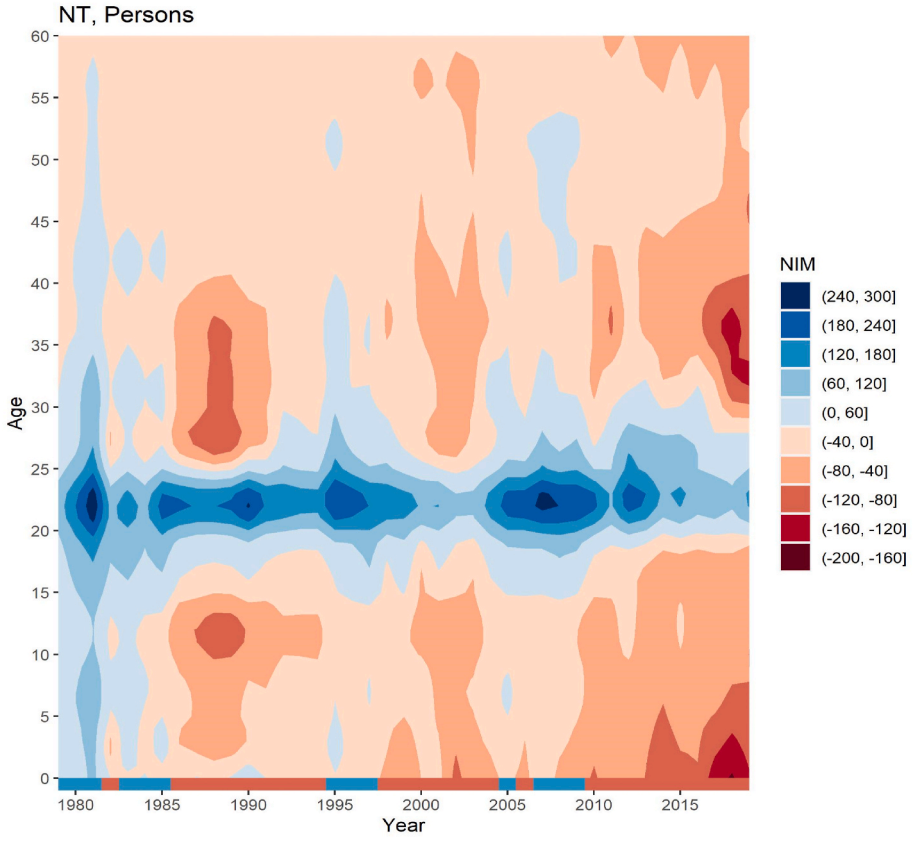

Fig. 2. Northern Territory Net Interstate Migration by Age, 1979–2019. Colour strip at the bottom indicates a total net positive (blue) or negative (red) NIM. *Source*: Compiled by authors based on custom ABS data. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

the net migration of those in their 20s. It underscores the entrenched nature of the Territory's migration profile as it continues to run-to-stand-still through a consistent inflow of younger adults, and their subsequent outflow as they age.

The pronounced 'tunnel' of blue shading in Fig. 2 is particularly prominent during the late 1970s and early 1980s, reflecting the substantial influx of interstate migrants following the reconstruction of Darwin in the aftermath of Cyclone Tracy in 1974, which had devastated the city. The figure also visually captures the associated net inflow of children during this period, likely arriving as part of young families relocating to the Territory. While the strong net inflow of early-career individuals has remained a definitive characteristic of the Northern Territory's migration profile the intensity of this inflow has declined since around 2014, suggesting a weakening of this long-standing demographic trend of population gain coming almost exclusively from early-career inflows.

Fig. 2 also reveals a marked increase in net negative migration among individuals aged in their mid-30s to mid-40s, and their children, from 2014 onwards, with the intensity of out-migration growing over time. Additionally, from around 2010, there is clear evidence of negative NIM emerging among older age groups, reflecting the ageing of a cohort of long-term residents who began transitioning into retirement during the first two decades of the century. While the Northern Territory's population is ageing, this demographic shift is not being offset by an influx of retirees from other parts of Australia. As a result, the out-migration of older residents is contributing to demographic decline without corresponding gains from interstate retirement migration, exacerbating the Territory's structural population challenges.

The summation of the data in Fig. 2 is that the Northern Territory has a deeply entrenched and age-specific migration profile characterised by a high rate of population churn. This pattern is largely driven by the inflow and subsequent outflow of early-career individuals, a life stage that has historically underpinned periods of population growth. However, the intensity of this inflow has declined in recent years, with downstream effects on other demographic groups, particularly children. In the absence of sufficient offsetting gains from overseas migration, the Territory faces the prospect of a demographic cliff in the coming years. The prospect of this is enhanced by ageing in the Aboriginal and Torres Strait Islander population and large declines in the Total Fertility Rate for these in the past thirty years. Without effective policy interventions to influence internal migration patterns, the Northern Territory's capacity to sustain population growth and economic stability will be challenged.

3. The macroeconomic environment and territory NIM

Classical migration theory highlights interrelationships between economic pull and push factors for migration across borders; whether international or internal borders, such as States and Territories in the case of Australia. Theories such as Lee's seminal 1966 theory of migration link the enactment of migration by an individual to an expectation of better economic (and other) outcomes in a new location (destination) and an ability to overcome obstacles which might impede migration from the source to the destination (Lee, 1966). However, it is widely recognised that a range of complex non-economic factors operate in parallel to determine migration flows in Australia and beyond. These include social, environmental, and lifestyle factors, as well as the opportunity costs of moving or not moving. Migration decisions are complex and vary across the life-stage according to a mix of considerations for the potential migrant and their families. Available research on individual economic, personal and familial drivers for migration to and away from the Northern Territory (for example Dyrting et al., 2020;

Maertens and Taylor, 2018; Thurmer et al., 2019), confirms jobs and careers as significant factors.

For the Northern Territory specifically, it might be hypothesized that favourable employment conditions internally would precede increasing in-migration and thus a likely improvement to the NIM position. Likewise, strong house price growth might be viewed as a leading indicator for higher out-migration as housing becomes relatively more affordable elsewhere. Understanding historical leading and lagging correlates such as these provides a framework for forecasting future NIM positions and for devising policies and interventions to improve NIM and subsequently population growth outcomes; as well as anticipating likely secondary effects like changes in the demand for housing, services and goods in the Territory economy. However, identifying clear links between individual macroeconomic indicators and Northern Territory NIM is complex and, where identified, the explanatory power of individual indicators may be limited due to complexities around the interconnectivity, interdependency and feedback effects for individual variables, as well as lags and deficiencies in data. Overlaying this, some indicators may be leading and some lagging, with the period of lag or lead being unknown without ongoing analysis.

Nevertheless, and emphasising the need for the research here, the authors have only identified one previous direct attempt to identify macroeconomic correlates for a northern Australian jurisdiction - that of Carson (2016). His exploratory analysis focused on variables correlated with either the absolute value or sign (positive or negative) of Territory NIM from the 1970s to the early 2000s, as well as correlates with a change in a NIM era - a transition from a negative to positive era or vice versa. The key findings of that research were.

- Strong links were found between NT NIM and housing costs outside the NT, particularly for Sydney. Declining housing costs elsewhere signified positive NIM for the NT.
- Falling youth unemployment and increasing job availability in many states, especially Queensland, Western Australia and Tasmania were associated with positive NT NIM.
- NT NIM was positive when employment conditions were like elsewhere in Australia.
- Relatively higher costs of living elsewhere were linked with positive NIM for the NT.
- Overall, internal macroeconomic conditions appeared to have little bearing on NT NIM.

Based on these findings, Carson suggested a 'peripheral' interstate migration system involving the NT and those parts of Queensland, Western Australia and Tasmania outside of their respective capital cities was in operation.

Carson (2016)'s research was an initial exploration of correlates with NT NIM. However, the period over which macroeconomic variables were modelled was just a three-year lag. Additionally, in conducting the work on assessing the relationship of macroeconomic correlates with a change in era, variables were sampled two-years prior to a change in era or defined as averages over an era, potentially limiting the predictive value of the analysis. Furthermore, Carson's work did not examine the economic climate in the NT; such that only exogenous macroeconomic variables were included in the modelling.

In this analysis we apply a twelve-year leading and twelve-year lagging period to an extended set of variables and focus on cross-correlations between predictive variables and NIM. We examine both economic variables for the NT economy for their cross-correlation with NT NIM, and the same set of indicators for other Australian States to assess the connections between economic conditions outside of that said jurisdiction and the directions in Northern Territory NIM. The aim is to provide methods which can be applied by other rural jurisdictions to identify factors which might be leveraged to help improve their migration outcomes and thus grow population. Equally, this study will identify macroeconomic variables not impacting statistically on NIM outcomes.

4. Data and methods

Data for interstate arrivals, interstate departures, and net NIM by 5-year age interval, state and territory was obtained by a custom data request with the Australian Bureau of Statistics for calendar years 1972–1997 and from ABS (2020b) for calendar years 1997–2020, leaving out the COVID impacted years of 2020–2022. During the COVID pandemic, NIM outcomes for the NT were bifurcated from the long-term averages with a small positive due to far fewer people migrating out, while arrival numbers fell by less, creating a small net positive in the year 2020 (see Fig. 1). The data was disaggregated into single years of age using polynomial interpolation (see Dyrting, 2018).

In terms of possible macroeconomic correlates with interstate migration we considered 5 variables: the consumer price index, gross state product, job vacancies, labour force status, and a residential property price index. Quarterly national, and capital city Consumer Price Index data for years 1948–2021 were from ABS (2021a), from which we constructed an annual time series of quarterly index numbers, quarterly percentage changes, and annual percentage changes. For the CPI covariate we used the annual percentage in the June number. Data for the June Gross Domestic Product (GDP) and state and territory Gross State Product (GSP) for years 1990–2020 were from ABS (2020a). Time series data modelled included level and annual percentage changes in chain volume, per capita chain volume, real gross state income, per capita real gross state income, and gross state product (current prices). For the GSP covariate we used the annual percentage change in chain volume GSP.

Quarterly national, state, and territory job vacancies data for years 1979–2021 was obtained from ABS (2021b). For the job vacancies covariate (JV) we used the May job vacancies time series. Quarterly national, state, and territory labour force status data for years 1978–2021 was obtained from ABS (2021c). For the general labour force status covariate (LFS) we used the June unemployment rate (original, ie without seasonal adjustment and smoothing). For the youth labour force status covariate (YLFS) we used the June unemployment rate (original) for 15–24-year-olds. Quarterly capital city residential property price data was from ABS (2021d). The data covers the years 1986–2021, although no single series spans the entire interval. We constructed an extended property price index from the residential property price index (2003–2021) by backcasting from it from September 2003 using quarterly percentage changes in the established house price index (1986–2005). For the residential property price covariate (RPPI) we used annual percentage changes in the June value of the extended property price index.

The relationship between an interstate migration times series and a macroeconomic time series was analyzed using lagged cross-correlations (R Core Team, 2022; Venables and Ripley, 2002). Given a migration time series $Y = [Y_1, \ldots, Y_n]$ and a macroeconomic time series $X = [X_1, \ldots, X_n]$, the lagged cross-correlation of X with Y is given by

$$\rho_t(X, Y) = \frac{1}{n} \frac{\sum_{i=\max(1,-t)}^{\min(n-t,n)} (X_{i+t} - \mu_X)(Y_i - \mu_Y)}{\sigma_X \sigma_Y} \quad (1)$$

where $\mu_.$ and $\sigma_.^2$ denote the mean and variance of a time series. Note that the lag t applies to the covariate X so that a positive value indicates a macroeconomic variable later and a negative value indicates one at an earlier time. Here we are interested in identifying variables that are potential leading indicators of migration and so are looking for significant cross-correlations at negative lags.

Fig. 3 is an example cross-correlation plot resultant from the above equations. The horizontal axis shows the lag, and the vertical axis shows the cross-correlation, in this case the Darwin RPPI with NT NIM. The horizontal lines above and below the lag axis indicate the 95 %

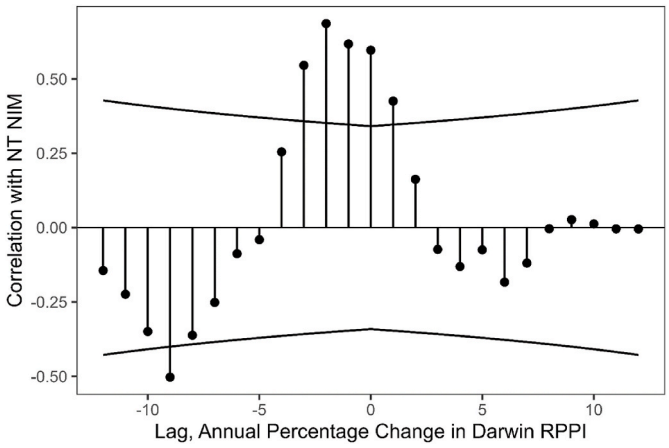

Fig. 3. Example lagged cross-correlation between the annual percentage change in the June Residential Property Price Index for Darwin and net interstate migration. Horizontal lines indicate the 95 % confidence interval. Source: Based on ABS data.

confidence interval for an observed cross-correlation assuming the actual cross-correlation is zero, so that cross-correlations outside the region bounded by these two lines are significantly different from zero. In this example, there is significant positive correlation between NIM and the annual percentage change in the Darwin RPPI one-to-three years earlier. Therefore, if we were to observe an increase in the RPPI index in year t, we would anticipate an increase to Northern Territory NIM in the following three years. Readers should note that the zero-lag time point is only provided for reference and should not be interpreted. Leading years to the right of year zero are provided to assess whether changes in the NIM influence the cross-correlated variable.

5. Results

We calculated lagged cross-correlations between total NIM and the suite of economic indicators outlined in the Methods above. Following Dyrting et al. (2020), and motivated by Fig. 2 we also calculated cross-correlations between the economic indicators and NIM decomposed into its contribution from the early-career life stage, ages 18 to 29, and the remainder (non-early-career NIM). The full set of 162 cross-correlation plots are provided as supplementary material to this article. In the following subsections we summarise results for each covariate. For each capital city or State and Territory we indicate either a statistically significant positive (+), negative (−) or statistically insignificant (0) cross-correlation for lags −5 to −1 (years) and highlight in bold those cases where we judge the potential for a leading indicator to be strong.

5.1. Residential property price index

Table 1 shows a significant positive correlation between the annual percentage change in the residential property price index for capital cities, other than Sydney and Melbourne, and Northern Territory NIM one-to-three years later. That is, when the RPPI for Brisbane, Adelaide, Perth, Hobart, Darwin or Canberra increases, we would anticipate Northern Territory NIM to increase one to three years later. For all except Adelaide, this applies to both the early-career and non-early-career groups. Figure A.16 shows that there is also a significant positive correlation between the annual percentage change in the Darwin residential property price index (RPPI) for both early-career and not-early-career NT NIM one-to-three years later.

Table 1
Summary of cross-correlations of RPPI with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	0	0	0	A.1, A.2
Sydney	0	0	0	A.3, A.4
Melbourne	0	0	0	A.5, A.6
Brisbane	+	+	+	A.7, A.8
Adelaide	+	+	0	A.9, A.10
Perth	+	0	+	A.11, A.12
Hobart	+	+	+	A.13, A.14
Darwin	+	+	+	A.15, A.16
Canberra	+	+	+	A.17, A.18

5.2. Consumer price index

Table 2 shows no significant correlation between CPI and early-career NIM, and significant positive correlations with non-early-career NIM. In contrast to the RPPI, the Darwin CPI showed the weakest correlation (see Table 3).

5.3. Unemployment rate

In almost all cases there is either an insignificant correlation (NSW, Vic, SA, WA, Tas, NT) or weakly significant correlation (Qld) with total, early-career and non-early-career NIM. The exception is the ACT which shows a strong positive correlation with non-early-career NIM.

5.4. Youth unemployment rate

For most states there was no significant correlation with youth unemployment in either the total, early-career, or non-early-career NIM (Table 4). When this was observed, such as for Queensland and Western Australia, early-career and non-early-career NIM had opposite signs - negative and positive respectively.

5.5. Job vacancies

For all states there was no significant correlation in early-career, and a significant negative correlation with non-early-career NIM (Table 5). As for youth unemployment there was a tendency for early-career and non-early-career NIM to have opposite signs, positive and negative respectively.

5.6. Gross state product

For states other than Queensland and Western Australia, correlations were either insignificant or weakly significant (Table 6). For Queensland non-early-career there was significant large positive correlation with

Table 2
Summary of cross-correlations of CPI with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	+	0	+	B.1, B.2
Sydney	+	0	+	B.3, B.4
Melbourne	+	0	+	B.5, B.6
Brisbane	+	0	+	B.7, B.8
Adelaide	+	0	+	B.9, B.10
Perth	+	0	+	B.11, B.12
Hobart	+	0	+	B.13, B.14
Darwin	0	0	+	B.15, B.16
Canberra	+	0	+	B.17, B.18

Table 3
Summary of cross-correlations of LFS with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	0	0	0	C.1, C.2
NSW	0	0	0	C.3, C.4
Vic	0	0	0	C.5, C.6
Qld	0	–	0	C.7, C.8
SA	0	0	0	C.9, C.10
WA	0	0	0	C.11, C.12
Tas	0	0	0	C.13, C.14
NT	0	0	0	C.15, C.16
ACT	+	0	+	C.17, C.18

Table 4
Summary of cross-correlations of YLFS with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	0	0	0	D.1, D.2
NSW	0	0	0	D.3, D.4
Vic	0	0	0	D.5, D.6
Qld	0	–	0	D.7, D.8
SA	0	0	0	D.9, D.10
WA	+	–	+	D.11, D.12
Tas	0	0	0	D.13, D.14
NT	0	0	0	D.15, D.16
ACT	0	0	0	D.17, D.18

Table 5
Summary of cross-correlations of JV with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	–	0	–	E.1, E.2
NSW	–	0	–	E.3, E.4
Vic	–	0	–	E.5, E.6
Qld	–	0	–	E.7, E.8
SA	0	0	–	E.9, E.10
WA	–	0	–	E.11, E.12
Tas	0	0	–	E.13, E.14
NT	–	0	–	E.15, E.16
ACT	0	0	–	E.17, E.18

Table 6
Summary of cross-correlations of GSP with total, early-career, and non-early-career NT NIM. For lags −5 to −1 entries indicate a significant positive (+), significant negative (−) or insignificant (0) cross-correlation. Cross-correlation plots are shown in the supplementary material.

State/City	Total	Early-Career	Non-Early-Career	Figures
National	0	–	0	F.1, F.2
NSW	–	–	0	F.3, F.4
Vic	0	0	0	F.5, F.6
Qld	+	0	+	F.7, F.8
SA	0	0	0	F.9, F.10
WA	+	+	+	F.11, F.12
Tas	+	+	+	F.13, F.14
NT	0	0	0	F.15, F.16
ACT	0	0	0	F.17, F.18

non-early-career NIM, and for Western Australia, there is significant positive correlation with both early-career and non-early-career (and therefore total) NIM.

6. Discussion and conclusions

This analysis of the long-term data shows some economic variables have significant correlations with Northern Territory NIM at negative time lags. These are potential candidates for forecasting changes in resident population driven by interstate migration, as well as possible targets for interventions to improve Northern Territory NIM outcomes. A major finding is that correlations strengthen or vanish when total NIM is decomposed into early-career and non-early-career components, indicating that these two life stages are not equally sensitive to the same economic factors. The exception to this general rule is property prices, for which we found that the percentage change in Darwin property prices is a significant leading indicator for both early-career and non-early-career NIM. House prices in Brisbane, Canberra and Hobart are also positively correlated with a change in Northern Territory NIM, but unfortunately, the Northern Territory government can have little influence over the directions of prices in other jurisdictions.

The finding here of property prices changes outside of the NT being a positive correlate to NT NIM is converse to Carson's findings in 2016. There may be a range of reasons for this including the method used to construct the RPPI here, which differs from Carson's variable. And while it makes intuitive sense that house price appreciation in other capital cities might stimulate a better NIM position for the Northern Territory, the finding of a positive cross-correlation between higher rates of price increase in Darwin for both life stages and future NIM outcomes is less instinctive. Both the exogenous and internal correlations for the RPPI are nevertheless lagged by one to three years. This seems to indicate that one is not influencing the other, at least in the first year where both the exogenous and internal RPPI increases, or that one cancels out the other (for example, in years when the exogenous RPPI is declining but the Darwin one is not). Readers should also note that RPPI data excludes regions outside of the capital cities of each State and Territory, which is important for the NT as migration intensities between regional Australia and the NT are relatively large, including prominent exchanges with northern parts of Queensland.

The effect of inflation on NIM was mixed, with the percentage change in the CPI for all capital cities except Darwin showing as significant leading indicators for non-early-career NIM one to three years prior, but not significantly correlated with early-career NIM. This finding may reflect a degree of price-insensitivity for newly arrived early-career workers experiencing high incomes relative to during their university studies or very early-career period. The Territory certainly imports enough early-career workers each year for them to influence the findings here, although further qualitative research would be required confirm the supposition that sensitivity to marginal price changes for residents in their 20s is low.

Meanwhile, our findings have refuted the unemployment rate outside of the Territory influences NIM outcomes for the NT. This applies to both the general and youth unemployment rates which, overall, are not strong leading indicators, although they do show a tendency to have oppositely signed correlations for early-career and non-early-career NIM. Consequently, rising unemployment outside the Northern Territory cannot be considered a signal for better NIM outcomes for that jurisdiction. The exception was for the ACT where a strong positive correlation exists between the unemployment rate and Territory NIM, but only for the non-early-career group. Youth unemployment was found to have a weak correlation with Northern Territory NIM except for Queensland (a negative correlation for early career only) and Western Australia (a positive correlation for non-early career only). The predictive capacity apparent for the youth unemployment rate for the non-early career group (ie non-youth) in the case of Western Australia might be explained by its influence on the migration patterns of their children.

For job vacancies, no significant correlations were observed for the early-career group, but a significant negative correlation was found for non-early-career group. That is, when job vacancies fall exogenously to

the NT (in NSW, Victoria and the ACT) the northern jurisdiction's NIM position improves. While this may reflect the penchant for a relatively depressed jobs market elsewhere to stimulate better migration outcomes for the NT, the finding of a negative correlation within the Northern Territory for job vacancies is curious and an explanation is not immediately apparent. Furthermore, job vacancy increases in the Northern Territory do not appear to stimulate better NIM outcomes in the years following the increase. This is a sobering result, since jobs creation has long been tendered by governments in the Northenr Territory and elsewhere as the panacea for economic and population growth.

For GSP, only Queensland and Western Australia were found to be correlated with Northern Territory NIM, with a positive correlation for both. While for Queensland this was only for non-early career NIM, for WA GSP was positively correlated with both early-career and non-early-career NIM. For Queensland, the correlation was observed to be lagged by one-to-three years, while for WA this was one and two years prior to the observed increase in NIM.

Collectively, the results have provided the interesting observation that none of the variables tested were strongly correlated exclusively with the early-career cohort. Conversely, the unemployment rate and job vacancies outside the Northern Territory were correlated exclusively with the non-early-career group. This raises one of the potential limitations of this study, whereby the number of variables was large but not exhaustive. It may be that other variables are correlated solely with early-career NIM or that other variables not tested here have more explanatory power overall. For early-career NIM, university enrolments and rental costs may be worth investigating, for example. Extending this, a further consideration for the reader is the independent nature of modelling of the variables herein. That is, combinations of changes in two or more of the variables modelled here may be jointly significant and provide more explanatory power; and this is an area where further research could be undertaken.

Overall, this study provides some steps forward in our understanding about the relationship of Northern Territory NIM to its economy and to economic conditions outside. The absence of strong correlations between internal economic conditions and NIM would seem to support the notion of the NT economy being primarily subject to exogenous economic conditions, more so than internally, fitting its description as a small-open economy. Even outside of the Northenr Territory, the number of variables with strong correlations were limited and, for those which were, correlations were mostly for just one of the two life-stages applied here and one or two of the other Australian states. Nevertheless, there are opportunities for policy interventions to be devised based on this research with the aim of improving the stubbornly poor Northern Territory NIM position. For example, increasing cost of living (CPI) outside the NT has a positive effect on NT NIM and so could be emphasised in efforts to attract and retain residents. Rising house prices elsewhere could be marketed as a drawcard for moving to the Territory, and indeed the present-day situation sees median house and unit prices far lower in the Northern Territory than for almost all the rest of Australia.

The summation from the collective results here is the Northern Territory Government has limited economic levers for managing internal migration outcomes and improving growth for the jurisdiction. This is sobering and leads immediately to the question of what else the government might do outside of a focusing on macroeconomic issues? Key to this quandary is perhaps recognition of the locked-in nature of movements involving young workers who arrive in large numbers each year but are exported out in a handful of years subsequently. That process (and that population) is still necessary for population growth, workforce needs and economic capacity and but, without the injection of large numbers of overseas migrants, the population of the NT will continue to be *running to stand still* in a demographic sense.

Despite the constraints of few macro-economic levers, there is growing evidence on the importance of 'soft' or qualitative factors influencing migration decisions for individuals and families (for example, Orria and Luise, 2017; Vaishar and Šťastná, 2021) which might hold promise for the Northern Territory. The availability of good quality education and health services are two such factors for families and the rapidly increasing pre-and-post retirement cohort. Engendering feelings of belonging and embeddedness in the community are likely to improve retention and this can be encouraged through social networks and arranged events, or through the financial support of volunteering ventures and sporting organisations.

Conversely, and while a difficult task, addressing crime and safety concerns in the community is also likely to improve retention rates over the long-term, as this is a factor which arises persistently and anecdotally in media (for example, ABC, 2023), and in research from 2019 as a factor for leaving the NT, albeit for a relatively small proportion of those who had left (see Dyrting et al., 2020). Rates of imprisonment in the Northern Territory are very high compared to elsewhere in Australia, and are unfortunately led by incarcerations of Indigenous residents.

Collectively, while the economic-related data analysis undertaken here presents a gloomy perspective for policy makers, there is much that can be attempted to redress NIM outcomes through building community and social capital, and at relatively low costs when compared to efforts to impart broad-based economic stimuli. The role of social capital and social networks in sustaining growth, primarily through encouraging population retention, is gaining traction in research for regions which might be considered as sparsely populated, which the Northern Territory certainly is. Extending this argument, the opportunity exists for the Northern Territory Government and peak bodies, like the Chamber of Commerce, to lobby the Australian Government to permit further concessions for international visas for the NT or to allocate a fixed proportion of the national intake to the Northern Territory. Certainly, there has been good traction for the retention of residents recently migrated from certain countries including the Philippines, Nepal, India and some African nations (Taylor and Carson, 2017).

One issue which stands out from examining recent data is that it took the COVID pandemic, which led to the Northern Territory's only year of positive NIM since 2009, to reverse the polarity of NIM, albeit with a small positive value. Unfortunately, as borders opened during 2022 and 2023, pent-up demand to leave was observed in even more voracious negative NIM outcomes for 2023 and 2024 (Fig. 1). In this sense, the NT seems to have missed out on the much vaunted "regional COVID migration wave" associated with the digitalisation of work and working remotely from base. Nevertheless, the NT can appeal to remote workers looking for a lifestyle change, especially given its extensive array of natural attractions, including the climate during the winter season, cultural heritage and events. On top of these, buying a house is almost half as expensive as for the major Australian cities at the time of writing. A case could be made to design a marketing campaign with accompanying incentives for moving to and staying in the Territory. On the downside, the rental market continues to be very tight and high rents in comparison to house prices reflect this. Any interventions to suppress rents are likely to be met negatively with investor-owners. Additionally, airfares to and from other jurisdictions and within the Territory are high given its distance from the major southern cities and remoteness within.

Lastly, areas experiencing shrinkage might consider applying this study to their regions, where data availability facilitates it, to uncover policy levers to help with developing policy responses to shrinkage. In addition, replicating the analysis elsewhere might help others sharpen the policy focus by providing more definitive evidence on economic levers which do and do not precede improving migration outcomes. This includes for elsewhere in Northern Australia where the goal is to grow both the economy and the population by large amounts under the Developing Northern Australia agenda.

CRediT authorship contribution statement

Andrew Taylor: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Funding acquisition,

Conceptualization. **Sigurd Dyrting:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

We declare there are no known competing financial interests or personal relationships that could have influenced the work reported in this article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2025.103743.

Data availability

Data will be made available on request.

References

ABC, 2023. NT Police data reveals alarming spike in assaults, as victims consider whether to stick it out. https://www.abc.net.au/news/2023-03-27/crime-violent-statistics-northern-territory-businesses-leaving/102147020.

ABS, 2020a. Australian national accounts: state accounts. https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/2019-20.

ABS, 2020b. Data explorer - Interstate migration: arrivals, departures and net, state/territory, age and sex - calendar years, 1997 onwards [Data set]. Retrieved May 19, 2021, from. https://explore.data.abs.gov.au.

ABS, 2021a. Consumer price index, Australia. https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/jun-2021.

ABS, 2021b. Job vacancies, Australia. https://www.abs.gov.au/statistics/labour/jobs/job-vacancies-australia/may-2021.

ABS, 2021c. Labour force, Australia. https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia/jun-2021.

ABS, 2021d. Residential property price indexes: eight capital cities. https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/residential-property-price-indexes-eight-capital-cities/mar-2021.

ABS, 2023. Regional population. https://www.abs.gov.au/statistics/people/population/regional-population/2021-22.

ABS, 2024a. Regional population. https://www.abs.gov.au/statistics/people/population/regional-population/latest-release.

ABS, 2024b. National, state and territory population. https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/jun-2024data-downloads.

Australian Government, 2014. Pivot North - inquiry into the development of Northern Australia: final report. https://www.aph.gov.au/-/media/02_Parliamentary_Business/24_Committees/244_Joint_Committees/JSCNA/Final_Report/Final.pdf?la=en&hash=D4616FC805D47AF899633BA831A21F67883728F8.

Australian Government, 2015. Our North, Our Future: White Paper on Developing Northern Australia. Australian Government. https://www.infrastructure.gov.au/sites/default/files/documents/nawp-fullreport.pdf.

Carson, D., Rasmussen, R., Ensign, P., Huskey, L., Taylor, A. (Eds.), 2011. Demography at the Edge: Remote Human Populations in Developed Nations. Ashgate Publishing, Farnham, England.

Carson, D., 2016. *Economic Correlates of Net Interstate Migration to the NT (NT NIM): an Exploratory Analysis* (Research Brief 2016/04). Northern Institute. Charles Darwin University. https://digitalcollections.cdu.edu.au/nodes/view/4673.

Copus, A., Kahila, P., Dax, T., Kovács, K., Tagai, G., Weber, R., Grunfelder, J., Meredith, D., Ortega-Reig, M., Piras, S., Löfving, L., Moodie, J., Fritsch, M., Ferrandis, A., 2021. European shrinking rural areas: key messages for a refreshed long-term European policy vision. TERRA: Revista de Desarrollo Local 8, 280–309. https://doi.org/10.7203/terra.8.20366.

Crommelin, L., Denham, T., Troy, L., Harrison, J., Gilber, H., Dühr, S., Pinnegar, S., 2022. *Understanding the Lived Experience and Benefits of Regional Cities* (AHURI Final Report No. 377). Australian Housing; Urban Research Institute. https://doi.org/10.18408/ahuri7126301.

Dyrting, S., 2018. Osier: a library for demographic calculations. https://doi.org/10.13140/RG.2.2.13400.39682.

Dyrting, S., Taylor, A., Shalley, F., 2020. A life-stage approach for understanding population retention in sparsely populated areas. J. Rural Stud. 80, 439–451. https://doi.org/10.1016/j.jrurstud.2020.10.021.

ESPON, 2017. *Shrinking Rural Regions in Europe: towards Smart and Innovative Approaches to Regional Development Challenges in Depopulating Rural Regions* [Policy Brief]. ESPON. http://www.espon.eu/rural-shrinking.

European Union, 2021. Rural vision. https://rural-vision.europa.eu/.

Finlay, L., Haan, M., 2024. The places we'll go: how have rural residents changed over time? J. Rural Stud. 105, 103181. https://doi.org/10.1016/j.jrurstud.2023.103181.

Government of Newfoundland and Labrador, 2023. Population growth strategy. https://www.gov.nl.ca/populationgrowth.

Grasland, C., Ysebaert, R., Corminboeuf, B., Gaubert, N., Lambert, N., Salmon, I., Baron, M., Baudet-Michel, S., Ducom, E., Rivière, D., Schmoll, C., Zanin, C., Gensel, J., Vincent, J.-M., Plumejeaud, C., Van Hamme, G., Holm, E., Strömgren, M., Coppola, P., Stoleriu, O., 2008. Shrinking Regions: a Paradigm Shift in Demography and Territorial Development (Study No. IP/B/REGI/IC/2007-044). Policy Department B: Structural; Cohesion Policy, Directorate-General for Internal Policies of the Union, European Parliament.

Human Resources Directorate, 2018. NT Government to Create, vol. 21. *000 jobs*. https://www.hcamag.com/au/news/general/nt-government-to-create-21000-jobs/153126.

Hunter, L.M., Boardman, J.D., Onge, J.M.S., 2005. The association between natural amenities, rural population growth, and long-term residents' economic well-being. Rural Sociol. 70 (4), 452–469. https://doi.org/10.1526/003601105775012714.

Huskey, L., Taylor, A., 2016. The dynamic history of government settlements at the edge. In: Taylor, A., Carson, D.B., Ensign, P.C., Huskey, L., Rasmussen, R.O., Saxinger, G. (Eds.), Settlements at the Edge: Remote Human Settlements in Developed Nations. Edward Elgar Publishing, pp. 25–48. https://doi.org/10.4337/9781784711962.00009.

Karacsonyi, D., Taylor, A., 2022. Understanding demographic and economic patterns in sparsely populated areas – a global typology approach. Geogr. Ann. Ser. B Hum. Geogr. 105 (3), 228–247. https://doi.org/10.1080/04353684.2022.2103445.

Lee, E.S., 1966. A theory of migration. Demography 3 (1), 47–57. https://doi.org/10.2307/2060063.

Maertens, A., Taylor, A., 2018. Improving population retention in northern Australia: clues from German-born territorians. Australian Population Studies 2 (1), 39–51. https://doi.org/10.37970/aps.v2i1.24.

Martel, C., Taylor, A., Carson, D., 2013. Changing patterns of migration to Australia's Northern Territory: evidence of new forms of escalator migration to frontier regions? Migr. Lett. 10 (1), 101–113. https://doi.org/10.33182/ml.v10i1.115.

Membretti, A., Dax, T., Machold, I., 2022. Thesis 1: reframing remote places and remoteness as a collective resource and value for Europe. In: Membretti, A., Dax, T., Krasteva, A. (Eds.), The Renaissance of Remote Places: MATILDE Manifesto. Routledge, pp. 17–26. https://doi.org/10.4324/9781003260486.

Northern Territory Government, 2021. Population growth strategy. https://population.nt.gov.au.

OECD, 2020. Rural well-being: Geography of Opportunities. OECD Publishing. https://doi.org/10.1787/d25cef80-en.

Orria, B., Luise, O., 2017. Innovation in rural development: "neo-rural" farmers branding local quality of food and territory. Italian Journal of Planning Practice 7 (1), 125–153.

Piras S., T., Grunfelder, J., 2020. Measuring, mapping and classifying simple and complex shrinkage. Annex 2 to the Final Report of ESPON ESCAPE (European Shrinking Rural Areas: Challenges, Actions; Perspectives for Territorial Governance) 3. https://www.espon.eu/escape.

R Core Team, 2022. R: a Language and Environment for Statistical Computing. R Foundation for Statistical Computing. https://www.R-project.org/.

Saint Onge, J.M., Hunter, L.M., Boardman, J.D., 2007. Population growth in high-amenity rural areas: does it bring socioeconomic benefits for long-term residents? Soc. Sci. Q. 88 (2), 366–381. https://doi.org/10.1111/j.1540-6237.2007.00462.x.

Saxinger, G., Petrov, A., Krasnoshtanova, N., Kuklina, V., Carson, D.A., 2016. Boom back or blow back? Growth strategies in mono-industrial resource towns – "east" and "west.". In: Taylor, A., Carson, D.B., Ensign, P.C., Huskey, L., Rasmussen, R.O., Saxinger, G. (Eds.), Settlements at the Edge: Remote Human Settlements in Developed Nations. Edward Elgar Publishing, pp. 49–74. https://doi.org/10.4337/9781784711962.00010.

Taylor, A., Carson, D., 2017. *Synthesising Northern Territory Population Research: a Report to the Northern Territory Department of the Chief Minister* [Research Report]. Northern Institute. Charles Darwin University. https://digitalcollections.cdu.edu.au/nodes/view/4703.

Taylor, A., Dyrting, S., 2019. *Northern Territory Contemporary Indigenous Migration Trends* (Research Brief 02/2019). Northern Institute. Charles Darwin University. https://theterritoryandme.cdu.edu.au/wp-content/uploads/2019/12/Contermporary_Indigenous_Migration_published.pdf.

Taylor, A., Thurmer, J., Karácsonyi, D., 2022. Regional demographic and economic challenges for sustaining growth in Northern Australia. Regional Studies, Regional Science 9 (1), 425–445. https://doi.org/10.1080/21681376.2022.2082316.

Thurmer, J., Carson, D., Taylor, A., 2019. Modelling population retention in Australia's Northern Territory – how do current forms of migration contribute to population turnover and retention? Aust. Geogr. 50 (4), 435–452. https://doi.org/10.1080/00049182.2019.1682318.

Tietjen, A., Jørgensen, G., 2016. Translating a wicked problem: a strategic planning approach to rural shrinkage in Denmark. Landsc. Urban Plann. 154, 29–43. https://doi.org/10.1016/j.landurbplan.2016.01.009.

Vaishar, A., Šťastná, M., 2021. Rural development in sparsely populated areas. Vranov Na Dyjí micro-region in Moraviailada. European Countryside; Brno 13 (2), 436–454. https://doi.org/10.2478/euco-2021-0026, 2021.

Venables, W.N., Ripley, B.D., 2002. Modern Applied Statistics with S, fourth ed. Springer. https://doi.org/10.1007/978-0-387-21706-2.