The Relationship between Age, Duration of Stay and Inter-State Migration for the China-born Immigrants in Australia

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1. Introduction

Australia is a country heavily reliant on immigration, with over 28% of its population born overseas (ABS, 2018a). Since the mid-1990s, both the level and the diversity of Australia's immigration have increased (Hugo, 2004; Khoo et al., 2008; Clyne and Jupp, 2011; Raymer et al., 2018). The main sources of immigrants have shifted from European countries to Asian countries. Of the recent immigrant groups, those from mainland China represent a significant and rapidly growing component, forming the largest non-European-origin population since the 2006 Census.

Immigration has been a major driver of subnational demographic and socio-economic changes in high immigration countries (Dunn, 1988; Frey and Liaw, 1999; Rogers and Henning, 1999; Newbold, 2007; Hugo and Harris, 2011; Raymer and Baffour, 2018). This paper investigates how the China-born immigrants have moved between states and territories in Australia over the last few decades. In particular, the relations between age, duration of stay and inter-state migration are examined, where duration represents immigrants' accumulated experiences in the destination country. Place of residence is influential to immigrants' internal mobility as local communities have different capabilities to sustain and attract international migrants (Hugo, 2008; Raymer and Baffour, 2018). Thus, the origin and destination of immigrants' inter-state movement are also considered in this paper. To identify commonalities and variations in the migration patterns, comparisons are made between the

China-born population and other major overseas-born groups in Australia, including the more established European immigrants and the new arrivals from India.

The study of internal migration of immigrants is important for two reasons. First, the redistribution of immigrants, particularly in low fertility countries with high international migration, significantly impacts the compositions and geographic distributions of the population (Rogers and Henning, 1999; Hugo and Harris, 2011). Second, internal migration represents a refinement of immigrants' settlement processes in the destination society (Kritz and Nogle, 1994; Newbold, 2007; Houle, 2007; Reher and Silvestre, 2009). Thus, examining how immigrants move and settle concerning their age and duration of stay in the destination country allows us to understand the implications for subnational population change, economy, society, culture, and environment (Hugo and Harris, 2011) as well as the individual's adjustment to locate their place of more permanent residence.

This study focuses on two research questions. First, how have inter-state migration probabilities changed for the China-born immigrants by age and duration of stay in Australia, over time, and in comparison with other overseas-born populations in Australia? Second, how does the age-and duration-of-stay affect immigrants' inter-state migration by state/territory of residence? This paper employs duration as an important and independent scale representing immigrants' acquirement and accumulation of information and knowledge in the destination society. The expectation is that immigrants' propensity to internally migrate declines with longer durations of stay in the destination country. Further, the direction of migration is expected to vary depending on immigrants age, duration of stay, birthplace, and their current state/territory of residence.

This research makes several contributions to the immigrants' internal migration literature in high immigration countries. First, year of arrival (or period of residence) rarely appears in Australian internal migration literature (except for Bell and Hugo, 2000; Hugo,

2008; Hugo, 2011; Hugo and Harris, 2011). Much of the literature is focused on the United States and countries in Europe (Kritz and Nogle, 1994; Wright et al., 1997; Frey and Liaw, 1999; Reher and Silvestre, 2009; Catney and Finney, 2016). Moreover, duration is often grouped into two broad periods: less than five years and more than five years (Wright et al., 1997; Hugo, 2008; Hugo, 2011; Hugo and Harris, 2011). In this paper, five-year intervals are used to model immigrants' length of stay in the destination country, which helps to better understand changes to immigrants' internal migration patterns with increasing years in the destination country. Second, data from multiple Censuses are used, making it possible to track changes by immigrant cohorts over time (Bell and Hugo, 2000). Third, using aggregated census data, this research accounts for directions of movement so that links to population (re)distribution can be made. Finally, with the dominance of a young adult migration age profile (Rogers and Castro, 1981), it is necessary to control for the age of the immigrant before examining the role of duration in subsequent movements (Bell and Hugo, 2000: Figure 4.6; Reher and Silvestre, 2009).

2. Background

2.1 Internal migration of immigrants

Internal migration of immigrants can be very different from that of the native-born population: it can be higher or lower and may exhibit very different spatial patterns (Rowland, 1979; Rogers and Henning, 1999; Frey and Liaw, 1998 and 1999; Bell and Hugo, 2000; Raymer and Baffour, 2018). Variations in how immigrants internal migration differ from the natives' depend on immigrants' countries of origin, country of residence, age, period examined, year of arrival, socio-economic characteristics, and geographic levels examined (Bell and Copper, 1995; Frey and Liaw, 1999; Bell and Hugo, 2000; Finney and Simpson,

2008; Hugo and Harris, 2011; Finney et al., 2016; Catney and Finney, 2016; Raymer and Baffour, 2018).

Two theories help to explain the internal migration differences between immigrants and native-born populations. Frist, internal migration patterns are associated with key life course transitions (Bernard et al., 2014). For immigrants, however, international migration is a disruptive event that possible delay or affect other life course transitions (Andersson, 2004; Gray et al., 2007; Wingens et al., 2011; Holmes et al., 2015). Thus, the timing and schedule of their internal migration events may not be synced up with the native-born population. Second, spatial assimilation theory suggests that different spatial patterns reflect the social, economic, and cultural distances between immigrants and the native population (Massey, 1985). After migrating across the border, immigrants move within the destination country in response to different socio-cultural constraints and socio-economic opportunities. Studies in the United States show that immigrants, especially those socio-economically disadvantaged, resettled and concentrated to traditional immigration areas, relying heavily on migration network for economic and social activities (Kritz and Nogle, 1994; Nogle, 1997; Frey and Liaw, 1999; Rogers and Henning, 1999). In contrast, the native-born population, particularly those with low-skills, may be forced to leave high immigration areas due to competition with immigrants (Frey, 1996; Frey and Liaw, 1999), industrial restructuring (Wright et al., 1997), and retirement (Frey and Liaw, 1998). Immigrants and native population move differently because the reduction in their social, economic and cultural distances take time, even generations (Kuo and Roysircar, 2004; Frey and Liaw, 1999).

Recent settlers have higher migration rates because they are younger (Bell and Hugo, 2000; Hugo and Harris, 2011) and less settled or tied to places (Kritz and Nogle, 1994; Newbold, 2007). Evidence from Australia (Bell and Hugo, 2000; Hugo and Harris, 2011), North America (Kritz and Nogle, 1994; Nogle, 1997; Houle, 1997; Newbold, 2007) and

Europe (Catney and Finney, 2016) show that high internal migration rates of immigrants persist from immediately after arrival to five or more years after initial arrival. Hugo and Harris (2011) attributed differences in the spatial distribution between immigrants of different lengths of stay in Australia to migrant mobility converging toward that of the native-born, changes in the structure of major areas, and changes in the composition of migration. Factors driving their relocation, echoing the life course transitions and spatial assimilation theories, include (i) individual responses to economic conditions, such as income, housing needs, employment and economic growth, (ii) social capital, such as migrant networks and social ties, and (iii) human capital, such as education, English language proficiency and citizenship (Reher and Silvestre, 2009; Newbold, 2007). With longer residence in the destination country, aging and accumulated resources both exert influences on immigrants' responses to the above driving factors and thus their internal migration dynamics. For immigrants who arrived as adults, age at arrival can have a negative impact on the internal migration propensity (Reher and Silvestre, 2009). When age is controlled, immigrants' internal migration significantly declines with longer years in the destination country, showing the importance of acquiring resources after arrival and later on the increasing ties to location-specific capitals (Kritz and Nogle, 1994; Newbold, 2007; Reher and Silvestre, 2009).

In studies where the duration of stay is considered influencing immigrants' internal migration behaviors, the duration is usually modelled as a dichotomous variable where emphases are on the power of age and socio-economic factors (Kritz and Nogle, 1994; Newbold, 2007; Hugo and Harris, 2011). Without data from multiple years or in the absence of a time variable, it is impossible to track mobility changes of a single cohort of arrivals over time. These facts prevent the understanding of the speed of change in immigrants' internal migration patterns with increasing duration of stay in the destination country. In the few studies where the year of arrival is treated as continuous (Reher and Silvestre, 2009) or

categorical (Bell and Hugo, 2000), results show strong and significant negative relations between immigrants' lengths of stay in the receiving country and propensities to move. The relation remains after controlling for human capital, economic and social capital variables. Building from the above two works, this paper models age of immigrants and duration of stay over five-year fixed intervals to explore the regularities in the relations between age, duration and internal migration. Multiple quinquennial Australian Censuses are used to examine changes in internal migration between different cohorts of arrivals and changes in the same immigrant cohort over time.

2.2 *the Australian context*

The level and diversity of immigration to Australia has increased in recent decades (Clyne and Jupp, 2011; Raymer et al., 2018), In the context of Australia's high international migration levels, the movements of immigrants represent an important component of its changing geography (Hugo and Harris, 2011). The propensity to internally migrate, however, has been declining over time (Bell et al., 2018) with steady losses of native-born and European-origin populations from New South Wales to other states and territories (Hugo, 2008; Raymer and Baffour, 2018). Earlier research shows that overall mobility was higher amongst the overseas-born population than the Australia-born population in the 1960s and 1970s, but the differences narrowed and reversed in late 1970s (Bell and Hugo, 2000: p55). Now the overall level of internal migration is lower for the overseas-born population (ABS, 2018a), albeit with variations observed across birthplaces. For instance, recent immigrant groups in Australia, including persons born in China and India, are less mobile than earlier European immigrants and the Australia-born population (Raymer and Baffour, 2018).

Government policy has an important role in the changing geography of immigrants' settlement (Hugo, 2011). International migration to Australia is currently regulated under a two-step system that involves temporary visa and application for permanent residency once

certain criteria are met (Hugo, 2004; Khoo et al., 2008; Chiou, 2017). Thus, temporary residents represent an important part of the immigrant population in Australia, with international students being one of the largest temporary resident groups (Hugo, 2008; ABS, 2019). The characteristics of temporary migrants are likely to affect internal migration in two ways. First, graduation and application to permanent residency are key life course events followed by a series of employment and family formation transitions that link to high mobility of young adults (Bernard et al., 2014). Second, following the line of government's earlier attempts to influence where in Australia immigrants settle after their arrival, a state/territory nomination component has channeled certain numbers of temporary residents to designated regional areas (Hugo, 2004, 2008 and 2011; Chiou, 2017). Due to issues including lack of settlement services and mismatch between skills and occupations (Hugo, 2011), a significant proportion of immigrants may leave regional areas once they fulfilled their residential qualifications (Hugo, 2008 and 2011). Similar challenges of retention immigrants in designated regional locations were also found in Sweden (Hammer, 1993) and the United Kingdom (Robinson and Hale, 1989; Robinson, 1993).

2.3 The China-born immigrants in Australia

The Chinese population has a long history of migrating to Australia (Choi, 1975; Jupp, 2001; Reeves and Mountford, 2011). For them, there are three migration phases: (i) the gold rush in the nineteenth century; (ii) the Immigration Restriction Act in, 1901, underpinning the White Australia Policy, which excluded and expelled Asian descendants; and (iii) the relaxation of Australian's immigration policy since the 1970s with final dismantlement of the White Australia Policy in mid-1970s (Choi, 1975; Inglis, 1972; Jupp, 1995; Ho, 2008; Reeves and Mountford, 2011). In the third phase, the number of Chinese immigrants in Australia increased first as a result of ethnic Chinese from Vietnam in the 1970s as refugees, and later as mainland Chinese humanitarian migrants in late 1980s and early 1990s (Shu and

Hawthorne, 1996; Jupp, 2001). From the 1990s, with Australia placing greater emphasis on skilled migration (Hugo, 2004; Ziguras, 2015), the compositions of immigrants shifted from predominantly family and humanitarian migrants to skilled migrants. The number of tertiary qualified immigrants increased at a much faster rate than those under family reunion and humanitarian programs. Since 1998, a series of immigration policies were introduced to sustain international students as skilled migrants (Chiou, 2017; Tang et al., 2014). From there, Australia started to see drastic growth in the number of Chinese students and skilled migrants. Immigrants from mainland China have grown rapidly and become the third-largest overseas-born population in Australia since the 2006 Census, following the United Kingdom and New Zealand.

Today, international students constitute a significant share of China-born immigrants in Australia. Mainland China is the largest origin for Australia's international students (27%), and 22% of the China-born immigrants are university students (ABS, 2018b and 2019c). Around 5% of the China-born students enroll in regional areas, contributing to 24% of international student enrolments in regional Australia (Department of Education and Training, 2016 and 2019). These features potentially increase their probability of internal migration in Australia and affect the direction of movement for the China-born immigrants in two manners as discussed in Section 2.2. Whether the young graduates would stay and where they would move to have significant meaning to the distribution of the Chinese population and the local economy of regional and remote Australia.

The Chinese and China-born population are highly concentrated towards urban areas. Since the post-gold rush era, the Chinese immigrants have been highly concentrated in New South Wales (NSW) and Victoria (VIC), particularly in the capital cities Sydney and Melbourne (Huck, 1968; Inglis, 1972; Choi, 1975; Kee and Huck, 1991; Ho and Coughlan, 1997; Coughlan, 2008; Reeves and Mountford, 2011; Wang et al., 2018). In the most recent

Australian Census, Sydney had net losses of its Australia-born residents and most of its overseas-born residents from out-migration but a considerable net gain of the China-born residents from in-migration (ABS, 2018a). A multiregional analysis by Raymer and Baffour (2018) shows that out-migration of the China-born population from Australia's major capital cities Sydney, Melbourne, Brisbane and Perth were extremely low between 1981 and 2016. Meanwhile, regional Australia sends large numbers of China-born residents to major cities. As a result, the level of concentration for the China-born immigrants in state capital cities is higher than the Australia-born population (Guan, 2019). Compared to more established immigrants from mainland China, however, recent immigrants are less concentrated spatially and more similar to the Australia-born population (Coughlan, 2008; Guan, 2019).

3. Data and Method

This study focuses on immigrants who were born in mainland China. This is because: (i) birthplace is a clear and consistent measurement of immigrants in Australia Censuses (compared to ethnicity and ancestry); (ii) overseas birthplaces can be used to define first-generation migrants and thus reduce generation-related variations in the sample; and (iii) the China-born immigrants represent 41% of all ethnic Chinese in the 2016 Census and are the majority of recent Chinese immigrant in Australia.

Two sets of Australian Census data were obtained from the Australian Bureau of Statistics (ABS). The first set of data is 1986 to 2001 quinquennial Census population by birthplace, current usual residence, and usual residence five years before the census. The other set of data comes from ABS Census TableBuilder with 2006, 2011, and 2016 Census population by birthplace, age, sex, year of first arrival in Australia, current usual residence, and usual residence five years before the census. Birthplace is used to define immigrant

status. Usual residence information is grouped at state level[1] to capture inter-state migration status and avoid small and unreliable cells generated by TableBuilder[2]. The year of first arrival in Australia, used to define the immigrant cohort and estimate the duration of stay, is obtained across five-year periods[3]. The values range from arrived in Australia before 1972 (duration =35+ years in 2006 Census, duration=45+ years in 2016 Census) to five years before the census. Five-year age groups are used so that age, duration of stay, and internal migration intervals are consistent and can be used to model synthetic cohorts. The China-born immigrants are persons who reported themselves born in mainland China. Immigrants born in Hong Kong, Macau and Taiwan are grouped with other North East Asia-born. Overall, 18 significant and mutually exclusive and exhaustive overseas birthplaces (see labels in Figure 1 and Figure 3) are created. Countries and regions are grouped based on the ABS Standard Australian Classification of Countries (ABS, 2016).

[1] In both data sources, persons who did not report usual residence at the census or five years before the census (Not Stated), persons aged 0-4 at the census (Not Applicable), and/or persons who reported current or past usual residence as Other Territories are excluded from this analysis.

[2] ABS randomly assigned numbers to counts that are less than a pre-specified threshold value (usually 10) to "minimize the risk of identifying individuals in aggregated statistics" (ABS 2017b).

[3] Note that the Australian census is conducted in August. It creates inconsistency in the calendar year of arrival and five-year inter-state migration status. For instance, a person who arrived after census date in 2011 would not be enumerated in the 2011 but the 2016 census (conditioned on his/her presence in both Censuses). His/her actual years of living in Australia would be less than 5 years at the time of 2016 Census, though (s)he is counted as 2011 arrivals (i.e. with 5-9 years of living in Australia in the 2016 Census). A person who lived in one state at the 2011 census night might report a different state as 2011 usual residence in the 2016 census if (s)he had moved across states in 2011. Without event data, duration in this paper is defined by the calendar year. The differences between the calendar year intervals and census date intervals are acknowledged but omitted.

Note that there are some errors and inconsistency in the two self-reported Census variables: calendar year of first arrival in Australia and usual residence five years prior to the Census. A fraction of respondents who stated first arrived in Australia within the last five years also reported an Australian state or territory as their usual residence five years before the Census. For instance, 9,300 (5.7%) China-born persons out of 163,476 who stated they first arrived in Australia between 2012 and 2016 in the 2016 Census reported their usual residence in 2011 as one of the eight Australian states and territories. Meanwhile, another group of persons who stated they have lived in Australia for more than five years reported being overseas five years before the census (possibly return migrants). For instance, 10,477 (16.4%) China-born persons out of 63,592 who stated they first arrived in Australia between 2002 and 2006 in 2011 Census reported their usual residence in 2006 as overseas (See also Section 4 figures). Questionable reliability of self-reported data, inadequate question design to match calendar year interval with Census date intervals, and insufficient information on repeated international migration all possibly contribute to these errors and inconsistency. To overcome these problems, those who reported conflicting first year of arrival in Australia and previous usual residence are excluded from the analyses presented in Sections 5 and 6.

To test whether and how the duration of stay in Australia influences immigrants' inter-state mobilities, the proportions of stayers, inter-state migrants, and new arrivals are examined in Section 4 with and without duration decomposition. Inter-state migrants are those who reported different usual resident states or territories five years apart. Stayers are those who reported identical usual resident states or territories. New arrivals are those who reported an overseas usual residence five years before the census.

To account for the age effect on migration, age-specific inter-state probabilities[4] are compared in Section 5 for persons of different birthplaces and lengths of stay in Australia. For each five-year duration group, the age-duration-specific probability is calculated the number of inter-state migrants divided by the sum of inter-state migrants and stayers (non-migrants) by age. New arrivals are excluded from the denominator because they are not the population at risk. Comparisons are also made to examine temporal changes.

The direction of movement is analyzed using multiregional life tables to see how inter-state migration patterns differ by immigrants' place of residence within Australia. Multiregional life tables are constructed for the China-born immigrants of different lengths of stay in Australia using the Option 2 method in Rogers (1995, p97 -107). Comparisons are made with other three major immigrant populations (immigrants born in New Zealand, the United Kingdom, and India). Origin-destination-specific inter-state migration from Census are treated as transitions in the life table[5]. Age-sex-state/territory-specific mortalities from the Australian Human Mortality Database (Canudas-Romo, 2018) are used as life table decrements. A complete multiregional life table models the number of years a person from a synthetic birth cohort is expected to spend in each state and territory at a specified age, given the person's state or territory of origin[6]. Thus, it can be used to measure a state/territory's ability to retain its residents at a given age (see e.g. Rogers, 1990: Table 2; Raymer and Baffour, 2018). To avoid sparseness in life table inputs, five-year interval duration groups are

[4] The probabilities are conditional on survival between two Censuses.

[5] Due to data sparseness, the number of stayers for those who are in the Northern Territory in 2006, arrived in Australia between 2002 and 2006 and aged 20-24 in 2011 Census was changed to 1 to avoid a 100% outmigration probability.

[6] Technically multistate life expectancies are conditioned on the state/territory of birth. For immigrants who were born overseas, the state/territory of birth is only a hypothetical place of origin.

aggregated into the following immigrant cohorts: those who arrived before 1982, 1982-1996 (15 years window[7]), 1997-2001, 2002-2006 and 2007-2011.

Three sets of multiregional life table results are presented and discussed in Section 6. First, retention expectancies are calculated from life expectancies for each of the five duration groups using the following formula:

$$E_{x,d}^{ii} = \frac{e_{x,d}^{ii}}{\sum_{j=1}^{n} e_{x,d}^{ij}} \qquad \textit{(Equation 1)}$$

where $e_{x,d}^{ij}$ is an origin-destination-specific life expectancy from the multistate life table. It represents the remaining years a person would spend in state/territory j at age x if he/she is in duration group d and originated from state/territory i. $\sum_{j=1}^{n} e_{x,d}^{ij}$ is the sum of $e_{x,d}^{ij}$ across n states and territories. It represents one's total life expectancy at age x in the system (across the n states/territories) for persons in duration group d and originated from state/territory i. $e_{x,d}^{ii}$ is a special case of $e_{x,d}^{ij}$, referring to the persons remaining life in the state/territory of origin. $E_{x,d}^{ii}$ is the retention expectancy at age x for persons in duration group d who originated from state/territory i and is calculated as the share of $e_{x,d}^{ii}$ in $\sum_{j=1}^{n} e_{x,d}^{ij}$. The retention expectancy is therefore interpreted as the share of remaining life a person is expected to spend in his/her state/territory-of-origin at a specified age.

Second, to identify population composition effect, counterfactual analyses are carried out to control for mobilities of immigrants who have been stayed in Australia for (i) 5-9 years, (ii) 10-14 years, and (iii) 15-19 years. Overall retention expectancies (without duration

[7] Though there was an immigration hump from mainland China to Australia between 1989 and 1993, with about 40,000 student immigrants (Birrell, 1994; Jupp, 2001: p222-224; Ju Liu Sui Yue, 2014), the cross-classified data can still be sparse in some age-duration groups. Therefore, a 15-year window is used.

decomposition) are reported for each scenario and compared against the real data. Changes in the overall retention expectancies under the three counterfactual scenarios stem from variations in inter-state migration patterns of different duration groups. The calculation and interpretation of overall retention expectancies are similar to Equation 1, except that duration subscripts are removed:

$$E_x^{ii} = \frac{e_x^{ii}}{\sum_{j=1}^{n} e_x^{ij}} \qquad \textit{(Equation 2)}$$

Further, to investigate major destinations of recent arrivals, shares of remaining life expectancies are examined to show both retention, loss and gain of the China-born residents who have stayed in Australia for 5-9 years. The shares are calculated as:

$$E_{x,5}^{ij} = \frac{e_{x,5}^{ij}}{\sum_{j=1}^{n} e_{x,5}^{ij}} \qquad \textit{(Equation 3)}$$

where d in Equation 1 equals to 5, representing immigrants stayed in for 5-9 years. $E_{x,5}^{ij}$ is the share of remaining life expectancy one would spend in state/territory j at age x for recent arrivals who originated from state/territory i.

With five-year internal migration intervals, subsequent migration patterns of the new arrivals (i.e. those who have stayed in Australia for less than five years) cannot be determined. For the duration-migration relation, it would be interesting to examine mobility and state retention of those who arrived 1-4 years before the Census using the variable on the usual residence one year before the Census (Bell and Hugo, 2000). However, this creates data sparseness problems. Even with five-year interval data, sparseness (and the way ABS

randomize small numbers, see Footnote 2) in certain age or duration groups could result in poor life table modelling[8].

4. Shares of Inter-State Migrants

Shares of inter-state migrants are examined over time using data from 1986 to 2016 Australian Censuses for both overseas-born and Australia-born populations. The share of migrants (white bars), stayers (blue bars) and new arrivals (grey bars) are presented in Figure 1. Majority of the population do not move (i.e. stay) during the five-year window. The share of inter-state migrants is between 1.3% (persons born in South-East Europe, 2006-2011) and 6.9% (persons born in New Zealand, 1986-1991). Across all seven intercensal periods, low shares of inter-state migrants are observed amongst persons born in South-East Europe (the lowest was 1.3% in 2006-2011, the highest was 1.8% in 1986-1991), mainland China (the lowest was 1.4% in 2001-2006, the highest was 2.6% in 2011-2016), Vietnam (the lowest was 1.4% in 2006-2011, the highest was 3.5% in 1986-1991), and North Africa and the Middle East (the lowest was 1.8% in 1981-1986, the highest was 2.4% in 2011-2016).

The China-born population exhibits one of the lowest shares of inter-state migrants and one of the highest shares of new arrivals. Over the last three intercensal periods, both the share of new arrivals and inter-state migrants increased. In contrast, the share of inter-state migrants decreased over time for immigrants of European origins, reflecting an ageing European immigrant population in Australia (Raymer and Baffour, 2018). The growth of

[8] For instance, of the 2,916 age-duration-specific migration rates across 18 birthplaces in 2016 (Figure 3), 1,459 data points had zero movers, 340 data points were calculated from less than ten movers, and only 38% (1,117) data points were calculated from ten or more movers. For the China-born 2016 panel, 89 of the 162 cells have zero movers, 29 cells have movers less than 10, and only 27% (44) cells have ten or more movers. Thus, the nine duration groups in Section 5 grouped into five groups in Section 6.

inter-state migrants share for the China-born immigrants could be attributed to a cohort effect where recent arrivals are more mobile than more established Chinese immigrants, a compositional effect where the share of more mobile recent arrivals increases, and a period effect where the China-born immigrants become more mobile over time.

-------- Figure 1 about here --------

Disaggregating the China-born population by the period of arrival, Figure 2 shows how immigrant cohort and duration of stay in Australia differentiates their shares of inter-state migrants. Ten immigrant cohorts are plotted in Figure 2, with a trio of columns representing the changing shares of migrants for each cohort in 2006 (left), 2011 (middle), and 2016 (right), respectively. For persons of the same immigrant cohort, the share of inter-state migrants declines over time. For instance, the share of inter-state migrants who arrived in Australia during 2002-2006 is higher in the 2011 Census (4.9%) than in the 2016 Census (3.8%). This mainly reflects a combined effect from ageing and increasing lengths of stay in Australia where a longer residence is associated with decreasing probability to move between states/territories. For persons of different immigrant cohorts, recent arrivals see higher shares of inter-state migrants than earlier arrivals. For instance, shares of inter-state migrants in the 2016 Census are 6.7%, 3.8% and 1.9% for those who first arrived in Australia during 2007-2011, 2002-2006 and 1997-2001, respectively. The gaps are largely contributed by age and differences in their durations of stay in Australia. There is also a cohort-period effect that for immigrants with the same lengths of residence in Australia, the share of inter-state migrants increases over time. For instance, for those who have stayed in Australia for 5-9 years, their shares of inter-state migrants are higher in 2016 Census (2007-2011 immigrant cohort) than

in 2011 Census (2002-2006 immigrant cohort) and in 2006 Census (1997-2001 immigrant cohort). Relating to trends observed in Figure 1, the positive compositional, cohort and period effects offset the negative age and duration effects and raised the inter-state migrant shares for the China-born population between 2006 and 2016.

-------- Figure 2 about here --------

5. Inter-State Migration Probabilities by Age, Duration, and Period

Analysis in this section disentangles age and duration of stay effects. In Figure 3, age-duration-specific inter-state migration probabilities are examined for 18 overseas-born populations in Australia using 2016 Census data. In Figure 4, changes in the age-duration-specific probabilities are examined over time for the four largest overseas-born populations in 2006, 2011 and 2016 Australian Censuses. These probabilities are benchmarked to age-specific probabilities of the Australia-born population and the overseas-born populations (i.e. without duration-breakdown).

Despite variations across duration groups and birthplaces, the lines in Figure 3 represent typical migration age profiles: high migration probabilities are observed among young adults and very young kids. Comparing across duration groups, recent arrivals are usually more mobile than more established immigrants. The highest migration probability of each birthplace ranges from 6.5% (persons born in Vietnam, aged 25-29 in 2016, and have lived in Australia for 5-9 years) to 15.9% (persons born in non-United Kingdom North-West European countries, aged 25-29 years in 2016, and have lived in Australia for 5-9 years). Fewer variations between recent arrivals and more established immigrants are found for those born in Europe and Oceania.

Comparing across the 18 overseas-born populations, 11 of them have higher migration probabilities than the Australia-born population in ages 20-40 years. Recent arrivals tend to have very high probabilities, except for some South-East Asia-born populations. Inter-state migration probabilities decline with longer durations of stay in Australia. For immigrants born in mainland China, the highest age-specific migration probability is 12.4%, for persons aged 25-29 in 2016 who has lived in Australia for 5-9 years. Chinese who were 10-49 years old in 2016 and lived in Australia for 5-9 years have higher inter-state migration levels than the Australia-born population. After age 50, their migration probabilities are extremely low, particularly among pre-2001 arrivals (duration >15 years).

The interaction between age and duration of stay is evident in Figure 3. For instance, migration probabilities of Chinese aged 20-24 years in 2016 who arrived in Australia during 1992-1996 (have lived in Australia for 20-24 years), 1997-2001 (have lived in Australia for 15-19 years), 2002-2006 (have lived in Australia for 10-14 years), and 2007-2011 (have lived in Australia for 5-9 years) are 8.9% (28 movers), 7.6% (97 movers), 6.6% (144 movers) and 10.1% (1,030 movers), respectively. Except for the recent arrivals (5-9 years of residence), those arrived in Australia at very young ages are more mobile than immigrants of the same birth cohort but later immigrant cohorts. This phenomenon is most evident at young adult ages. Similar patterns are observed for immigrants born in other overseas countries (e.g. Philippines, the Pacific Islands, and North America). It implies an age-on-arrival effect that persons who migrated to Australia at very young ages resemble the more mobile Australia-born population and have high probabilities to move around once reaching adult ages. For the more established European immigrants, however, there is no such evidence, which is possibly due to their mobilities already being very high.

-------- Figure 3 about here --------

In Figure 4, changes in age-duration-specific migration probabilities of the China-born immigrants are examined between 2006 and 2016. The highest age-duration-specific probability increases from 5.8% in the 2006 Census, to 8.6% in the 2011 Census, and 12.4% in the 2016 Census. Migration probabilities of the recent arrivals increase over time, with the 2016 statistics becoming very close to that of the United Kingdom-born (12.9%) and the New Zealand-born (12.9%) immigrants. Echoing observations in Figure 2, the increase implies a cohort-period effect. Age-specific migration probabilities (the dash black line) of the China-born immigrants also increased significantly, particularly for 20-39 years old age groups. It reached such a high level in 2016 that the China-born immigrants (10.5%) are having higher probabilities to migrate inter-state than immigrants born in the United Kingdom (9.7%) and New Zealand (10.5%) at age 25-29 years. However, the ageing-in-place, cohort characteristics, and the temporal changes are less evident for elderly and established immigrants, particularly those who arrived before 1986 (have lived in Australia for at least 30 years in 2016).

Comparing the four major Australian immigrant populations in Figure 4, growth is also observed for the India-born except for a moderate drop between 2006-2011 and 2011-2016. The opposite temporal changes happened to persons born in Australia (the continuing undotted line in each chart), New Zealand and to a lesser extent the United Kingdom.

-------- Figure 4 about here --------

6. Retaining and Losing the China-born Immigrants by State and Territory

As shown in the last two sections, the presence of length of residence in Australia significantly differentiates immigrants' inter-state migration probabilities. To further investigate whether and how the duration of stay affects the direction of inter-state movements, origin-destination-specific migration transitions are modelled using a multiregional life table. Life table retention expectancies are calculated using *Equation 1* to compare each state/territory's ability retaining their China-born residents at different ages. This is done for persons from different immigrant cohorts. Results are presented in Figure 5 for males. The figure has three rows of line charts representing 2006, 2011, and 2016 Australian Censuses. Dots on each line represent the proportions of remaining life a person would spend in his/her state/territory of origin at different ages, given the person's duration of stay in Australia. Retention expectancies are benchmarked to the total China-born population (i.e. without immigrant cohort decomposition, calculated using *Equation 2*) presented with undotted black lines in each chart.

Consider first the overall retention expectancies (the undotted black lines). The eight Australian states and territories have different abilities to sustain China-born residents. NSW, VIC, Queensland (QLD) and Western Australia (WA) -- states with significantly large metropolitan areas and relatively large Chinese population -- are better at retaining China-born immigrants. In particular, Chinese male from NSW and VIC are expected to spend 71% to 90% of their remaining lives in these two states. Retention expectancies of Tasmania (TAS) and Northern Territory (NT) remain low in all three Censuses, losing the majority of their China-born residents before age 40 years. South Australia (SA) and Australian Capital Territory (ACT) retained increasingly less China-born residents over time, showing decreasing popularity of these two states among immigrants from China. Similar patterns and trends are found for female Chinese and results are presented in Figure A1 in Appendix A.

As discussed earlier in Section 5, persons born in mainland China are less likely to make inter-state movements with increasing duration of stay in Australia. This is true for residents in all eight states and territories regardless of the size of the local Chinese community or the size of state/territory. However, the speed of mobility change varies by state/territory. The gap between lines is wider for small states/territories (i.e. SA, TAS, NT, ACT) in Figure 5, meaning that recent arrivals spend substantially fewer years in these states compared to more established migrants. Such gaps accumulate across age, broadening between 20 and 40 years old age groups. In contrast, the gap between lines is smaller in NSW, VIC, QLD and WA, meaning that chances of stay in these states change less with immigrants' duration of stay in Australia increasing. Thus, the strong duration effect is uneven across states and territories and varies depending on age. There are few exceptions caused by small numbers, particularly at old ages. For instance, five 70-year-olds (age in 2011) China-born males moved from WA to NSW between 2011 and 2016 while nine stayed in WA, causing a sharp decline in WA's retention expectancy at age 70 in the 2016 panel. Overall, the duration of stay has a persistent and diminishing effect on Chinese immigrants' concentration towards big states during the first 20 years of their arrival in Australia[9].

Immigrants born in the United Kingdom, New Zealand, and India (Figure A2-A7 in Appendix A) also exhibited gradual changes in retention with the duration of stay increasing, though the levels vary. For instance, high retentions of persons born in India were observed in VIC and WA. High retentions of the persons born in New Zealand were observed in QLD.

[9] Emigrants are not considered here. They are assumed to follow the same inter-state migration patterns and state-level mortality schedule as those non-emigrants in the current model. Another multistate model where emigration is treated as a unidirectional decrement resulted in substantially lower life expectancies but similar retention expectancies across all age groups and states/territories, showing a consistent effect from emigration across states and territories.

High retentions of persons born in the United Kingdom were observed in WA. It seems that different levels of retention between persons of different overseas birthplaces follow the relative distribution of immigrant networks and community sizes in these states (ABS, 2017a).

-------- Figure 5 about here --------

In most charts of Figure 5 and Appendix A (particularly in the Chinese and Indian cases), the overall retention expectancies resemble that of those whose have been in Australia for 5-9 years. To investigate the relative contributions to the overall retention expectancies by different duration groups, a set of counterfactual analyses are carried out assuming no inter-state movements for immigrants who have been stayed in Australia for (i) 5-9 years, (ii) 10-14 years, and (iii) 15-19 years. Retention expectancies are calculated using *Equation 2* for each scenario. Thus, the relative contributions to the overall retention expectancies are identified for those who have been in Australia for 5-9 years (Scenario 1), 10-14 years (Scenario 2), and 15-19 years (Scenario 3).

Figure 6 presents the counterfactual results for male residents born in China. Scenario 0 is identical to the unbroken lines in Figure 5, showing retention expectancies for a synthetic cohort from the actual data. Scenarios 1 to 3 present counterfactual retention expectancies under different assumptions. Results for Chinese female and immigrants born in the United Kingdom, New Zealand and India are attached in Appendix B. A sharing feature of these figures is the large gap between Scenario 1, where all recent arrivals are forced to stay in where they were five years before the census, and the other Scenarios, where recent arrivals can move as in the actual data. It shows that losing recently arrived immigrants is the key

factor lowering the overall retention expectancies. The pattern holds for almost all state/territories and the four major immigrant populations examined, except for some outliers in TAS, NT and ACT.

-------- Figure 6 about here --------

Further, the shares of remaining life expectancies for recent arrivals are calculated using *Equation 3* and plotted to examine directions of their movements. Figure 7 presents the results for males. The stacked areas represent shares of remaining life spent in each state/territory at different ages. The chunk of the three darkest red areas (NSW, VIC and QLD) in each state and territory shows that the China-born residents from small states would spend the majority of their lives in big states. On the contrary, if they are from big states, it is expected they spend majority of remaining lives in the state of origin. Recent China-born immigrants spent most of their time in NSW and VIC if they were from the two states or SA, TAS, NT and ACT. QLD attracted some residents from SA and NT. Likely due to its geographic distance, WA sustained the majority of its Chinese residents but did not attract much from elsewhere in Australia. The relative attractiveness between big states also changed over time. Comparing the shares in 2006 and 2016, immigrants now tend to spend less time in NSW but more in VIC. For instance, SA, TAS and ACT became less capable of retaining their recently arrived Chinese residents between 2006 and 2016. The majority of their residents went to VIC in 2016 except for the China-born males from ACT. In the meantime, retentions of recently arrived Chinese residents in the popular destination NSW decreased over the ten years. Thus, the growing presence of VIC in the inter-state migration system over the last decade is likely caused by both the increasing concentration of Chinese

international students[10] in VIC and their secondary movements towards VIC after graduation elsewhere in Australia. Results for the China-born female population are presented in Appendix C and similar patterns are observed.

-------- Figure 7 about here --------

In summary, results from multistate life tables show variations in the probabilities and directions of migration for immigrants of different length of residents in Australia. For persons born in mainland China, the chances of staying or moving to NSW and VIC are high and change relatively less with increasing duration of stay in Australia. The chances of leaving SA, TAS, and ACT become increasingly high over time. QLD and WA are relatively more likely to retain recently arrived Chinese persons and attached some from elsewhere within Australia. Though immigrants of different duration of residence have different propensities to migrate, the direction of migration has less to do with their duration but more the economic opportunities and networks in local areas.

7. Conclusion and Discussion

This paper examines inter-state migration patterns of the China-born immigrants in Australia concerning their age and duration of stay in the host country. Comparisons are made between immigrants born in mainland China and other major sending countries to investigate regularities and variations across birthplaces. Similar to previous studies in Australia, Europe

[10] International students are usually new migrants with less than five-year residence in Australia (ABS 2019).

and North America, results in this paper show that in the presence of a young age pattern, duration of stay in the host country has an important but gradually diminishing power on immigrants' internal migration (Bell and Hugo, 2000; Newbold, 2007; Reher and Silvestre, 2009). In the meantime, the origin of immigrants and place of residence in Australia bring out variations in the age-duration-migration relation.

Age and duration of stay strongly affect immigrants' internal migration patterns. Following a typically young migration age schedule, five-year probabilities of migration are much higher for immigrants with shorter experiences in Australia. The counterfactual analysis shows that migration of recent arrivals is the major contributor to immigrants' overall inter-state migration. Their high mobility suggests intensive opportunity searching and key life course events during transitions from temporary to permanent migrants (Hugo, 2004; Khoo et al., 2008; Chiou, 2017). With immigrant's year of living in Australia increasing, they become more settled and attached to local areas with progressively declining migration probabilities (Sampson, 1988). From a cohort perspective, the same cohort of arrivals also has higher probabilities to move in their early years in Australia. After excluding the cohort of recent arrivals, there is possibly an age-on-arrival effect where persons who migrated to Australia at very young ages exhibit high migration probabilities once reaching adult ages. This interaction between age and duration is evident amongst immigrants born in China, the Philippines, the Pacific Islands and North America at age 20 years. This observation supports the spatial assimilation and life course transition theories that the 1.5 generation (Rumbaut, 2012) are adopting the Australian population's high mobility once reaching young adult ages.

With such strong regularities in the age-duration-migration relation, the level of internal migration varies by birthplace and changes over time. Asian immigrants have relative lower inter-state migration probabilities than European-origin immigrants (Raymer and Baffour, 2018). For the China-born immigrants, probabilities of inter-state migration are

lower compared to persons born in Australia or other top sending countries. However, recently arrived Chinese immigrants are becoming increasingly mobile between 2006 and 2016: their age-specific migration probabilities peak as high as those born in the United Kingdom and New Zealand in the 2016 Census. The escalating mobility for persons born in China (and India) may have to do with enlarged shares of skilled and student immigrants in these two populations. These people are either more advantaged than family and humanitarian migrants in responding to economic opportunities across Australia or constrained by the current two-step migration pathway.

Current state/territory of residence affects immigrants' inter-state migration. There is a gap in the propensities to stay in the state/territory of residence between the China-born immigrants living in states with relatively large Chinese communities and the other four less populated states/territories. Accounting for the direction of their movements, the four small states/territories loss their China-born residents to New South Wales and Victoria, particularly New South Wales. Though immigrants of different duration of residence in Australia have different propensities to migrate, the direction of migration has less to do with their accumulated experiences (duration of stay) but more the economic opportunities and networks in local areas. Evidence shows that levels of retention for immigrants with different overseas origins reflect the relative distribution of their networks and community sizes in the state/territory: for instance, Chinese in New South Wales, Indian in Victoria, New Zealander in Queensland, and British people in West Australia. Over time, however, recently arrived Chinese are increasingly favoring Victoria than New South Wales, though New South Wales still has the highest concentration of the Chinese and the China-born communities. The shifting direction of migration results in a tendency of spatial diffusion for the well-educated and skilled recent Chinese cohorts who exhibited alternative settlement patterns compared to established immigrants with traditional regimes (Guan, 2019). In the meantime, South

Australia, Northern Territory, and Australian Capital Territory became less capable to retain their Chinese residents. It shows a decreasing attractiveness of these states and territories. Australia's temporary-permanent migration pathway, with its state/territory nomination component, is also likely stimulating high internal migration amongst immigrants.

In conclusion, this study contributes to the understanding of immigrants' adjustment and settlement in the destination society as well as the patterns of their dispersion and concentration in Australia. It identifies the regularities in age-duration-internal migration relations and shows the necessity of taking that into account to understand the subsequent migration of immigrants in the destination country. Following the line of this research, further investigation can focus on how the duration of stay affects immigrants' other settlement outcomes such as socio-economic success and socio-cultural integration (National Academies of Sciences, Engineering, and Medicine, 2015). The study also extends our knowledge on the changing geography of a large immigrant population in a major immigration country. With a continuous shift of Australia's immigrant population toward skill-based, stricter enforcement of regional nomination system (Department of Home Affairs, 2019), and Asia becoming an increasingly important origin for international migration, a changing population geography is expected to persist.

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Appendix A

-------- Figures A1-A7 about here --------

Appendix B

-------- Figures B1-B7 about here --------

Appendix C

-------- Figure C1 about here --------

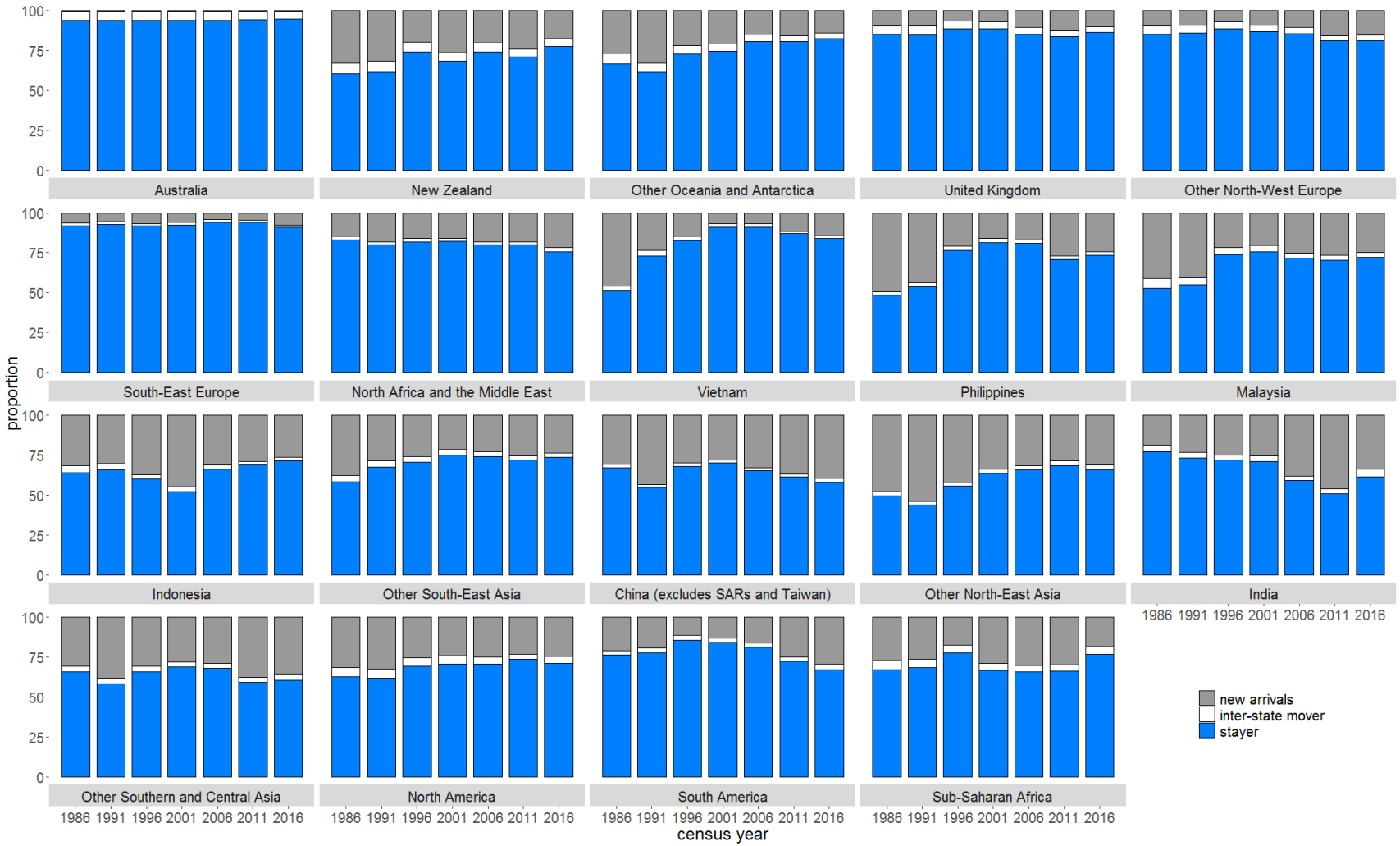

Figure 1. Decomposing birthplaces-specific populations by five-year inter-state migration status: 1981-1986 to 2011-2016

Data sources: 1986, 1991, 1996 and 2001 numbers from customized ABS Census tables; ABS 2006, 2011 and 2016 numbers from Census TableBuilder (ABS, 2018a)

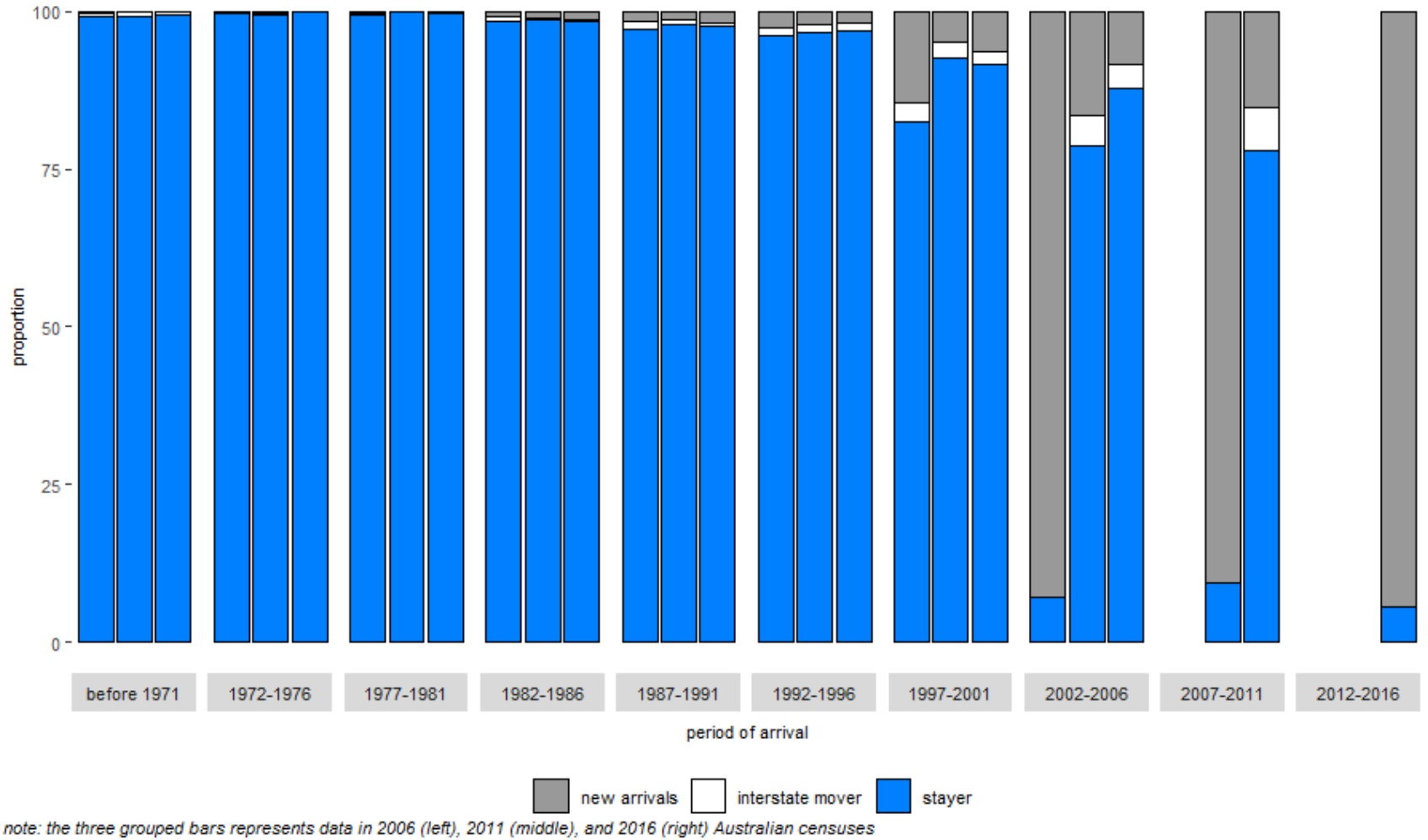

Figure 2. Proportions of the China-born population in the 2006, 2011 and 2016 Censuses, by five-year inter-state migration status and disaggregated by immigrants' period of arrival in Australia

Data source: ABS Census TableBuilder (ABS 2018a)

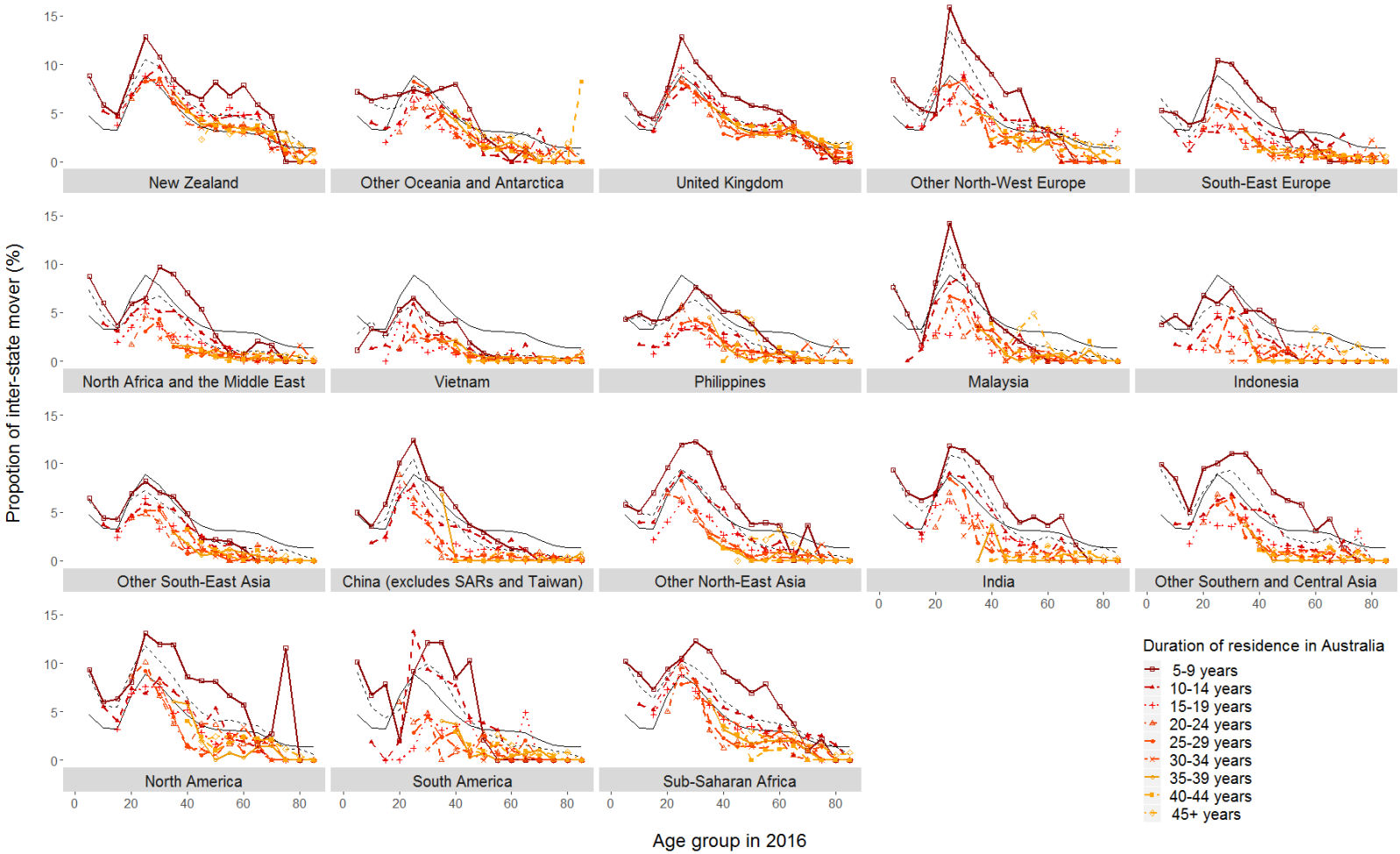

Figure 3. The age profile of inter-state migration probabilities for 18 overseas-born populations by the duration of stay: 2011-2016 intercensal period (undotted black lines are the probabilities of the Australia-born (the unbroken ones) and immigrants born in the specific country without duration breakdowns (the broken ones))

source: ABS 2016 Census TableBuilder (ABS, 2018a)

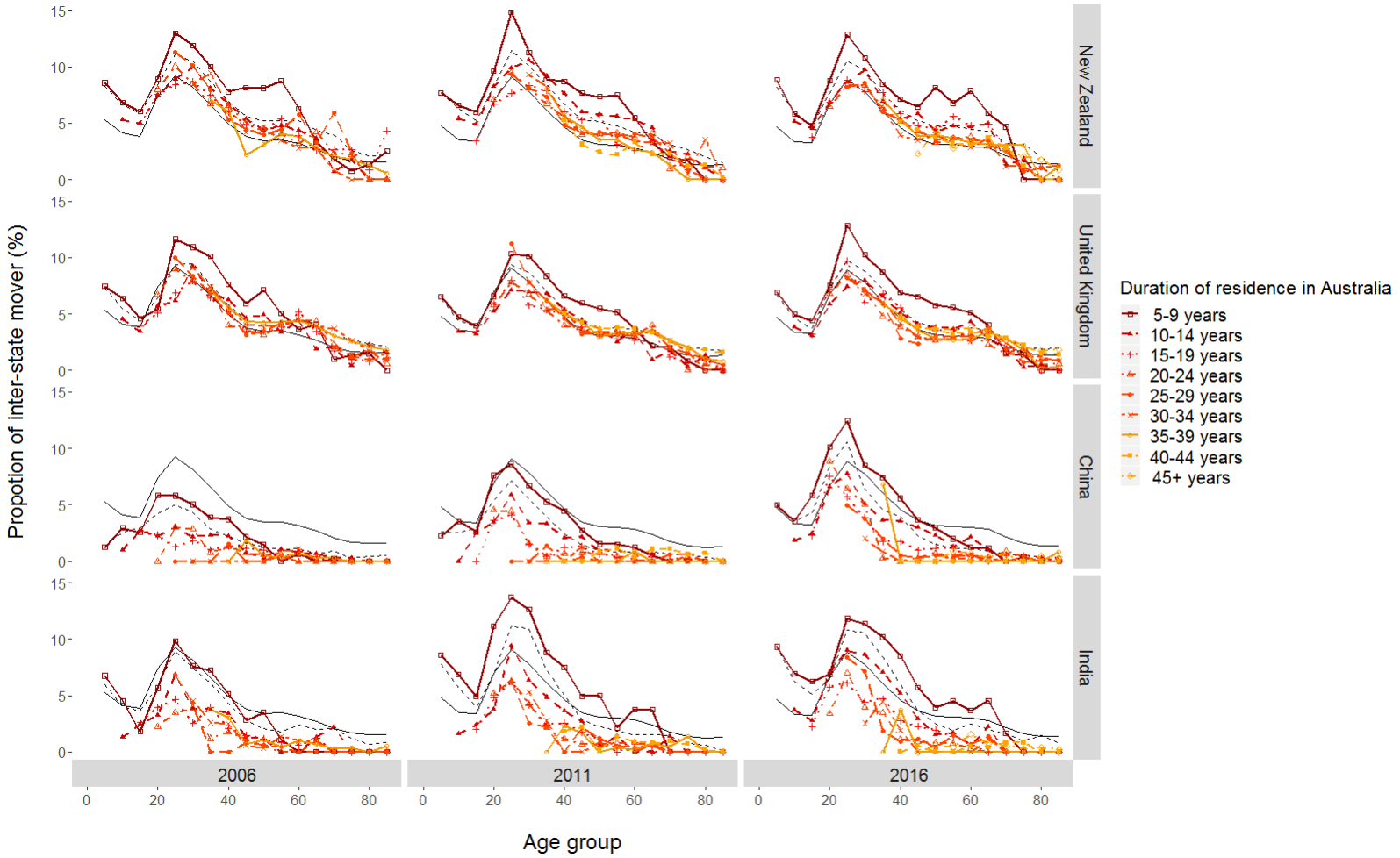

Figure 4. The age profile of inter-state migration probabilities for four overseas-born populations by the duration of stay: 2001-2006, 2006-2011, 2011-2016 intercensal periods (undotted black lines are the probabilities of the Australia-born (the unbroken ones) and immigrants born in the specific country without duration breakdowns (the broken ones))

source: ABS 2006, 2011, and 2016 Census TableBuilder (ABS, 2018a)

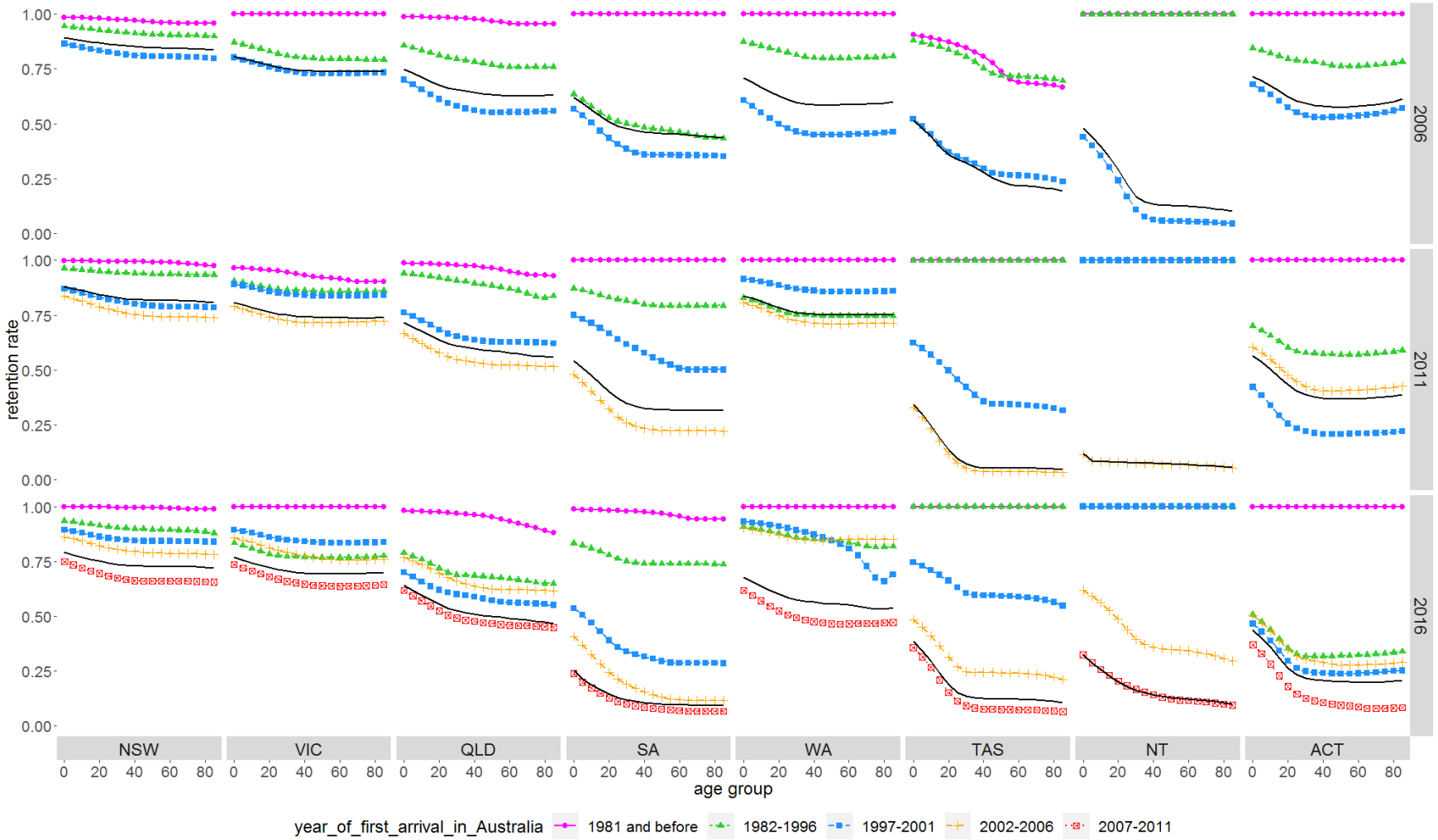

Figure 5. Retention of the China-born male population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all China-born men without duration breakdowns)

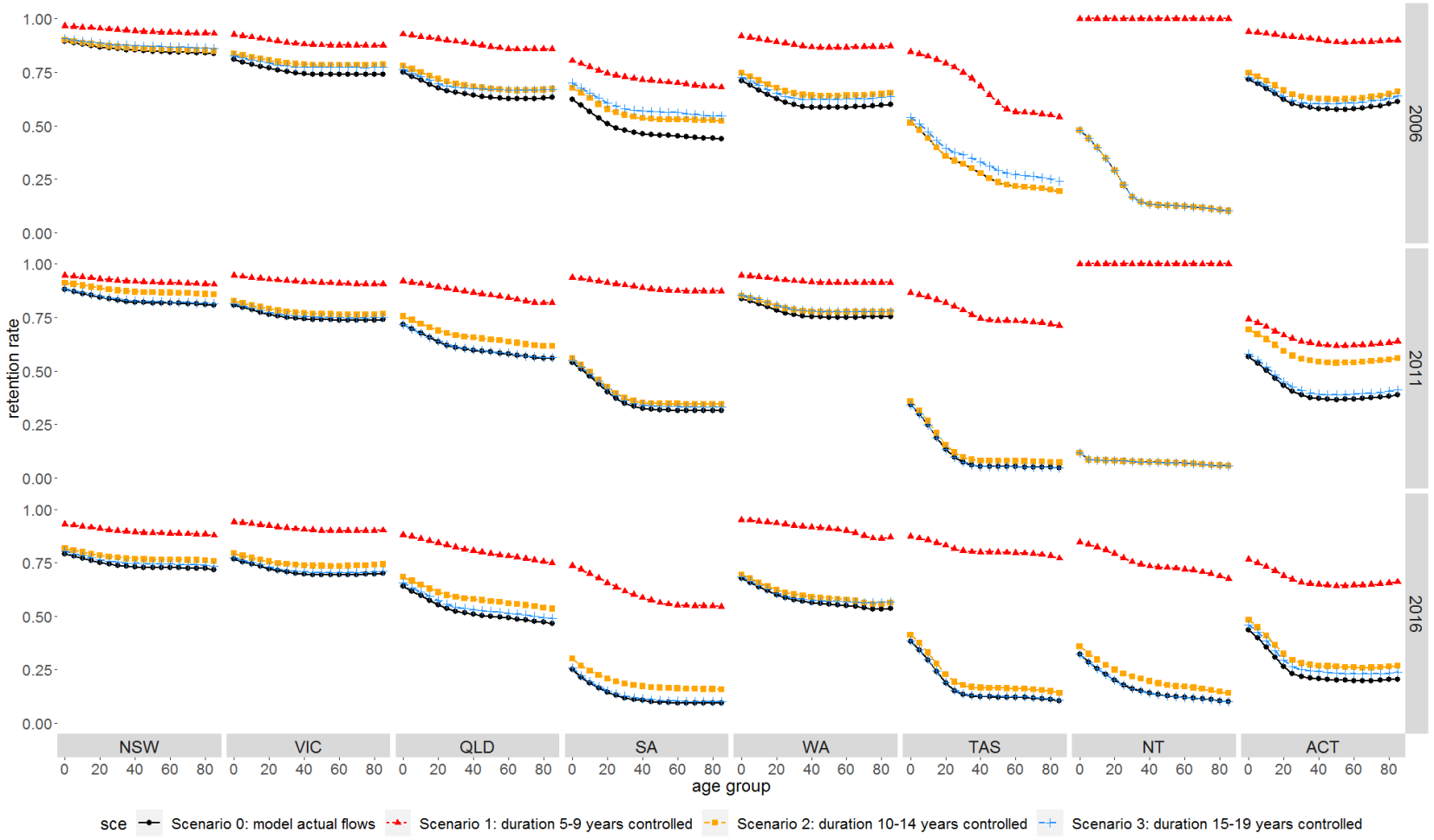

Figure 6. Retention of the China-born male population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3) in which immigrants who have been stayed in Australia for (i) 5-9, (ii) 10-14, and (iii) 15-19 years are forced to stay in where they were five years ago, 2006, 2011, and 2016 Censuses

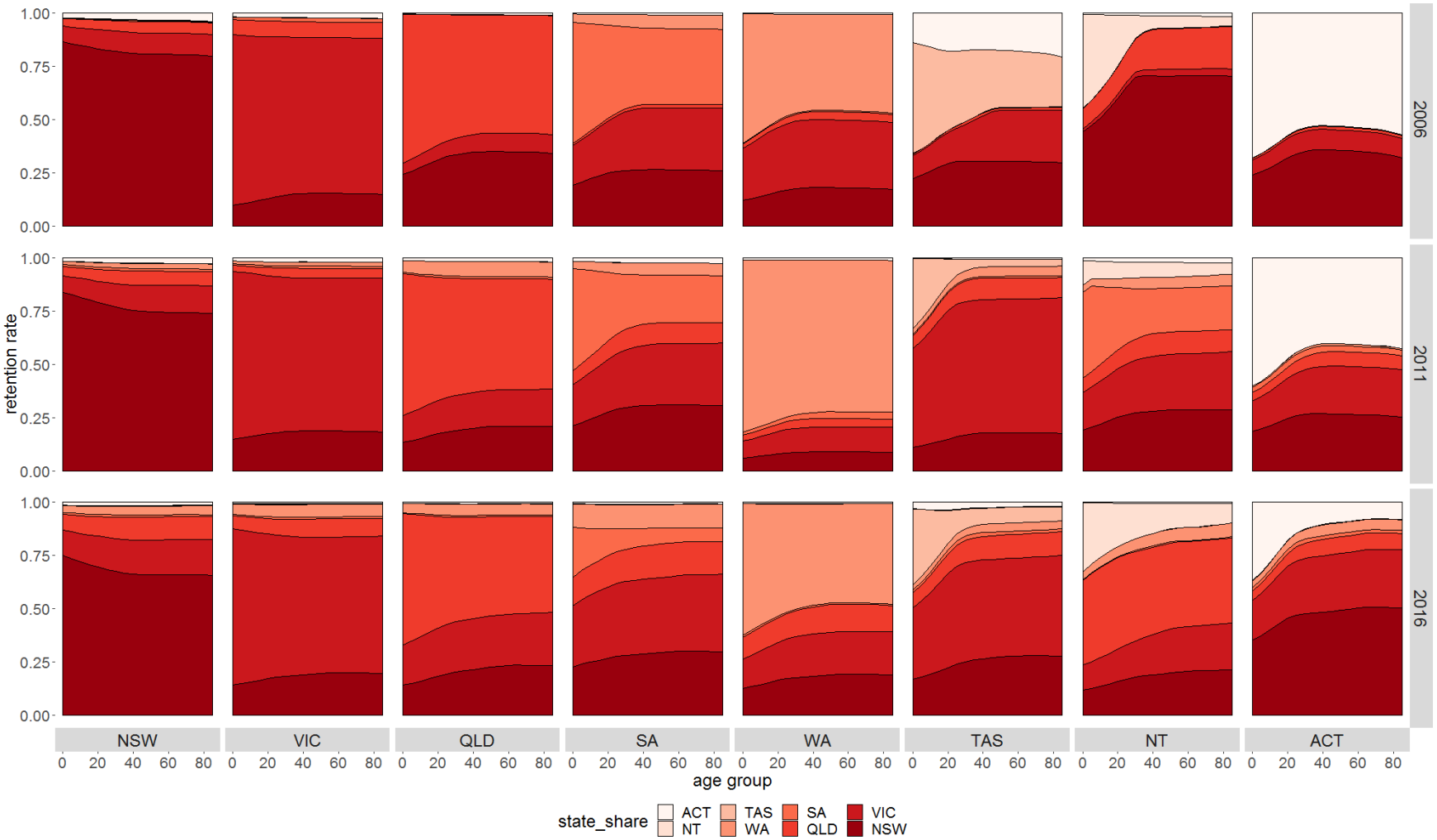

Figure 7. Shares of expected remaining life spent in eight Australian states/territories for the recently arrived (with 5-9 years duration of stay in Australia) China-born male population by age and state of origin, 2006, 2011, and 2016 Censuses

Appendix A

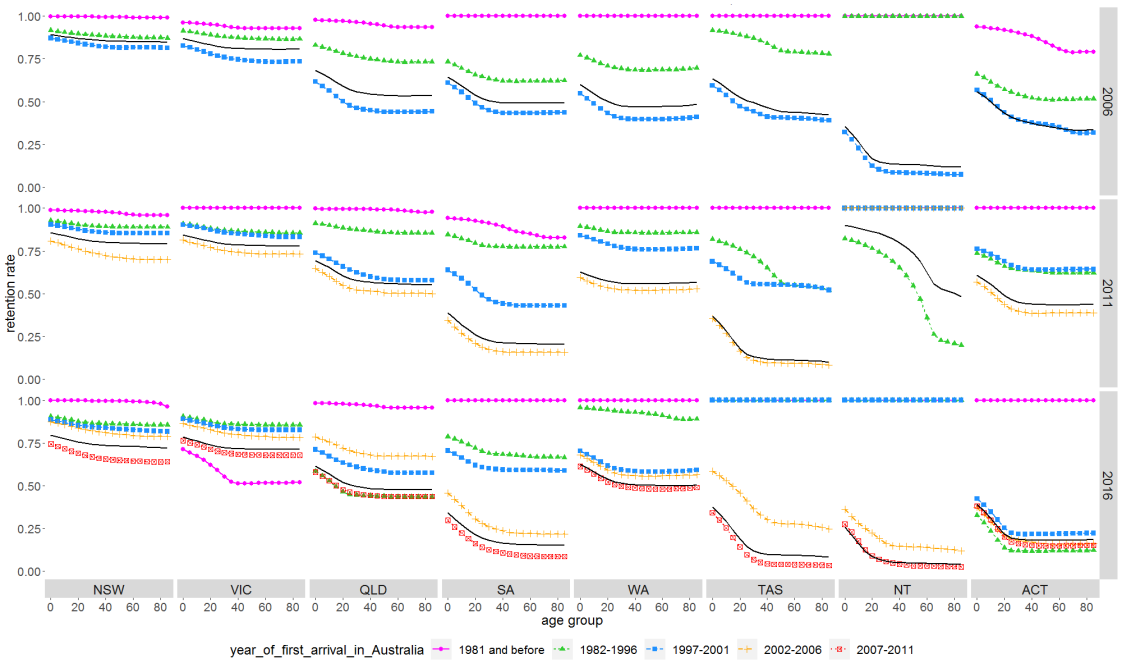

Figure A1. Retention of the China-born female population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all China-born women without duration breakdowns)

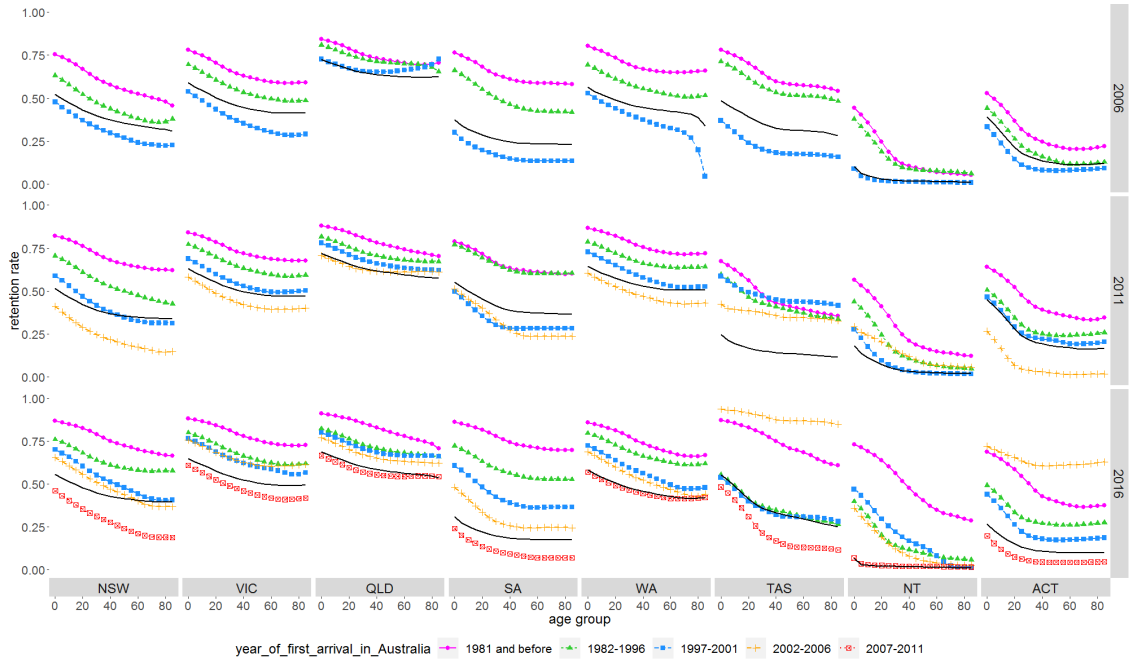

Figure A2. Retention of the New Zealand-born male population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all New Zealand-born men without duration breakdowns)

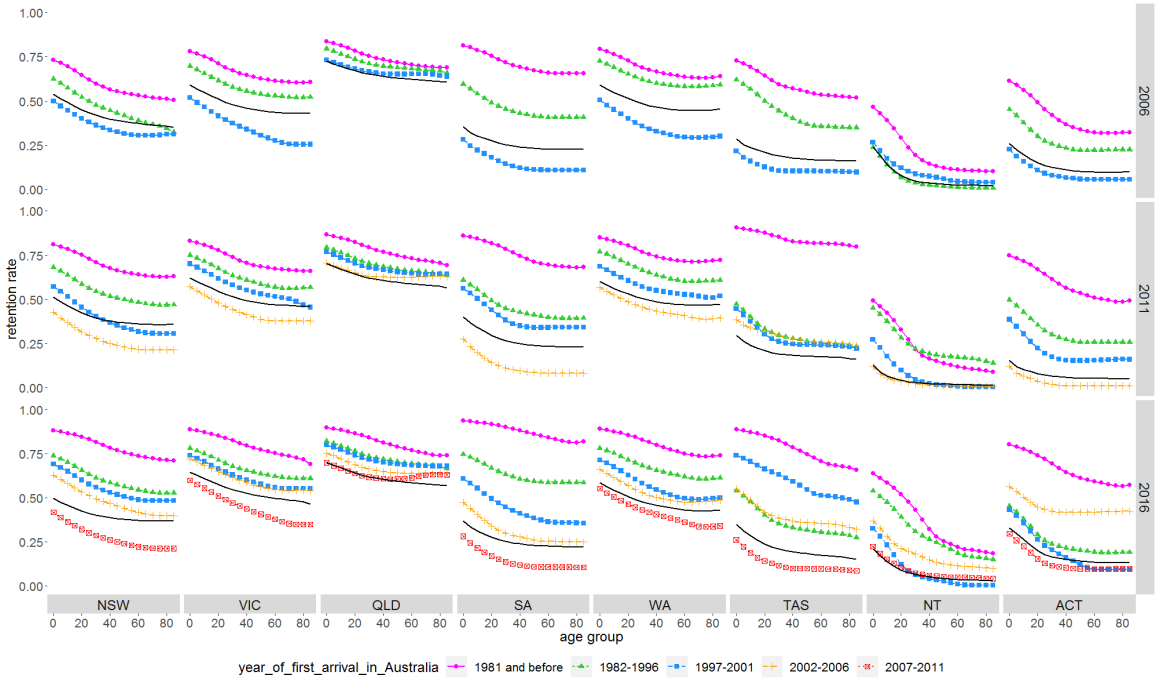

Figure A3. Retention of the New Zealand-born female population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all New Zealand-born women without duration breakdowns)

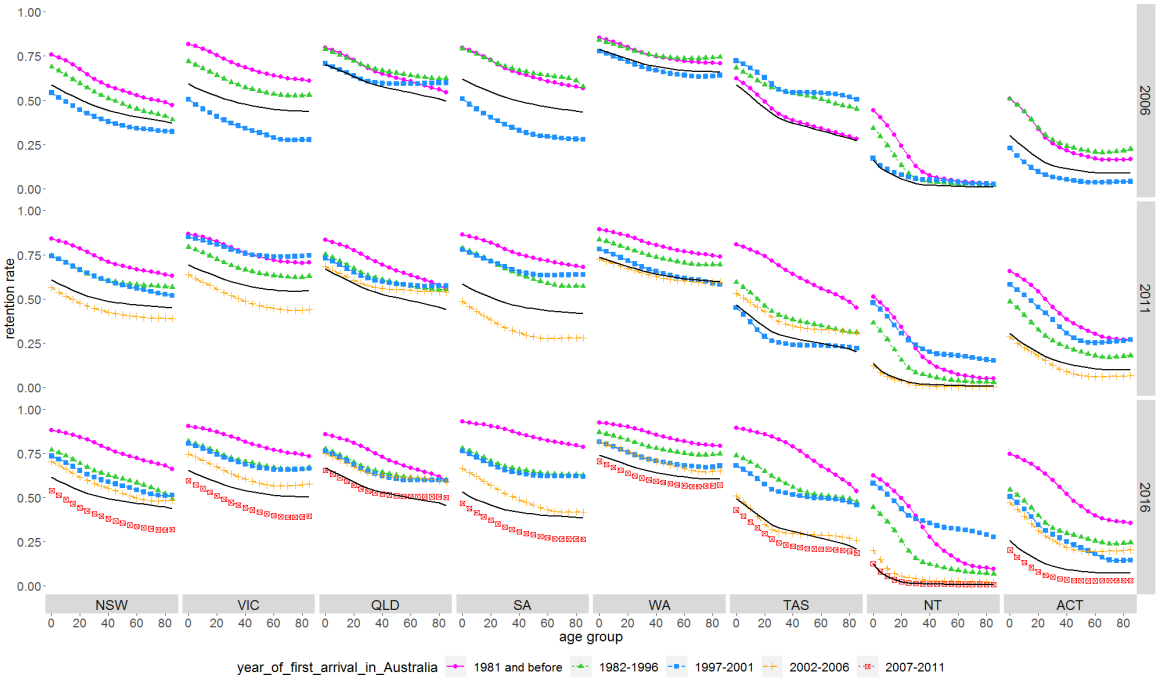

Figure A4. Retention of the United Kingdom-born male population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all United Kingdom-born men without duration breakdowns)

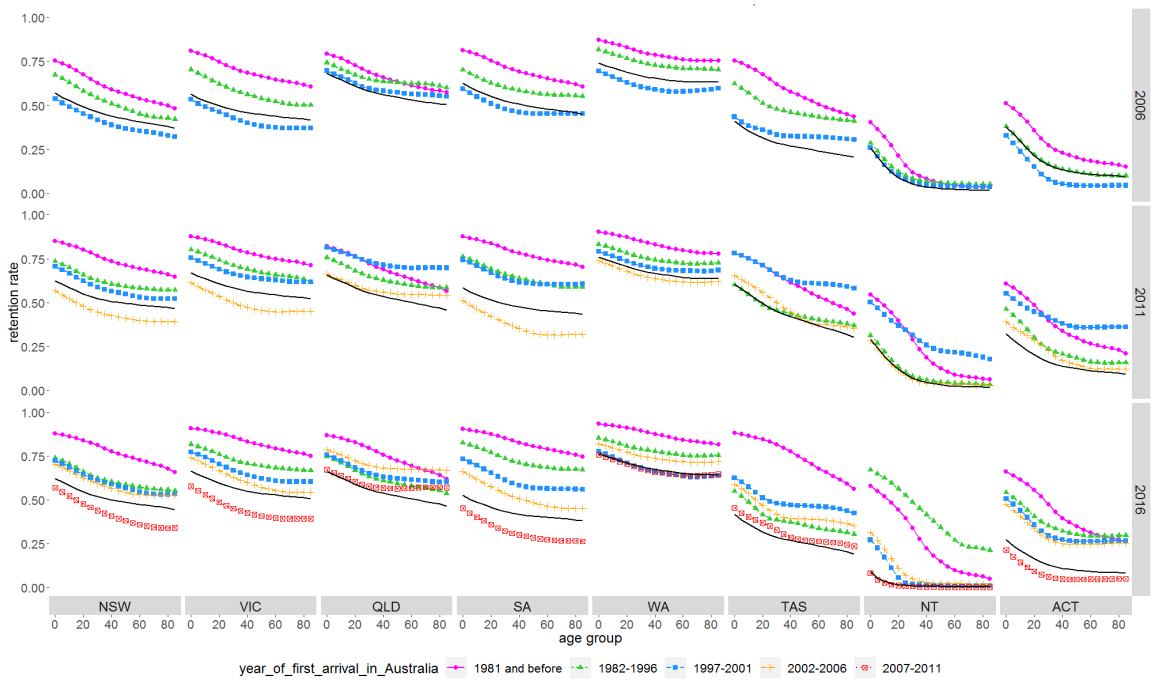

Figure A5. Retention of the United Kingdom-born female population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all United Kingdom-born women without duration breakdowns)

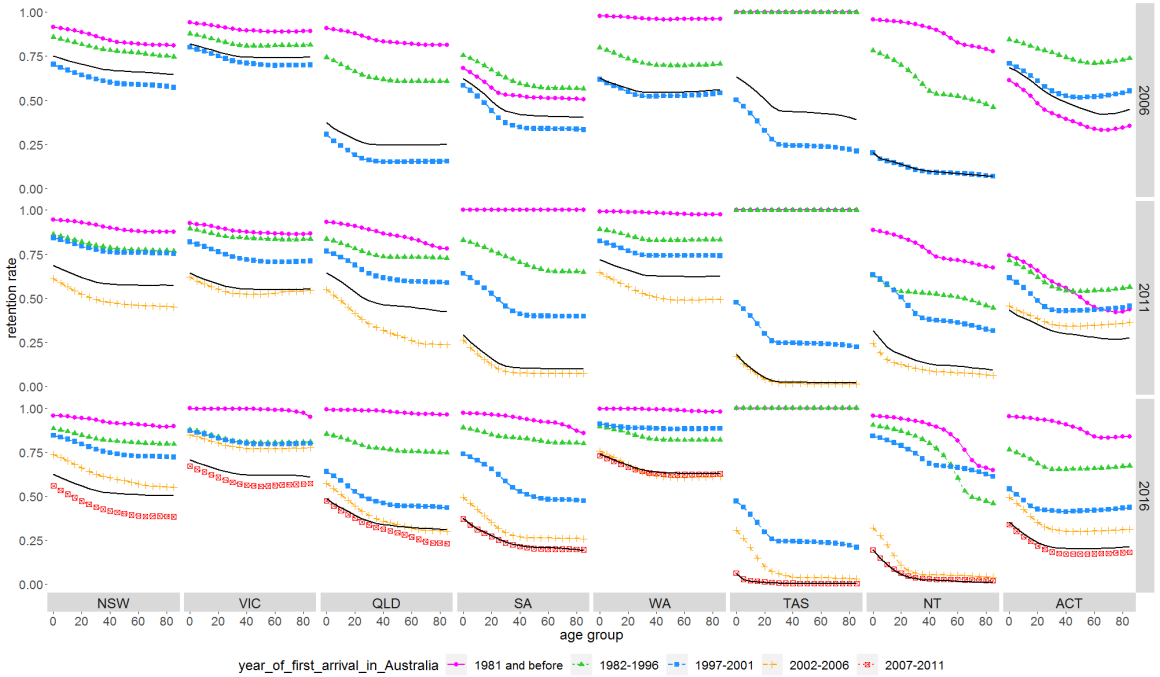

Figure A6. Retention of the India-born female population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all India-born men without duration breakdowns)

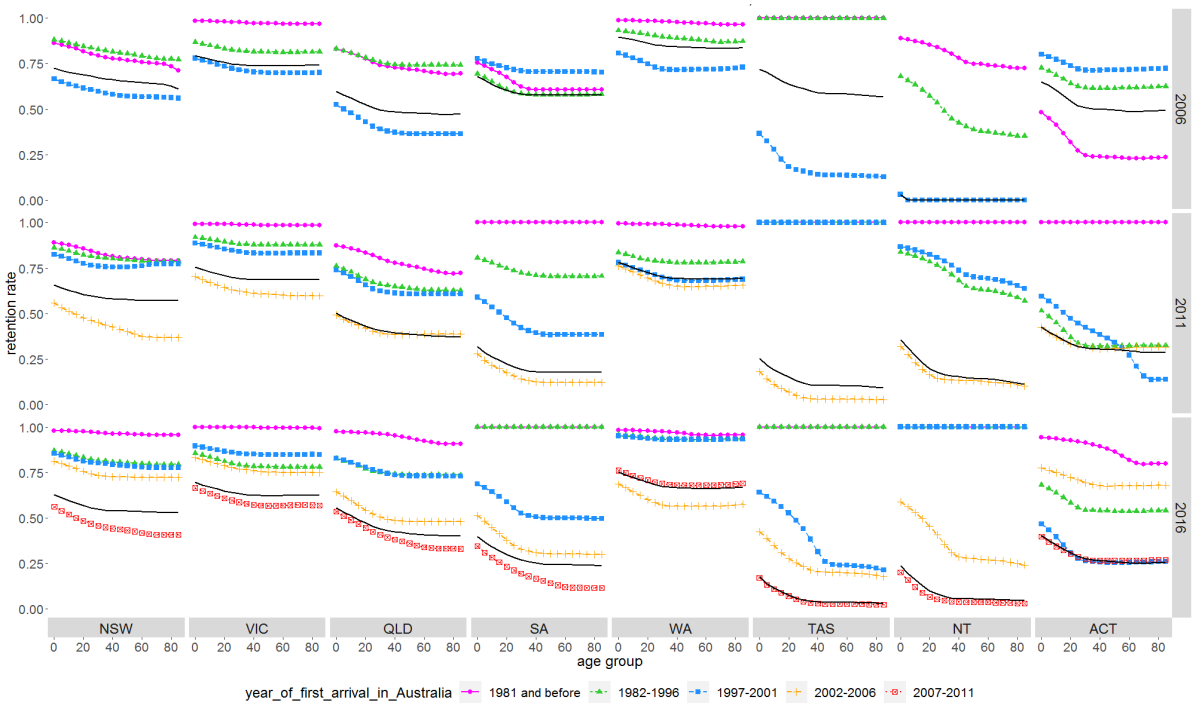

Figure A7. Retention of the India-born female population across eight Australian states/territories: multistate life table retention expectancies by age and period of arrival, 2006, 2011, and 2016 Censuses (unbroken and undotted black lines are retention of all India-born women without duration breakdowns)

Appendix B

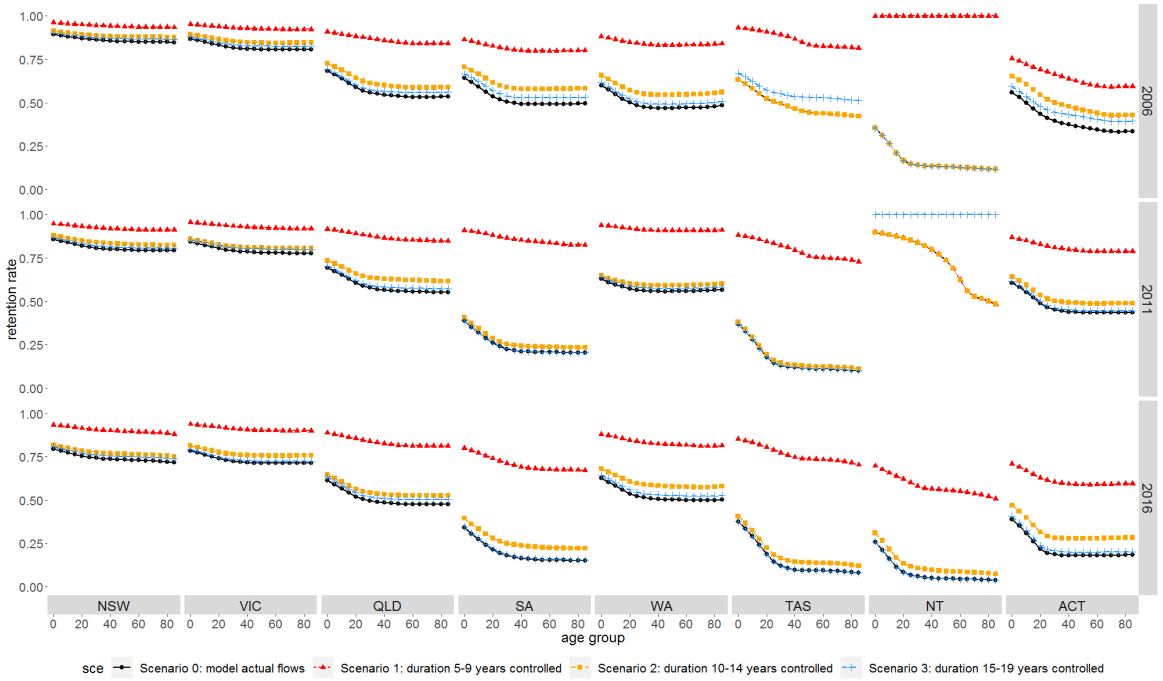

Figure B1. Retention of the China-born female population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

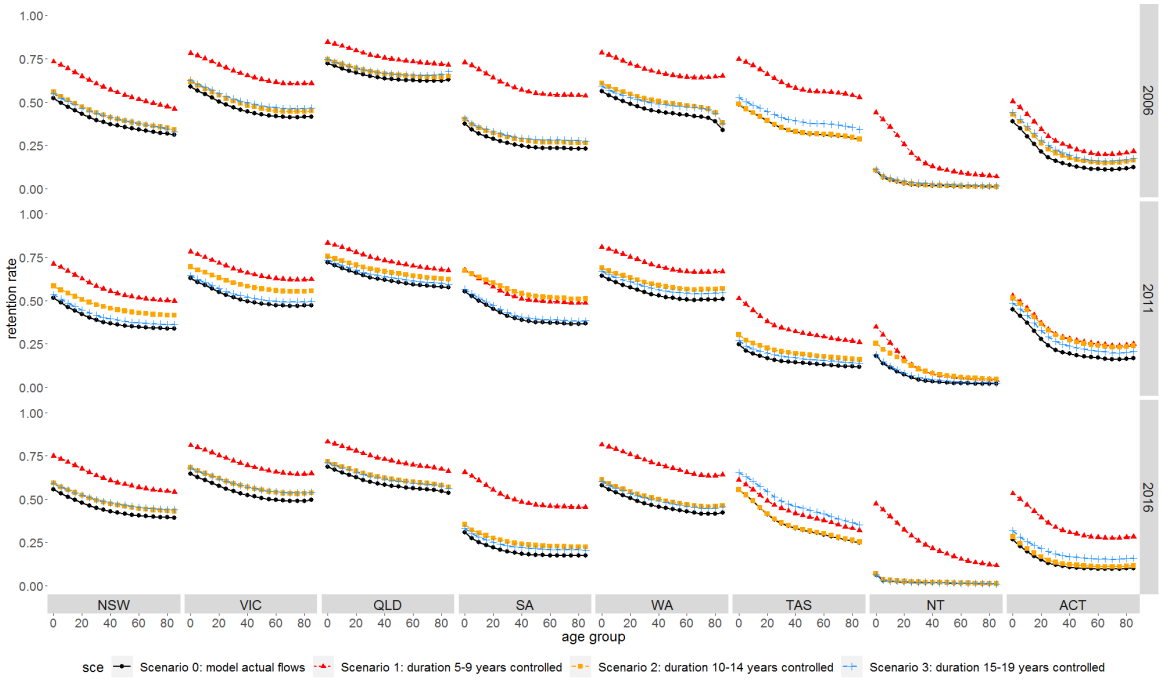

Figure B2. Retention of the New Zealand-born male population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

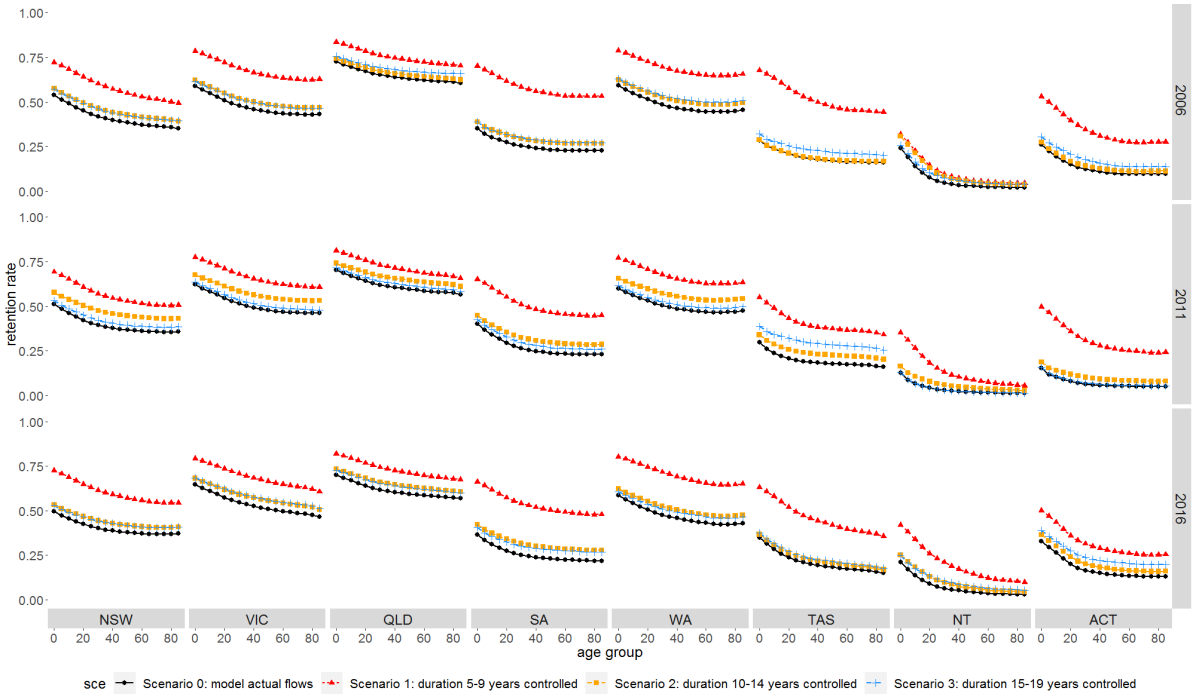

Figure B3. Retention of the New Zealand-born female population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

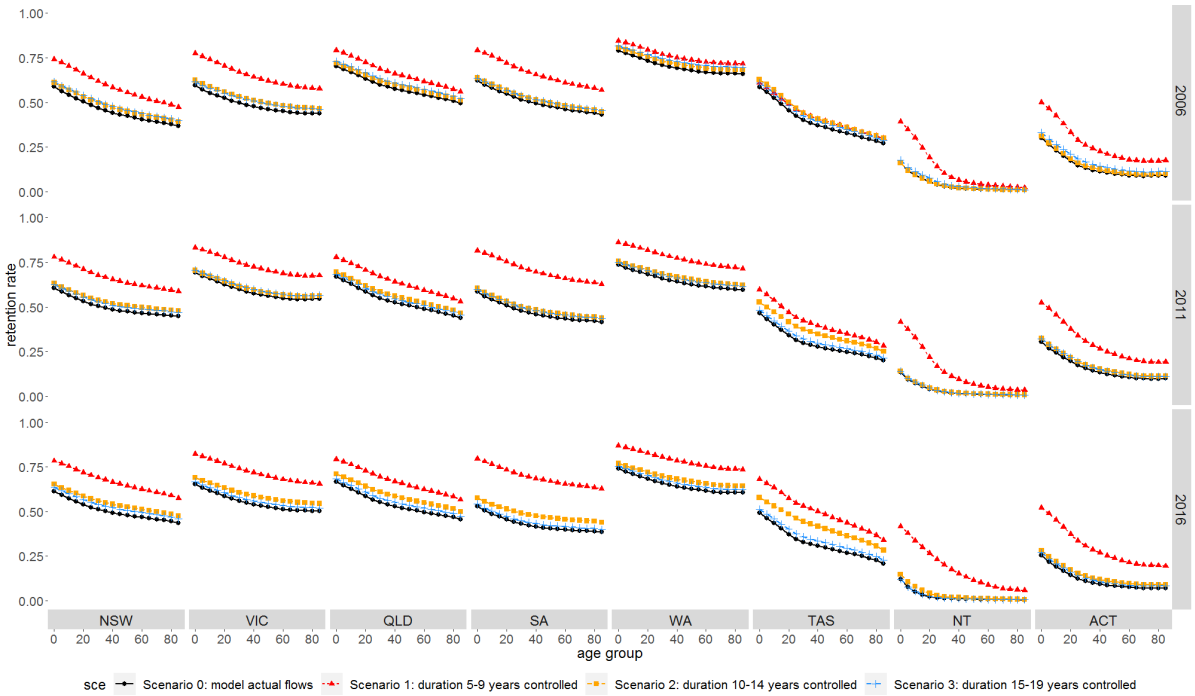

Figure B4. Retention of the United Kingdom-born male population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

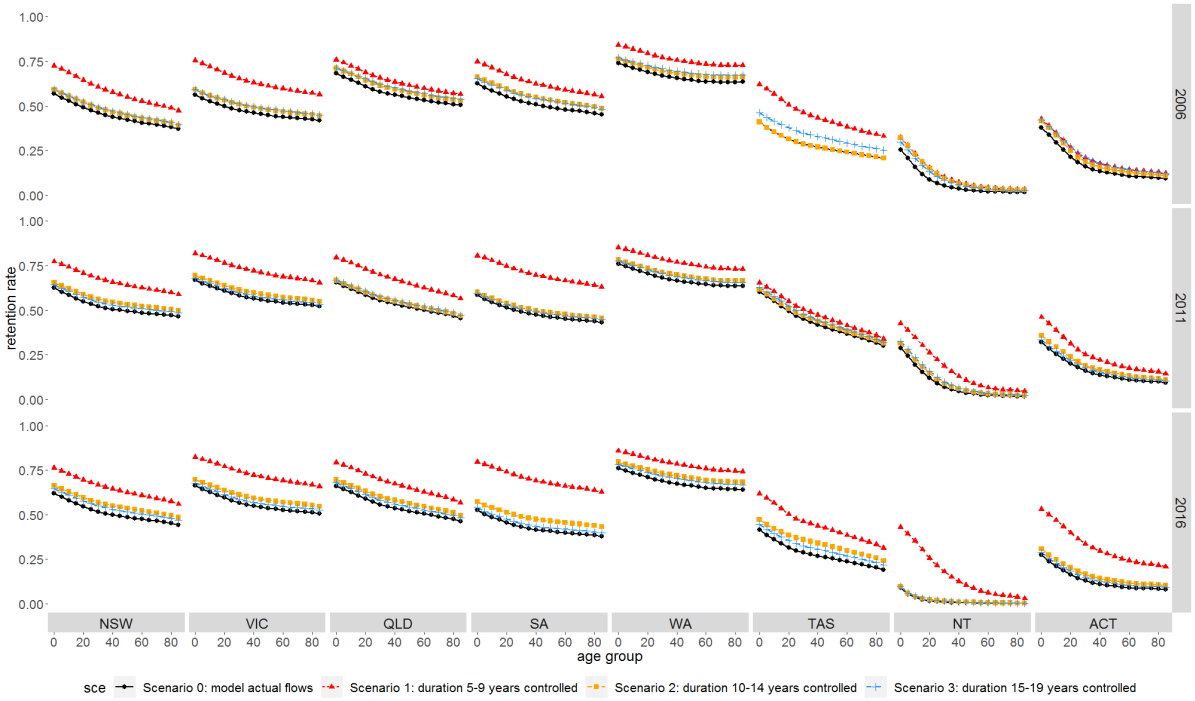

Figure B5. Retention of the United Kingdom-born female population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

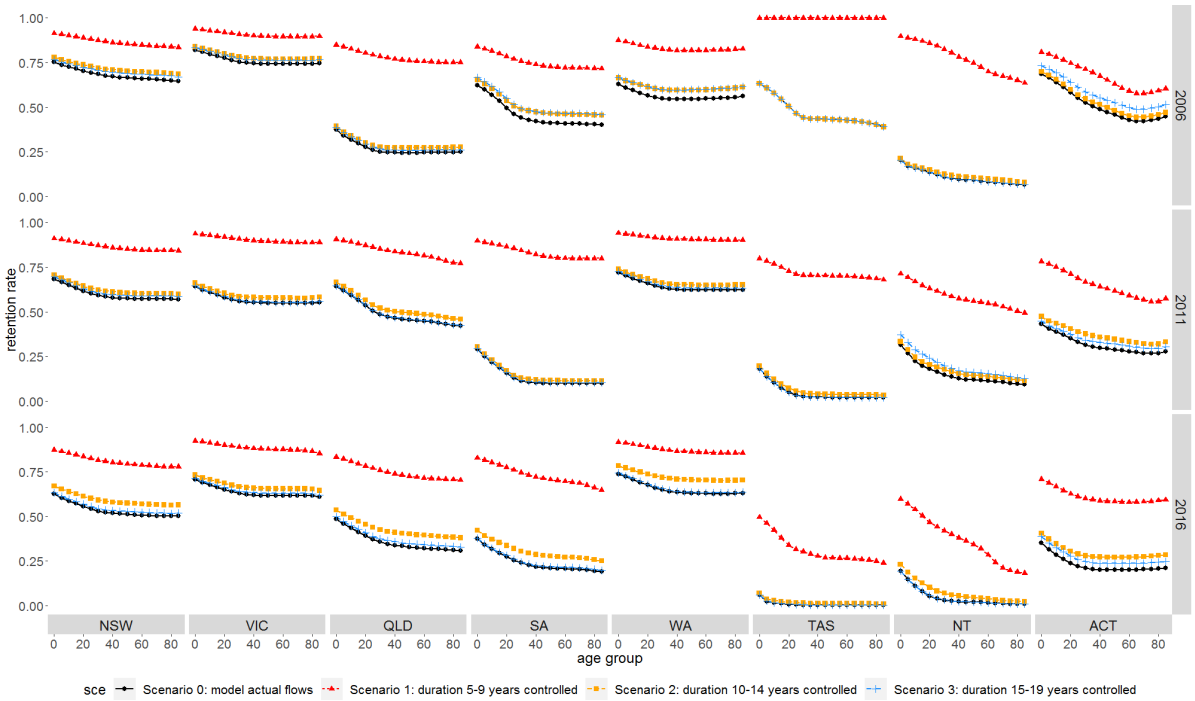

Figure B6. Retention of the India-born male population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

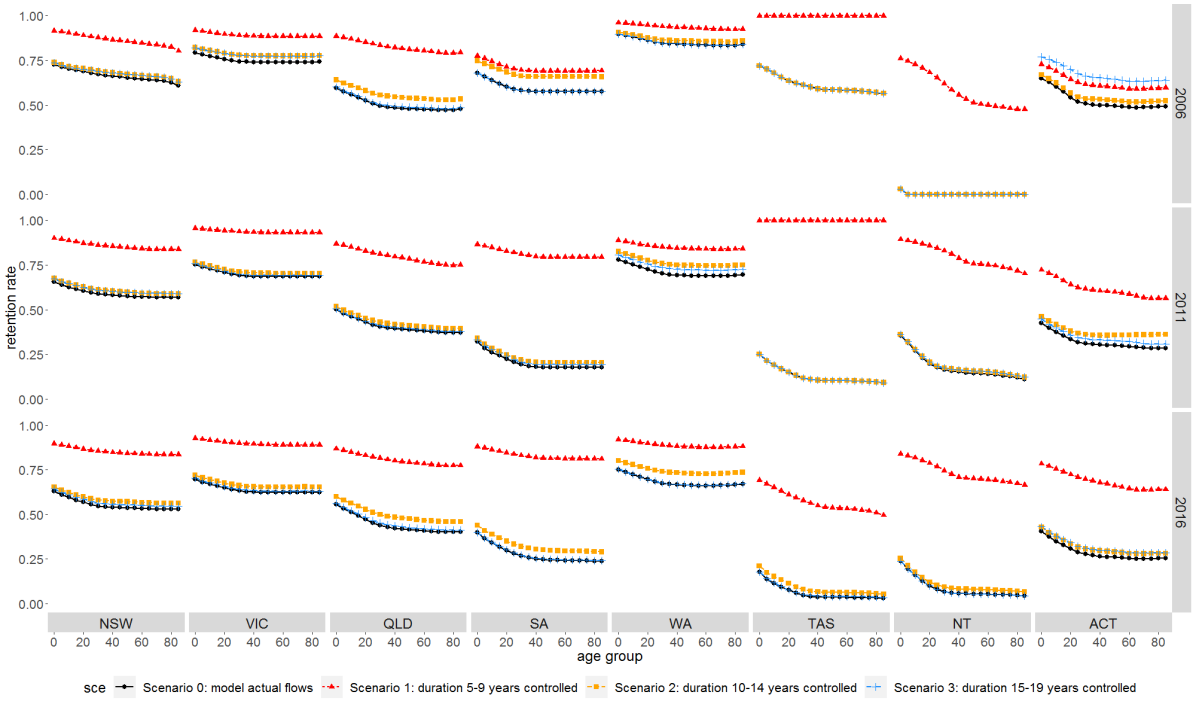

Figure B7. Retention of the India-born female population across eight Australian states/territories: the actual retentions (scenario 0) and three counterfactual scenarios (scenario 1-3), 2006, 2011, and 2016 Censuses

Appendix C

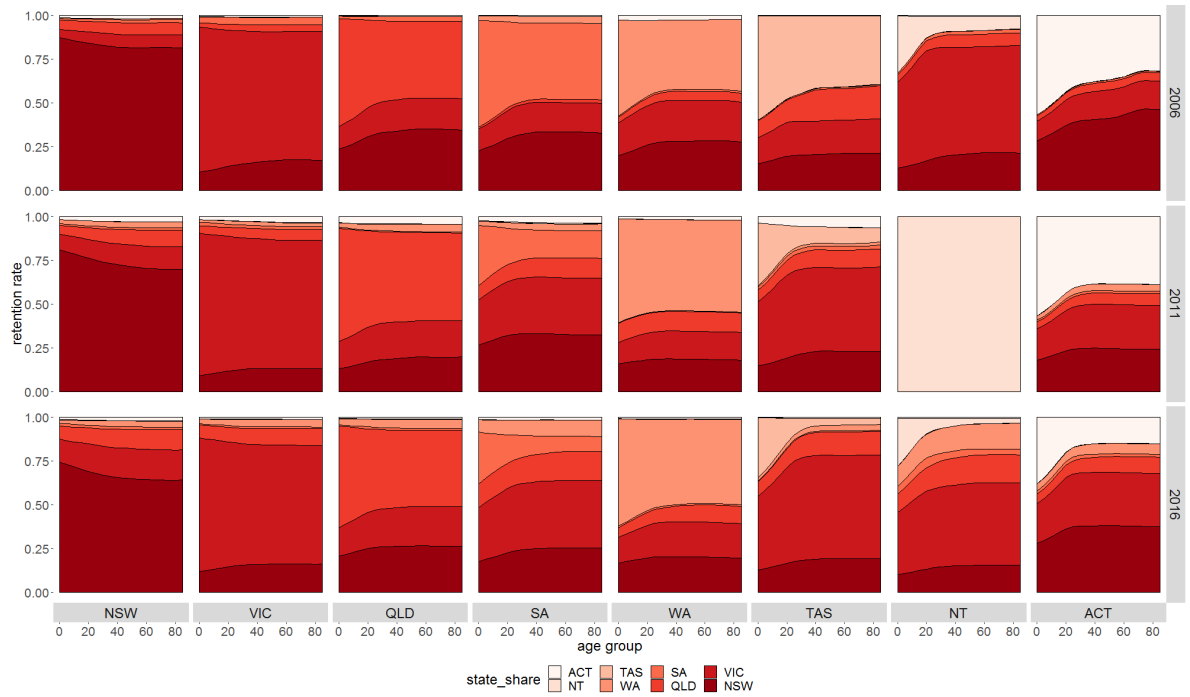

Figure C1. Shares of expected remaining life spent in eight Australian states/territories for the recently arrived (with 5-9 years duration of stay in Australia) China-born female population by age and state of origin, 2006, 2011, and 2016 Censuses