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How do rising care needs impact the formal and informal care sectors and existing inequalities?
Comparing Austria and Spain

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Abstract

As populations in Asia and Europe face unprecedented levels of ageing, the demand for long-term care (LTC) is escalating, thereby challenging the sustainability of social protection systems. This paper employs a novel dynamic microsimulation model to project LTC demand and supply in Austria and Spain through 2070, utilising data from the Survey of Health, Ageing and Retirement in Europe (SHARE). The findings of the study indicate that, in the context of the current demographic trends, both Austria and Spain are on course to experience an approximate 90% increase in the number of LTC hours required. This increase is primarily driven by improved mortality rates and shifts in population age structures. The model applies a stylized needs assessment and reveals that while the proportion of individuals needing care may decrease until 2040, significant increases in care gaps are anticipated thereafter, necessitating a substantial increase in both formal and informal care provision. The analysis further underscores pronounced variations in care delivery models across the two nations. While Austria places greater emphasis on formal care, Spain's system is marked by a more pronounced reliance on informal care. The analysis suggests that both countries will encounter difficulties in meeting the increasing demand, with the gap between care needs and available hours more than doubling, particularly in Spain. Furthermore, educational attainment plays a crucial role in shaping future care needs, with potential strategies to mitigate demand through enhanced educational opportunities. The scenarios presented demonstrate the sensitivity of LTC needs to assumptions about health trends, emphasising the importance of proactive policy measures tailored to each country's socio-cultural context. The findings of this study indicate a necessity for augmented public funding for formal care services, the implementation of supportive policies for informal caregivers, and the adoption of collaborative approaches among stakeholders to establish sustainable and equitable solutions to the challenges posed by long-term care. The study acknowledges limitations related to data and modelling choices, and suggests avenues for further research on the interplay between education, health improvements, and the evolving dynamics of care provision.

Keywords: population ageing, long-term care, care gap, projections, dynamic microsimulation
JEL codes: C53, I11, J14

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1 Introduction

As populations in many countries, particularly in Asia and Europe, experience unprecedented ageing, the demand for long-term care (LTC) is increasing, challenging the fiscal and operative sustainability of social protection systems. According to the OECD (2023), even prior to the COVID-19 pandemic, only half of individuals aged 65 years and older with severe limitations of daily living activities in Europe received formal care. One out of four persons received neither formal nor informal care. The combination of increasing care needs, declining working age populations and changing family structures and gender roles calls for adapting LTC systems in multiple dimensions. Addressing the care needs in ageing societies necessitates a combination of both formal and informal care strategies. Optimal outcomes in the division between formal and informal care and also in terms of the working conditions and well-being of care-givers are hampered by limited resources, but also path-dependencies and institutional constraints.

The steady pace of demographic change, but also the time lag with which policy measures and institutional changes take effect, means that a forward-looking view is important to address the challenges associated with LTC. There is however a lack of evidence on the role of LTC systems in long-term trends, on the impact of rising demand for care on different groups of care-givers, and on sustainable ways of organizing care provision.

With this paper, we aim to help informing the policy debate with scenarios that highlight trajectories of LTC demand and supply. We assess how increasing care needs interact with institutional settings and impact on existing inequalities and systemic vulnerabilities. We compare Austria and Spain, combining the analysis of care systems with projections of the evolution of care needs.

There are different approaches to project the future LTC needs of a population, a brief overview including specific examples is given by Eggink et al. (2016) and Belmonte et al. (2023). In macrosimulation studies, the care needs of demographic groups are held constant over time and combined with population projections, so that shifts in aggregate demand result solely from changes in the size and composition of the population. Macrosimulation is particularly useful to carry out large, multi-country studies such as the Ageing Report published by the European Commission. Microsimulation approaches, on the other hand, model the interaction of various socio-demographic characteristics (such as age, sex, education and partnership status) with other care determinants (particularly health and activity limitations) at the individual level.

We use a dynamic microsimulation model to project care needs and simulate scenarios of how they can be met formally by the market and/or government and informally by the family. The model is based on comparative SHARE and EHIS data and is consistent with Eurostat population projections. Our projections quantify future needs and explore options for necessary system adjustments in the context of socio-demographic changes and changes in women's labour force participation affecting informal care.

Our projections illustrate that, under status quo assumptions, Austria and Spain face a very similar increase in demand for long-term care, with an increase in LTC hours needed of almost 90% by 2070. More than half of this increase is due to improvements in mortality, the rest to shifts in the age structure of the population. The positive effects of the educational expansion of the last decades are already taken into account in these figures. On the other hand, these projections are based on the assumption that a longer life also leads to more years of life with a need for care. As we show in scenarios with alternative assumptions, preventing an increase in the expansion of morbidity can cushion the effects of ageing significantly.

Our results also suggest that there is limited scope to increase the proportion of care provided by partners within the household, based on current patterns. This means that formal and informal care arrangements outside the household will need to be significantly expanded to meet additional care needs and avoid widening care gaps. Although the projected increase in demand for long-term care is similar in both countries, the differences in the care mix, but also in the composition of the population and household structures, pose partially different challenges for the long-term care systems in Austria and Spain. Our scenario analysis shows, for example, that bottlenecks in informal care would lead to a widening of the care gap in the Spanish care system that is about one and a half times larger than in Austria.

The remainder of this paper is structured as follows. In the next section, we provide a brief overview of the LTC systems in Austria and Spain, with the aim to highlight their common and specific vulnerabilities to increases in care demand and care gaps. Section 3 describes the steps for the parameterization of the microsimulation model used in the analyses. In Section 4, we present the results from our baseline projections, covering the years 2018 to 2070. Section 5 is devoted to the scenarios we use to explore different drivers of LTC demand and supply. Section 6 concludes with a discussion of our main results, the limitations of our approach and avenues for further research.

2 Identifying vulnerabilities in the Austrian and Spanish long-term care system

Austria and Spain share some common features in their long-term care systems. Both countries have a family-based tradition of care provision, initially characterized by a low level of services and a lack of policies to support informal care. Over time, both countries have moved towards 'optional defamiliarization through the market' (Le Bihan et al., 2019), where families are encouraged to provide family care and given alternatives through the provision of (subsidized) market care. The two countries are thus part of a wider international trend, underpinned by the expansion of cash-for-care (CfC) schemes, increasingly regulated care markets and policies to support work and care (Famira-Mühlberger & Leoni, 2024).

However, there are also important differences that make for an interesting comparison and highlight the role of institutions and policies in shaping the organisation of care. Austria has a higher level of public and publicly subsidized service provision with a 'mixed' family/state model, whereas the Spanish system has retained stronger family features with less public care. The Spanish CfC system offers a broad coverage but comparatively low benefits, whereas the Austrian system is more targeted but offers higher benefits. Both countries rely heavily on migrant workers to maintain care provision, with differences in the composition of the LTC workforce by skills and work arrangements.

Austria and Spain face unique challenges and vulnerabilities in their long-term care systems that require careful analysis to ensure the provision of quality care in the future. Austria faces serious challenges in terms of supply shortages in the long-term care system, leading to difficulties in meeting the growing demand for care services. Projections of increasing demand (Famira-Mühlberger, 2024) indicate that the number of people needing inpatient and home care will increase by 120% and 100% respectively by 2050, with an accelerated rate after 2035 when the 1960s baby boom generation reaches the age of needing care. Moreover, reliance on informal care is critical in Austria (as it is in Spain), and any disruption in the availability or willingness of informal carers can strain the system. As fertility rates have fallen and women's participation in the labour market has increased, the potential for family members to provide informal care will be further reduced, leading to increased demand for formal care. Finally, the rising costs of long-term care and the need for public funding to support care services pose a challenge to the financial sustainability of the system.

Spain faces problems with long waiting lists for long-term care services, affecting the timeliness of access to care for those in need. It has a high dependency on migrant care workers, particularly in informal care arrangements, which creates vulnerabilities in terms of workforce availability and stability. Financial constraints and the need for sustainable financing mechanisms to support long-term care services represent further vulnerabilities in the Spanish care system (Costa-Font et al., 2023).

The main factors influencing the future care gap are demographic trends: Population ageing and demographic change will have a significant impact on the future care gap in both countries, increasing the demand for long-term care services. The old-age dependency ratio (the number of people aged 65 and over to the number of people aged 20-64) is changing dramatically in both countries. Whereas in 2021 there were 32 (Austria) and 33 (Spain) persons aged 65+ for every 100 persons aged 20-64, this ratio will rise to 52 (Austria) and 59 (Spain) by 2050. In both countries, therefore, there will be significantly fewer informal and formal carers in the future and fewer people to finance the long-term care system. The availability of skilled carers, the retention of carers and labour shortages will affect the ability to meet the growing

demand for care (Famira-Mühlberger & Leoni, 2024).

The integration of technology in care can both alleviate and create new challenges in addressing the future care gap. The use of new information technologies changes the workload of formal carers, the nature of work, communication and information flows (Kaihlanen et al., 2023). However, research shows that the care sector in both countries is a late adopter of new technologies. The use of AI has the potential to increase the quality of care, improve working conditions and support people with care needs, but AI applications in long-term care are almost non-existent (Hendriks et al., 2024).

In sum, government policies, funding allocations and regulatory frameworks will play a crucial role in shaping the future of long-term care systems and addressing the vulnerabilities that shape a potential future care gap. Considering the above arguments, with increasing pressure on long-term care provision, the use of long-term care may increasingly become a distributional issue, with those with fewer resources being disadvantaged.

3 Parameterization

This paper quantifies the micro-level demand and supply of elderly care in Austria and Spain and provides long-run projections of these quantities using dynamic microsimulation. We apply a recently developed method that draws on the Survey of Health, Ageing and Retirement in Europe (SHARE) to estimate individual hours of care needed, received and given, and in turn uses these inputs to parameterize the LTC module of the comparative model microWELT (Warum et al., 2025). While this section provides a brief exposition of our empirical strategy, further details on each step are contained in Warum et al. (2025).

We rely on SHARE to parameterize the care module, as it provides representative and harmonized data for the 50+ population of many EU countries and covers both the demand and supply sides of elderly care in sufficient detail, including the frequency of receiving different types of care. Parameters are estimated from cross sectional samples, pooling SHARE waves 1 to 9, excluding wave 3 and focusing on the population aged 65 and above. Since SHARE underrepresents nursing home residents, we recalibrate survey weights to better represent the nursing home population (Banks et al., 2023; Brugiavini et al., 2023).

Obtaining comparable data on individual care needs in hours is one of the major challenges our analysis confronts, since SHARE and other relevant surveys available for EU-countries lack direct measures of care hours needed. Our approach emulates the Austrian care allowance system's standardized assessment, which categorizes care needs in hours based on physical, cognitive, or psychological impairments across seven dependency levels (Warum et al., 2025). This system assesses individuals through a structured evaluation of Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs), alongside considerations for other factors such as mental health through motivational dialogues and severe mental illness provisions. Our simplified assessment for SHARE respondents mirrors these criteria, adding adjustments for under-reported limitations by including additional questions from SHARE and introducing a quadratic age term for people with limitations to address the nonlinear increase in care needs with age as well as unobserved factors. Table 2 in the Appendix shows this simplified care need assessment scheme. The age adjustment is calibrated against the Austrian care allowance prevalence in 2021 calculated from administrative data by age and sex (Famira-Mühlberger, 2024). Due to the universal nature of the care allowance, to which all persons above the threshold of 65 hours of monthly care are entitled, this data represents an excellent benchmark. We also account for inconsistencies in data availability across SHARE waves through imputation and proxies, ensuring a comprehensive assessment of care needs. This method allows for estimating monthly care hours needed, facilitating comparative analysis across SHARE countries under the assumption of consistent reporting and care need equivalence for given limitations.

Appendix Figure 6 shows histograms with the monthly hours of care need our scheme assigns to SHARE respondents in Austria and Spain. For Austria, our first alignment target of the age adjustment term is the share of 65+ year-olds with 65 or more hours of care need, which was around 20 percent in 2021. Our scheme assigns 65+ hours to a weighted share of 19.5 percent in Austria and 24.5 percent in Spain. Second, we target the Austrian conditional distribution of needing 65+ hours of care by age and sex. Appendix

Figure 7 compares this target to the results for Austria and Spain. While the prevalence of 65+ hours among Spanish men is remarkably close to that in Austria, Spanish women display a higher care need until age 90. Lastly, we also target the Austrian conditional distribution of average hours of care need by age and sex. Figure 8 shows that, for Austria, too few hours are assigned to women at the lower and upper ends of the age range and too many hours to men at the lower end. This could, however, be related to the limited number of observations with 65+ assigned hours around ages 65 and 100, which is again the threshold above which we have comparable statistics for Austria. Also, there is evidence indicating that benefit take up might be less than perfect, particularly at lower levels of care needs and thus for the younger age groups (Pennerstorfer & Österle, 2023). For Spain, we observe that we assign consistently higher average hours of care need.

Once hours of individual care need are obtained, we proceed in five steps to obtain parameters for the microsimulation model. First, we obtain estimates for the probability of needing any care by age, sex and education[1] applying statistical smoothing techniques as shown in Appendix Figure 9. The results show that the least educated have the highest probability of needing care and that the prevalence of having any care need with 65 is somewhat lower in Spain than in Austria. Second, we use quantile regressions to estimate decile means of the number of hours of care needed by age, sex and education (Appendix Figure 10). For both countries, we observe that the monthly care need tends to be lower for more educated individuals[2]. Third, we predict the probability to be in a nursing home via logistic regression by age, sex, care need, presence of a partner and number of children (Appendix Figures 11 and 12). While we observe higher nursing home probabilities for individuals with higher care need and no partner in their household in both countries, Spain exhibits a considerably lower nursing home prevalence, a less pronounced increase with age and a smaller difference between the effects of having one or two+ children.

In step 4, we first determine the home care mix, distinguishing between care received from partners, informal care from others and formal care services, and identify any care gaps using a decision tree approach based on SHARE responses and inferred data[3]. Subsequently, we estimate the probability of receiving any care from logit models interacting the covariates assessed care need, partner and children (Appendix Figure 13) and compute the share of total hours received for each care type within several subgroups (depending on care need, the presence of a caring partner and the number of children) to obtain parameters for the individual home care mix (Appendix Figure 14). As a consequence of our assumptions, virtually all people with partners in their household receive care and only few partners are classified as unable to care. For people without partners in their household, on the other hand, we observe that there is a substantial chance of not receiving care, especially at lower levels of care need and for people without children. This tendency is even more pronounced in Spain than in Austria. Turning to the care mix for those receiving care at home, in both countries, the share of formal home care (FHC) rises with needed care hours. Furthermore, having more children increases the share of outside informal care (OIC) across all groups. For those with a partner able to provide care, the share of partner care declines with increasing care need, except for very low levels of care need. On the other hand, people without partners able to care tend to experience the largest gaps at intermediate levels of care need. It is in this group that the largest difference occurs between countries, with considerably more formal care supplied to people without partner in Austria than in Spain.

In step 5, we obtain parameters on average hours of outside informal care (OIC) provided to adults outside the household by age and sex, as shown in Appendix Figure 17. We combine data from the European Health Interview Survey (EHIS) for the population younger than 50 with data from SHARE for the population aged 50 years and more to cover the age range 15-100 and apply statistical smoothing techniques. We observe that average hours for women peak earlier in Spain than in Austria, and at a higher maximum, while Spanish men report fewer hours of care given than Austrian men.

[1] ISCED 1997 levels are grouped into the categories low (0,1,2), medium (3,4) and high (5,6).

[2] We note that the Spanish parameters are based on few observations with medium or high education, which can also be seen in the Figure.

[3] Figures 15 and 16 in the Appendix provide illustrations of this categorization.

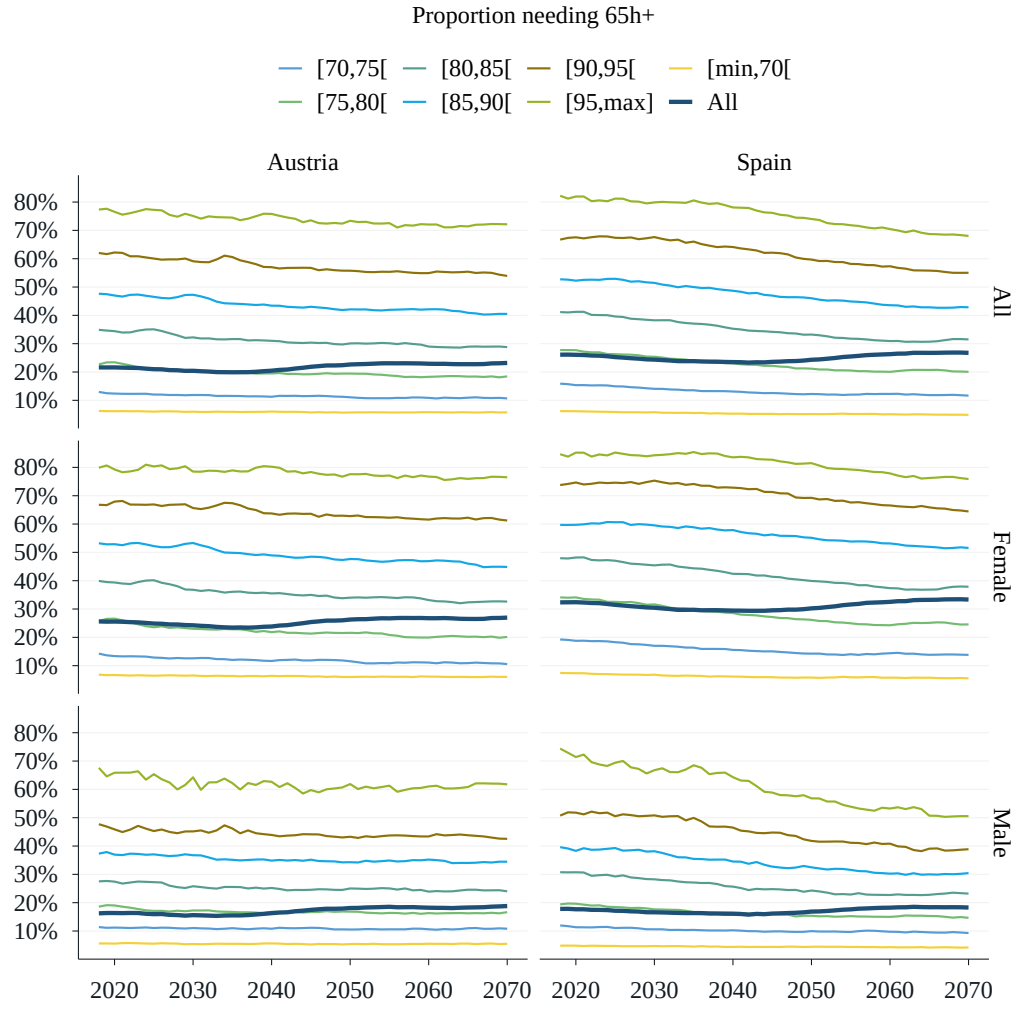
4 Results: Projecting care gaps and vulnerabilities in Austria and Spain

In order to project future care needs and scenarios for meeting them, we apply and extend the dynamic microsimulation model microWELT (www.microWELT.eu). While the basic LTC module of microWELT is detailed in Warum et al. (2025), this paper develops and explores several LTC scenarios. MicroWELT is a modelling platform explicitly designed for comparative studies, using readily available comparative data sources such as EU-SILC and - at the aggregate level - reproducing existing (in this case Eurostat) population projections while adding individual-level detail such as education, partnership status and parenthood.

Below we present the baseline (S0), which is based on status quo assumptions for both the demand and the supply of care: individual care needs by age, sex and education are held constant over time, as is the care-mix received for given needs and family characteristics such as having a caring partner and having one or more children. This baseline implicitly assumes that the supply of formal institutional and home care, and informal care received from someone other than a partner, adjusts to provide care according to currently observed patterns. For example, the number of nursing home places is assumed to increase by the amount needed to provide a place based on the individual-level probabilities of staying in a nursing home observed today. Accordingly, also the probability to face unmet care needs remains the same as it is today, given individual and family characteristics.

In our baseline, the main drivers of change in individual and aggregate care needs and the care mix are population ageing (the size and age distribution of the 65+ population), increasing longevity and increasing childlessness. The only two mitigating factors are the expansion of education and the prolongation of partnerships due to lower mortality. Concerning longevity, we assume that declines in mortality are not leading to changes in age-specific care needs in addition to changes driven by education. Concerning education, we assume that currently observed differences – higher educated people being less likely to need care and having lower care needs in hours – persist as observed today. Figure 1 illustrates the declining probabilities to need more than 65 hours/month of care by age group and sex resulting from education expansion. For the cohorts in question, the educational expansion in Spain was noticeably stronger than in Austria, which is why the need for care in Spain is also falling more sharply than in Austria. On the aggregate level, in both countries, shifts in the age structure of the 65+ population (baby-boomers moving to higher ages) reverse the declining trend in care need after about 2040.

Figure 1: **Projected changes in population proportions with care need of 65+ hours per month by age group and sex in Austria and Spain.**



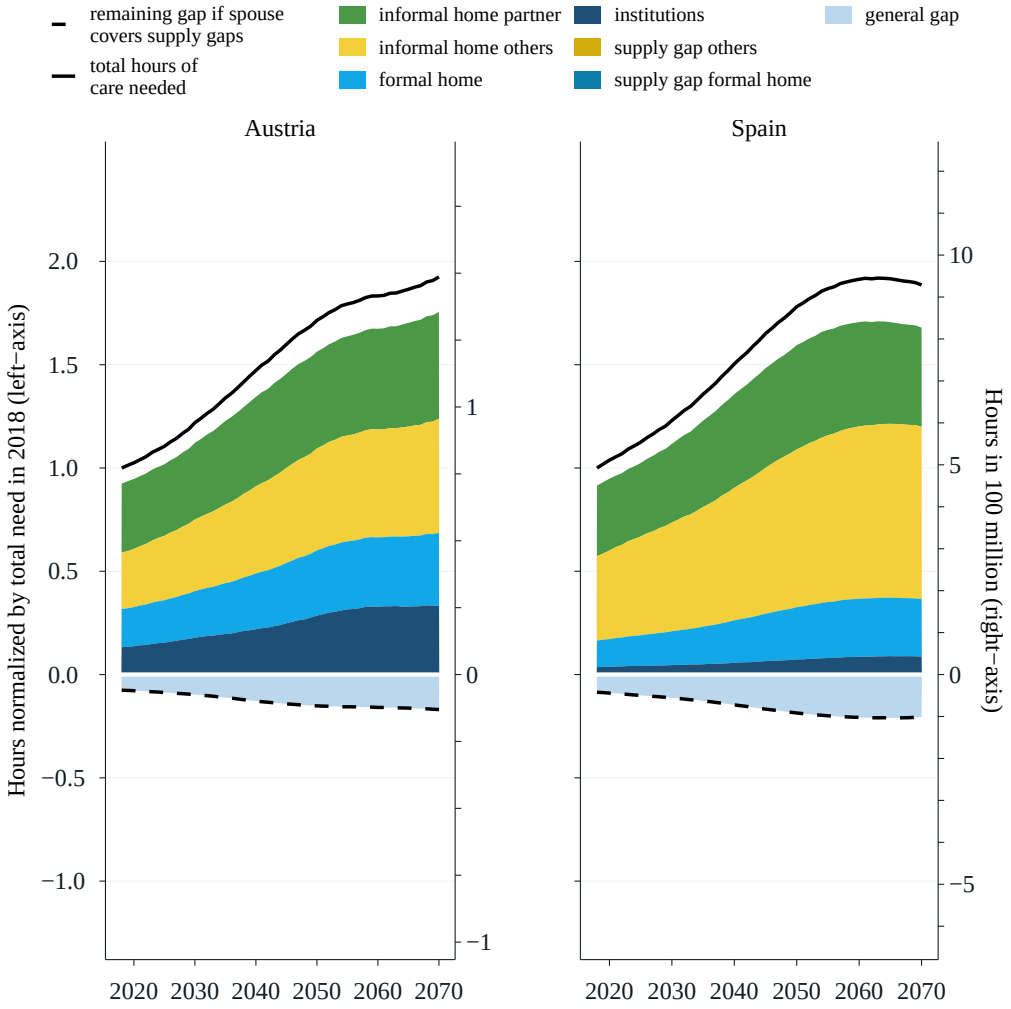
Note: We report baseline projections (S0) from microWELT.

Figure 2 illustrates the increase of projected care hours by provider, with total hours scaled to one in the first projected year (2018). Projected supply values are reported as positive shaded areas whereas additional required supply (or gaps) are indicated as negative shaded areas. The total care need is indicated by the solid black line and the dotted line indicates the remaining gap if partners are assumed to cover arising supply gaps (in the baseline, this is equivalent to the general gap). Until 2070, care needs increase by about 90% in both countries (93% in Austria, 89% in Spain). Based on current totals, the proportionately largest projected increase in hours of care provided by type concerns hours provided in nursing homes, which more than double in both countries. An equal over-proportional increase concerns the care gap. In contrast, the projected increase in hours of care provided by partners[4] is much smaller, at around 40% in Austria and 20% in Spain. The share of informal care provided by persons other than partners, presumably

[4]Partner care is modelled in more detail, since it requires to have a partner who is able to care.

children, is expected to remain roughly constant in Austria (just under 30%) and to increase slightly in Spain (from 43% to 46%). This corresponds to an increase in hours of care of about 85% in Austria and almost 100% in Spain. The resulting care gap more than doubles in both countries, with a higher increase in Spain than in Austria.

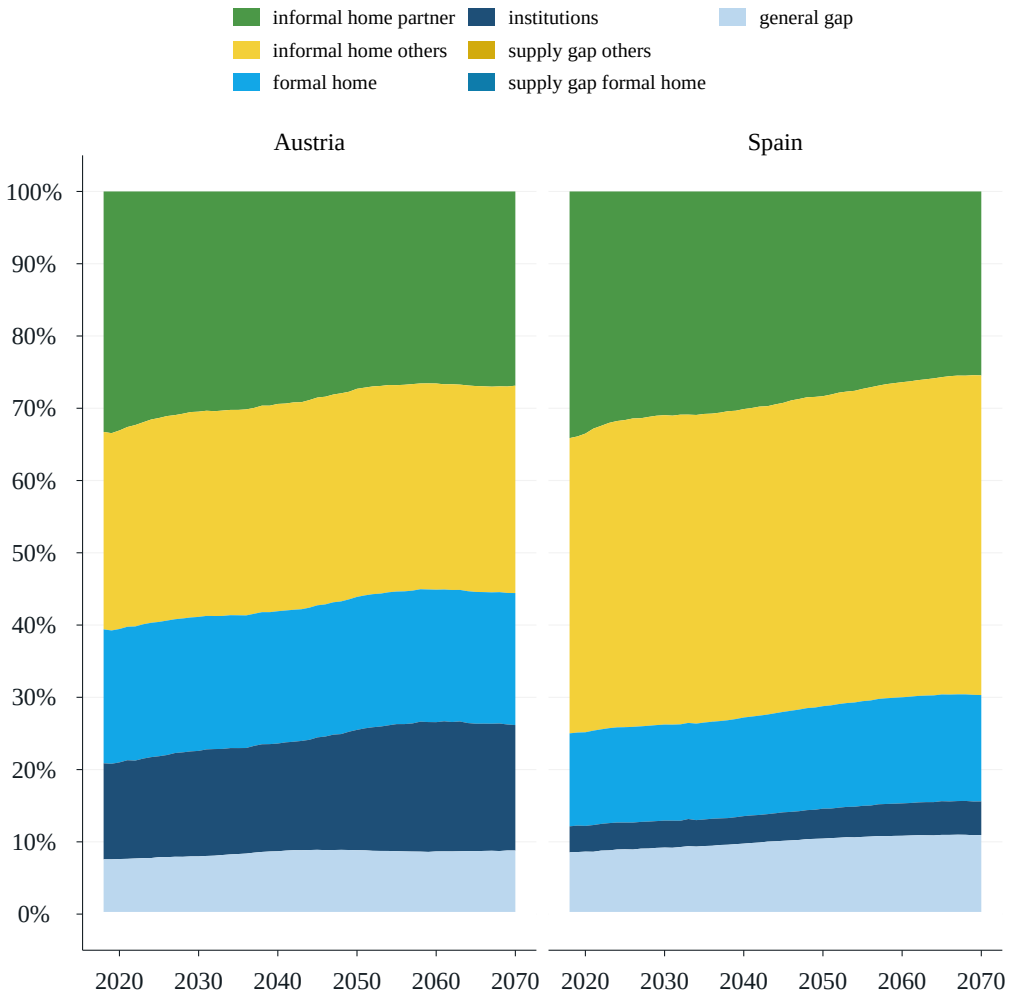
Figure 2: **Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018.**



Note: We report baseline projections (S0) from microWELT under status quo assumptions, i.e. the care mix at the individual level is assigned as observed today.

Under our status quo assumptions, the overall care mix - Figure 3 - changes only slightly due to shifts in demographic composition, with higher childlessness and the eventual increase in the share of older cohorts in the 65+ population leading to a proportional increase in formal - and here specifically institutional - care. Comparing Austria and Spain, the striking difference concerns nursing homes, which cover more than three times as much of the care need in hours in Austria, a difference that is compensated in Spain by informal care provided by others than the partner (presumably mostly children).

Figure 3: **Projected changes in the care mix received in Austria and Spain.**



Note: We report baseline projections (S0) from microWELT under status quo assumptions, i.e. the care mix at the individual level is assigned as observed today.

5 Exploring LTC demand and supply scenarios

Starting from the baseline (S0) outlined above, we employ a multi-layered scenario architecture to analyse how demographic trends, institutional constraints, and socioeconomic factors interact in shaping future care systems.

The first set of scenarios, S1 to S7, are aligned with the baseline projection on the future development of care needs. Starting from the status-quo assumption on the care mix, they highlight different supply constraints by deviating from the assumption in how care providers adapt their supply beyond current care patterns. So, for instance, in scenarios S2 and S3 the hours of formal home care or the total number of nursing home places are held constant at the current level. Scenario S7 represents a special case, as it explores the supply constraints resulting from a deviation from the baseline in terms of the likelihood of older people to live in a partnership (rather than the likelihood of partners to provide care).

Scenarios S8 to S12, on the other hand, investigate the role of education, longevity and health dynamics on long-term care. All these scenarios deviate from the baseline simulation of LTC demand, projecting different trajectories of care needs.

Taken together, the scenarios are intended to highlight the drivers of demand for care and potential gaps in the provision of care services, thus providing guidance for policy action. At the same time, the quantitative impact of various driving forces in the care sector will be highlighted and the sensitivity of the projections to these factors will be illustrated.

All scenarios, with the exception of the scenario that envisages a constraint in nursing home places (S3), include a quantification of the extent to which additional home care gaps (arising from constraints in informal or formal home care) could potentially be filled by additional care provided by partners. The amount depends on the share of people in need of care who are projected to have a partner who is able to provide care. In the constrained nursing home scenario, however, it is assumed that people who are not admitted to a nursing home receive the same home care mix as people who are currently not in a nursing home. While this mix may include care provided by a partner, the figure does not treat this care as a care gap that could be filled by additional care provided by partners, but rather as included in the hours provided by partners. Note that the assumption of the same care mix is likely to be problematic due to selection effects, as substituting care currently provided in nursing homes would likely require predominantly formal care services. In most of the scenarios presented, therefore, we assume that the supply of nursing home care adapts to current patterns and leave to a separate discussion the question of how to interpret potential gaps arising from constraints on the supply of nursing home care.

Table 1 gives a synthetic overview of the main features of all scenarios, which are described in more detail in the following section.

Table 1: Care Supply and Demand Scenarios

Scenario	Name	Demand	Supply
S0	Baseline	- Demography as in Eurostat projections - Education expansion - Constant care needs in hours by age, sex and education	- Constant care mix for given care needs and characteristics - All care providers adapt supply accordingly.
S1	Limited "Others"	Same as S0	- Informal supply of others than partner limited to today's supply patterns by age and sex
S2	Limited "Formal"	Same as S0	- Formal home care supply limited to today's supply in hours
S3	Limited "Nursing"	Same as S0	- Total number of nursing home places held at current levels
S4	Limited "Formal & Nursing"	Same as S0	- Combined supply constraints of S2 and S3
S5	Limited "All"	Same as S0	- Combined supply constraints of S1, S2 and S3
S6	Limited "Others & formal"	Same as S0	- Combined supply constraints of S1 and S2
S7	Current partnerships	Same as S0	Same as S6 except that women maintain current probability of being in a partnership by age and education (no mitigating effect due to longer partnerships resulting from increased longevity)
S8	Constant mortality	- Mortality by age and sex as of today (no gains in life expectancy)	Same as S6
S9	Slower ageing	- Increased life expectancy is met with equal increase in healthy life years (health care need increases more slowly with age)	Same as S6
S10	Education convergence	- Over the next 20 years, care needs and hours converge to those of persons with high education	Same as S6
S11	No Education Effects	- "Switching off" the mitigating effects of educational improvements	Same as S6
S12	No Education Effects & Current Partnerships	- Combined assumptions of S7 and S11 (no mitigating effects of educational improvements and of longer partnerships)	Same as S6

5.1 Defining scenarios

The baseline (S0) corresponds to a status quo scenario from the point of view of care recipients. Needs in hours by age, sex and education are the same as today, but demographic changes as in the Eurostat projections lead to a changing demographic composition and increased care needs. This demographic effect is mitigated by the education expansion, which leads to a higher share of aging people with lower care needs. For given individual needs and family characteristics, such as having a partner and number of children, the mix of care received remains the same as today. This assumes that the available supply of care adapts accordingly.

Scenario *Limited 'others'* (S1) is based on the same projection of care needs as S0, but assumes that informal provision by others than the partner is limited to current care patterns, based on the average hours of care currently provided by age and sex. It captures the fact that the increased earning potential of the better-educated younger generation may decrease the caring potential of children and others (Ozbugday et al., 2024). The model does not make any decisions about whether and how any resulting care gap will be filled.

The scenario *Limited 'formal'* (S2) assumes that formal home care is limited to the current supply (in hours). It captures the difficulty of recruiting care workers (OECD, 2020) and looks at the consequences of the shortage of labour supply. Again, the model does not make any decisions about whether and how to fill any resulting care gap. Like S1, this scenario also includes a quantification of the extent to which the gap could potentially be filled by additional care provided by partners, if any.

In scenario *Limited 'nursing'* (S3), the total number of nursing home places is maintained at current levels. It addresses not only the difficulty in recruiting care workers, but also the trend not to increase the number of nursing homes, which is the most expensive form of care. People are admitted on the basis of a ranking that takes into account the current probability of being admitted to a nursing home. Those not admitted are assumed to receive the same mix of home care as others with identical characteristics.

The scenario *Limited 'formal & nursing'* (S4) combines the assumptions of scenarios S2 and S3, which limit formal home care to the current level of provision (in hours) and nursing home supply to the current level of place. It gives insides into the effects of a no expansion scenario.

Scenario *Limited 'all'* (S5) combines scenarios S1, S2 and S3 and assumes that informal care provided by someone other than the partner is limited to current care patterns (based on the average hours of care currently provided by age and sex), that formal home care is limited to current provision (in hours) and that the total number of nursing home places is maintained at current levels. This scenario provides information on the impact if only those partners who are able to provide care fill the gaps (partially).

The scenario *Limited 'other & formal'* (S6) combines the supply constraints of S1 and S2. It splits 'informal care by someone other than a partner' and 'formal care at home' into hours covered and hours not covered due to supply constraints. Again, no decisions are made about whether and how to fill any resulting care gaps, but the output does include a quantification of the extent to which the care gap could potentially be filled by additional spousal care, if any. This scenario is used as the basis for all the scenarios that follow (S7-S12).

Scenario S7, *Current partnerships*, differs from S6 in that it assumes that the proportion of women in partnerships (given age and education) remains the same as today. In microWELT, partnerships are female-driven; in this scenario, women maintain the current probability of being in a partnership by age and education, i.e. they divorce if a partner would have died without the improvements in longevity. When contrasted with S6, this scenario shows the sensitivity of the partnership assumptions and the significant (mitigating) effect of increased partner survival as a consequence of increasing life expectancy on the care mix and care gaps.

While all the previous scenarios are aligned with the demographic projections by Eurostat and the baseline simulation of changes in the demand for care, the following scenarios (S8-S12) make assumptions that touch (also) on care needs. The *Constant mortality* scenario (S8) differs from S6 in that it assumes mortality by age and sex as it is today, showing the effects of improvements in mortality.

The *Slower ageing* scenario (S9), on the other hand, takes into account the beneficial effects that could result if increasing life expectancy can be accompanied by improvements in health. In contrast to S7, this scenario extends individual ageing by assuming that due to improvements in health, care needs and care hours increase more slowly with age. The parameter is set so that a person ages 4 years in 5 years. A person aged 70 will then be 69, a person aged 75 will be 73 and so on - and 90 will be the new 85, thus adjusting age-related care needs to increasing life expectancy. In other words, while the baseline implicitly assumes that at the individual level longer lives will also lead to a higher number of years with care needs, this scenario highlights the potential of health improvements to offset the challenges resulting for LTC systems from higher life expectancy (Payne, 2022; Straka et al., 2024).

Similarly to S9, scenario S10, *Education convergence*, is based on a more optimistic forecast of population health. This scenario assumes that the hours of care needed by those with low and intermediate education levels converge to those of the highly educated, on the assumption that the lower care needs of the better educated are determined by behaviors that can and will be adopted by others (Kelfve et al., 2023).

The *No education effects* scenario (S11) holds the educational composition by age and sex constant, which is equivalent to modelling care need in hours without taking education into account. The scenario mimics a model that does not account for educational differences. Compared to other scenarios, it helps to quantify the compositional effect of educational improvements.

Finally, the scenario *No education effects & current partnerships* (S12) removes the mitigating effects of educational improvements and maintains the current proportion of women in partnerships (by age and education). This scenario mimics a typical macro model based only on age and sex and does not take into account the mitigating effects of increased education and longer survival of partners. Of all the scenarios, this one leads to the largest increase in care needs and the care gap. It is a good illustration of the differences between the projections from a microsimulation model and those from a less informed macro model.

5.2 Results of the scenario analysis

This section presents and discusses the main results of our scenario analysis. We take a comparative perspective and contrast each of the scenarios S1 to S12 with the baseline S0. This means that we are primarily interested in highlighting the differences between the scenarios and the baseline projection, rather than presenting the scenarios in isolation. Thus, for example, the focus is not on the overall level of demand for care or the overall increase in demand for care in a particular scenario, but on the extent to which this scenario leads to higher or lower demand for care than in the baseline. In addition, the comparison of the results of the scenarios for Spain and Austria is intended to highlight the specific systemic vulnerabilities that the two countries face in relation to the different drivers of the demand and supply of care. In this respect, we are particularly interested to explore the size and evolution of care gaps.

Figure 4 graphically summarises the projected changes in the care mix and in the care gaps in both countries under all scenarios. While the future care burden of partners is quite similar in both countries, the graph clearly highlights the much higher responsibility of other informal carers, mostly children, in Spain in contrast to Austria. In both countries, however, we observe a substantial gap in the supply of informal non-partner care in those scenarios that limit the supply of informal non-partner care to current patterns - in Spain more so than in Austria due to the current importance of informal care. In both

countries we also see the development of a substantial gap not only in the supply of non-partner care, but also in the supply of formal home care. In Austria we also highlight the future importance of institutional care, especially after 2035/2040 when the baby boom generation reaches the age of needing care.

Figures 31 to 42 in the Appendix show the detailed results for each of the above scenarios. Figure 4, like Figure 2 for the baseline, describes for each year how the shares of supplied and missing care are distributed. The graphs in the Appendix, on the other hand, are structured like Figure 3 and display changes in the number of hours of care needed and the number of hours of care not provided, scaled to one in the first projected year (2018) as a reference. In addition, these detailed graphs show, for each scenario, the remaining supply gap under the assumption that partners adapt their behaviour toward covering additional care demand. The graphs in the Appendix therefore show the evolution of the demand for and supply of care and the gaps up to 2070 in relation to 2018.

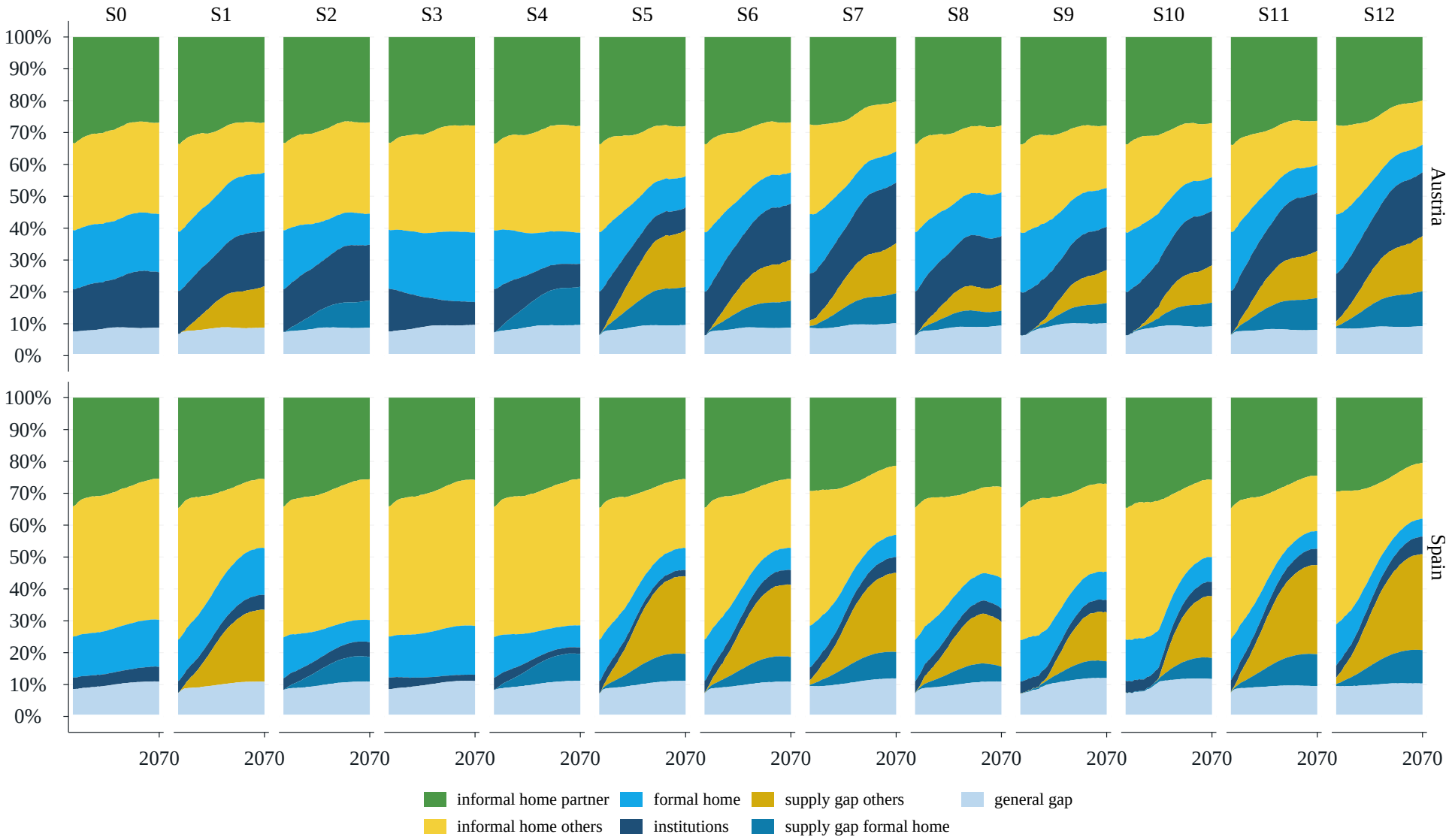
The primary objective of the what-if scenarios S1 to S7 is to illustrate the various gaps in care supply that emerge when we discard the baseline assumption that formal care providers will adjust their services beyond existing patterns. The trajectory and magnitude of care gaps depend on changes in demand, but also on the path-dependencies originating from the current LTC system and the prevalent care mix. Despite the similar quantitative increase in demand in Austria and Spain, differences in the care mix pose different challenges for the LTC systems in the two countries. Spain's greater reliance on informal care provided by someone other than a partner suggests that this source of care is a particularly challenging bottleneck

This can be seen in scenario S1, where the supply pattern of children and other informal care providers living outside the household is kept constant. According to this projection, the Spanish care gap will widen sharply, with a sevenfold increase in unmet hours of care and a care gap of approximately 30% of total care needed by 2070. This means that, in this scenario, almost two-thirds of the increase in the demand for care will go unmet. In Austria, scenario S1 results in a more moderate widening of the care gap, amounting to 22% of total care needs in 2070, with an almost fivefold increase in unmet care hours.

If we assume that formal home care is limited to the current supply (in hours) (S2), the number of hours with unmet need will increase by almost four times in Austria as well as in Spain. As a result, we will see a roughly equal care gap in 2070 in both countries, with a share of unmet care on total care needed in 2070 of 17% in Spain and 15% in Austria.

The, at first sight, surprisingly small increase in the care gap in scenario S3 (about two and a half times in both countries), where we limit the supply of institutional care to current levels, is related to the way in which our model treats the excess demand for nursing home places. In our model, individuals who would be placed in a nursing home but do not get a place due to supply constraints obtain home care with the same likelihood and mix as otherwise equal individuals. Due to the high care need of these cases, they receive a corresponding amount of home care hours in line with our home care parameters, rather than facing an entirely unmet need, thus leading to a care gap that is not considerably larger. It is therefore important to point out that limiting the supply of institutional care would lead to a substantial increase in the demand for formal home care and informal care by others.

Figure 4: **Projected changes in the care mix received in Austria and Spain across all scenarios.**



Scenario S4, in which all formal care is limited to current levels, results in a substantial care gap in both countries (about 20% of the total care needs in 2070 in both countries) and an increase in the demand for informal care and from non-partner care of almost 2.5 times in Austria and more than a double in Spain. As formal care is more important in Austria than in Spain, the care gap due to not supplied formal care hours is larger in Austria (Figure 33).

S5 goes one step further and also limits the supply of informal care provided by others than the partner (mostly children). Unsurprisingly, this scenario leads to a larger gap than the previous ones in both countries, as partners can only cover a small part of the supply gap. Because of the greater importance of informal non-partner care in Spain, the resulting gap is larger than in Austria. In 2070 the Austrian LTC system would have a care gap of 34%, equivalent to 70% of the additional demand. The Spanish care gap would be even larger, accounting for almost 40% of the total care demand and 85% of additional demand.

Partnerships play a major role for LTC supply. A comparison of scenario S7 with scenario S6, which shares the same assumptions in terms of supply constraints but has higher shares of people living in partnerships, highlights how increased partner survival and longer partnership status can cushion care needs. This is particularly true of Austria, where the difference in care gap between S6 and S7 amounts to over 20% (32% vs 26%); in Spain, the difference is approximately 10% (41% vs 37%). In other words, a lower share of older people living in partnerships would exacerbate the pressure on LTC systems due to demographic ageing.

On the other hand, the simulations show that there is only limited scope to increase the share of long-term care provided by partners (beyond the level that we can expect based on the current care mix). Both in Austria and Spain, in all scenarios, partners could potentially contribute as caregivers to mitigate new care gaps resulting from supply constraints in other parts of the LTC sector, but this contribution is of very limited magnitude. In scenarios S1 and S4, for instance, additional care provision by partners could cover less than 3% of the care gap that is expected in 2070.

Changes in the health status of the population are an important and highly uncertain determinant of the dynamics of long-term care. There is an extensive literature on the question of whether the lengthening of the human lifespan is associated with a decreasing, constant or increasing proportion of healthy life years. For two recent examples, see for instance Payne (2022) and Straka et al. (2024). The available results show a mixed picture, depending on the research method, but also on the country, time period and population groups studied.

Several of our scenarios highlight the sensitivity of LTC projections to assumptions of future health developments. Our baseline (S0) implicitly assumes that longer lives will translate in a higher share of life years with care needs, because the care-needs probabilities are kept constant by age (as well as by sex and education).

S8 shows that improvements in mortality account for more than 50% of the total increase in care hours over the projection period, leading to a substantial care gap in both countries. The gap is predicted to be higher in Spain due to the importance of informal care from others than the partners.

Scenario S9 introduces a more optimistic assumption, whereby care needs are shifted along the age curve over time, broadly neutralizing the longevity effect on the number of years with care needs. Comparing S9 with the baseline, we see that this assumption results in a much less dynamic increase in hours of care needed. In Austria, the demand for care in 2070 in S9 is only about 54% higher than in 2018 (as compared to an increase by 92% in the baseline). In Spain, the increase in care needs amounts to 47% instead of 89% in the baseline. Thus, in both countries assuming a development in healthy life years that matches the extension of longevity reduces the total amount of care needed by between 40 to 50% when compared

to the baseline.

The demand for care is also linked to differences between socio-economic population groups. These are analysed in our models on the basis of the attained level of education. Higher levels of education have been shown to be associated with a lower proportion of years spent in need of care, an association that can be explained by various mechanisms such as higher levels of health education, a healthier lifestyle and less demanding working conditions (Frangos et al., 2023; Grigoriev & Doblhammer, 2019). To highlight this effect and to gauge its magnitude, we can compare scenarios S10 and S11 with the baseline.

S10 represents an upper benchmark for the reduction of socio-economic health disparities, assuming that over the next decades people with lower and medium education can attain, on average, the same health levels and care need profiles of people with higher education. Under this assumption, in Austria the demand for care will increase over the projection horizon by 77%, thus about 15% less than in the baseline. Due to the lower share of highly educated individuals, in Spain the effect would be stronger, dampening the increase in demand by almost 25% (an increase by 67% against 89% in the baseline).

The comparison of S0 with S11, on the other hand, shows the effect of educational expansion, which is included in our base scenario. In scenario S11, the differences between the education groups are disregarded, so that the positive effect that can result from the shifts in the educational composition of the population is absent. For Spain, not taking educational differences into account means that the need for care will increase by almost 50% in 2070 (+130% vs +89%), compared to the baseline. In Austria, due to the already higher educational structure, the difference is less pronounced, at around 24% (+114% vs +92%) .

Finally, S12, which not only removes the mitigating effects of educational improvement, but also maintains the current proportion of women in partnerships, mimicking a typical macro model that does not take into account either the educational effects or the longer survival of partners. We see that this scenario produces a very large increase in care demand and, in combination with a supply gap of other than partners, a large caregiving gap. In addition to the baseline, the care need increases by 25% in Austria and by 47% in Spain. In absolute terms, the number of hours of care needed but not supplied increases ninefold in Spain, resulting in a care gap in 2070 that accounts for almost half of the total demand. In Austria, the number of hours of care needed but not provided increases sevenfold and the care gap in 2070 corresponds to one third of total demand.

6 Conclusions

In this paper, we apply a novel approach to quantifying and projecting into the future the demand and supply for LTC in Austria and Spain in different scenarios (Warum et al., 2025). Quantifying individual care needs in hours by subjecting SHARE respondents to a stylized needs assessment according to Austrian rules allows us to validate our modelling of care needs. Assuming that respondents in different countries tend to give similar answers to the corresponding questions based on their limitations, and that the need for care corresponding to a particular limitation is the same in all countries, this approach can be applied to all SHARE countries to determine the need for care in hours.

We use the information provided by respondents in SHARE to determine the mix of care received and the amount of informal care provided as input to the comparative microsimulation model microWELT to project the development of long-term care in Austria and Spain to 2070 in a baseline assuming that individual care needs by age, sex and education are constant over time, as is the mix of care received for given needs and family characteristics. Demographic changes lead to a changing demographic composition and increased care needs. This demographic effect is mitigated by the education expansion, which leads to a higher share of ageing people with lower care needs. In this baseline, the supply of different forms of care adapts to changing needs according to currently observed patterns, thus providing insights into the

demand for different forms of care.

The results of the baseline show that the proportion of people in need of care in all age groups will decrease over time, leading to a slight decrease in the overall proportion of people aged 65 and over in need of care by around 2040. After 2040, compositional effects will outweigh the beneficial cohort effects and lead to an increasing share of people needing at least 65 hours of care per month. We project that the demand for care in hours increase throughout the simulation period, with an increase of around 90% expected by 2070 in both countries.

However, there are marked differences in the mix of care forms, reflecting the institutional characteristics of the care systems in the two countries. In Austria, formal care, and in particular care in nursing homes, accounts for a three times higher share of care provision than in Spain. In Spain, conversely, informal care provided by others than the partner (presumably mostly children) plays a significantly larger role, compensating for the missing formal care provision. The role of partners as informal care providers is similar in both countries. Projecting this status quo into the future while accounting for shifts in demography, educational levels and family structures highlights in which areas the pressure to adapt will be greatest in order to meet the increasing demand for care.

In both countries, the amount of care provided by partners will increase in absolute terms, but their share in the care supply mix is bound to decrease. Based on current patterns, the provision of formal care would need to more than double in absolute terms to meet the increasing demand, which would also lead to an increase in its share of the care mix. The share of informal non-partner care is projected to remain roughly constant in Austria and to increase slightly in Spain, corresponding to an expansion in care hours in both countries. Thus, children and other persons providing informal care will have to increase their supply of care substantially beyond what we observe today. However, the expansion of informal care required to adjust to increased care needs is markedly higher in Spain (with an increase equivalent to the amount of care provided according to current patterns) than in Austria (where the increase, starting from a lower level, is expected to be equivalent to about two thirds of current supply). The gap between demand and supply of care hours, i.e. the proportion of care needs currently unmet, will more than double in both countries, although the increase will be higher in Spain.

Our baseline simulation shows that both countries will face significant care gaps if current patterns continue. Families will struggle to meet the growing demand as fewer family members are available to provide care. Although the required increase in formal and informal care is significant in both countries, there are clear differences between the two. These differences in care models highlight the need for tailored policy interventions that take into account the specific socio-cultural contexts of each country.

The scenarios presented in this paper show strong effects of education. First, we show that in a scenario where all people have the care needs profile of the more educated, the demand for care would be significantly lower in both countries, but with stronger effects in Spain due to a lower share of highly educated individuals. Second, we point out that it is essential to take account of educational development when projecting future demand for long-term care, and argue in favour of microsimulation approaches as opposed to simple macro projections. Consequently, implementing strategies that promote educational opportunities may mitigate some of the projected increases in care needs, particularly among lower socio-economic groups.

We also highlight the impact of assumptions about future health trends and their sensitivity to projections of future long-term care needs. By assuming improvements in mortality (S8) or slower ageing (S9) - and thus deviating from the baseline assumption that increases in life expectancy increase the proportion of years with care needs or change the incidence of care needs along the age curve - we show that the need for care, measured in hours, is substantially reduced in these scenarios. Consequently, improvements in health are crucial for reducing the dynamics of LTC demand.

Our findings underline the critical interplay between institutional frameworks and the availability of both formal and informal care, with important implications for future care provision. The projected increase in care needs highlights the urgent need for adaptation strategies within the long-term care systems of both countries. In particular, while Austria benefits from more robust public service provision, Spain's reliance on informal care provided by family members poses particular challenges, especially as traditional family structures evolve and female labour force participation increases. Our scenarios also show that in both countries partners provide a substantial share of care, but the simulations indicate that there is little scope for partners to provide more care, thus challenging public care provision.

Our findings call for proactive measures to address the impending challenges in long-term care systems in Austria and Spain. This includes enhancing public funding for formal care services, developing supportive policies for informal caregivers, and leveraging educational advancements not only to foster economic growth, but also to improve health outcomes. As we move forward, fostering a collaborative approach among stakeholders — including government entities, healthcare providers, and families — will be essential to create sustainable and equitable long-term care solutions that can adapt to the evolving needs of our ageing populations.

The projected care gap gives rise to a series of socio-political questions concerning the distribution of access to formal and informal care. Individuals with limited financial resources are especially reliant on public support for both formal and informal care. Consequently, issues pertaining to distribution policy must be given due consideration when formulating expansion strategies for care support measures.

The present study is subject to several limitations, the majority of which pertain to the data. While the Survey of Health, Ageing and Retirement in Europe (SHARE) constitutes the primary data source for our analysis, the presence of small sample sizes engenders elevated parameter uncertainty, which pervades the majority of the data steps leading to model parameterization. Furthermore, the presence of health-related attrition bias, as highlighted by Muszyńska-Spielauer and Spielauer, 2022, may have introduced bias into our findings. Furthermore, the under-reporting of limitations has the potential to lead to an underestimation of allocated care hours, as indicated by discrepancies with Austrian administrative data. The use of SHARE data restricts the validation of our results, particularly in terms of the assessment of dependency and the intricacies of informal caregiving provided by family members. While there are overlaps with the information on health limitations and care arrangements collected in other comparative surveys, such as the European Health Interview Survey (EHIS), differences in definition and sampling frames limit comparability. Furthermore, the fundamental limitations of SHARE, such as the absence of quantification (in hours) of care provided by spouses, are not addressed by data from these other surveys.

Data limitations also manifest in modelling choices. For instance, the simple distinction between informal care provided by partners and informal care provided by others (and our simplistic supply assumptions) may not adequately reflect the complexities of caregiving dynamics across diverse family and community structures. While the integration of diverse data sources, including the Austrian Care Need Assessment Scheme for modelling care needs in hours, is a notable strength of the study, it is important to acknowledge that this framework may not fully encompass alternative care systems.

There are several avenues for further research that we would like to highlight. The significance of education in predicting future care requirements has been demonstrated. The assumption that these differences persist may warrant scrutiny, as the expansion of education has been observed to lead to a greater selectivity in lower levels of education, potentially due to reduced educational opportunities being increasingly linked to health limitations. Concurrently, higher education has become more dominant, thereby diminishing its capacity as a socio-economic indicator. Future research on identifying the effect of education could include sensitivity analyses to provide more detailed insights into the compositional effects of educational expansion. Furthermore, there is a need for additional research to identify the effects of

mortality improvements and the effects of education on mortality, including alternative scenarios for the age pattern of care needs in the face of mortality improvements (e.g. scenarios of expansion and compression of care needs). Another fruitful avenue of research is the analysis of alternative scenarios on the supply of nursing homes and related queuing mechanisms to enter institutional care. A more detailed scenario analysis on the provision of informal care by non-partners and changes in the availability of children, on the likely impact of increased mobility and female labour force participation, on the future share of single households among those aged 65 and over, or on the potential limits to the provision of care by partners would shed more light on the impact of socio-economic changes in society.

Another avenue for further research concerns addressing parameter uncertainty. One methodology that has been proposed for incorporating this dimension involves the execution of a large number of model-runs, with parameters re-estimated from bootstrap samples. While the present contribution does not address this approach in any depth, it is nevertheless supported by the research workflow and modelling approach that has been developed. This approach facilitates the automated (re-)estimation of all model parameters and supports the handling of multiple model-runs.

Whilst the present study focuses on care needs and provision in terms of hours, further research is required to incorporate a monetary dimension into the projection analysis. Addressing sustainability issues and the distributional impact of care systems, including the public-private mix of care provision and financing, and the general quantification of transfers (both monetary and time) between population groups, cohorts, families, the market and the state, is an essential next step. While this is beyond the scope of this study, the applied microsimulation model microWELT is designed to address this dimension; moreover, our microsimulation approach allows for a longitudinal perspective of care needs over the life course. Although not discussed in this paper, we have included in the appendix figures on the projected lifetime hours of care needed and the care mix (including gaps) by cohort, gender and education, which complement each of the scenarios presented. An interesting insight from this perspective is that the negative correlation between care needs and education persists even after accounting for the pronounced mortality differentials by education.

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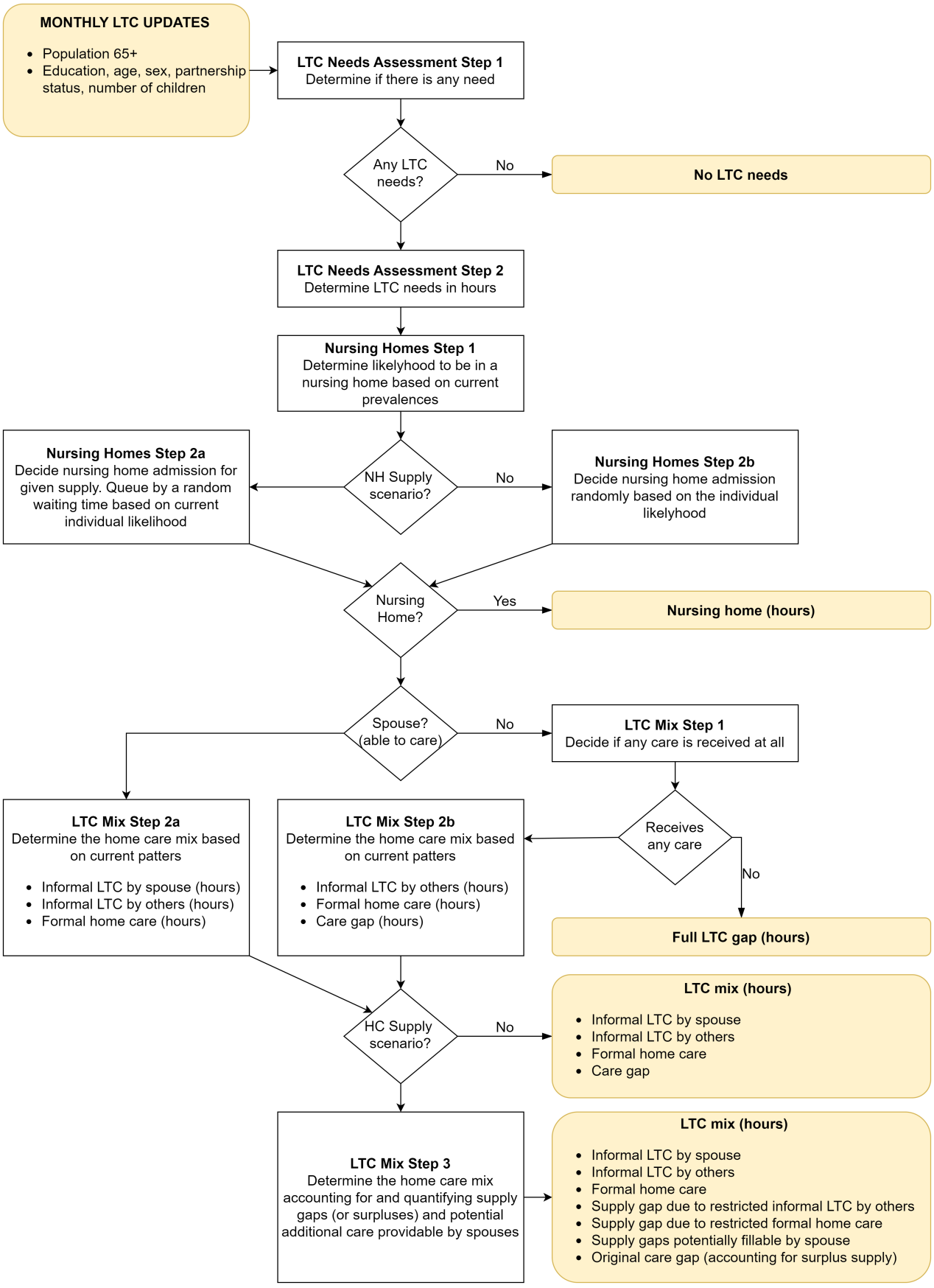
A Overview

Figure 5: Flowchart of the LTC module in microWELT.



B Parameterization

Table 2: **Simplified Austrian Care Need Assessment Scheme related to SHARE variables**

Limitation	Monthly Hours
ADLs	
Dressing	20
Walking AND getting up	30
Walking AND NOT getting up	15
NOT Walking AND getting up	22.5
Daily hygiene and bathing	35
Eating	30
Using the toilet	30
IADLs	
Preparing a hot meal	30
Shopping	10
Taking medication	3
House or garden work	10
Leaving home independently	10
Laundry	10
Motivational talk (Using a map OR Telephone calls OR Managing money)	10
OTHER	
Dementia	45
Psychiatric problem	45
Extra hours 1 (Climbing several flights of stairs without resting OR Stooping, kneeling, or crouching OR Reaching or extending your arms above shoulder level OR Pulling or pushing large objects like a living room chair OR Lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries)	5
Extra hours 2 (Walking 100 metres OR Sitting for about two hours OR Getting up from a chair after sitting for long periods OR Climbing one flight of stairs without resting OR Picking up a small coin from a table)	10
CONDITIONAL AGE TREND (if any condition OR GALI)	
	$(age - 65) * 0.73$
	$(age - 65)^2 * 0.042$

Figure 6: **Histograms of assigned monthly care hours for SHARE respondents in Austria and Spain**

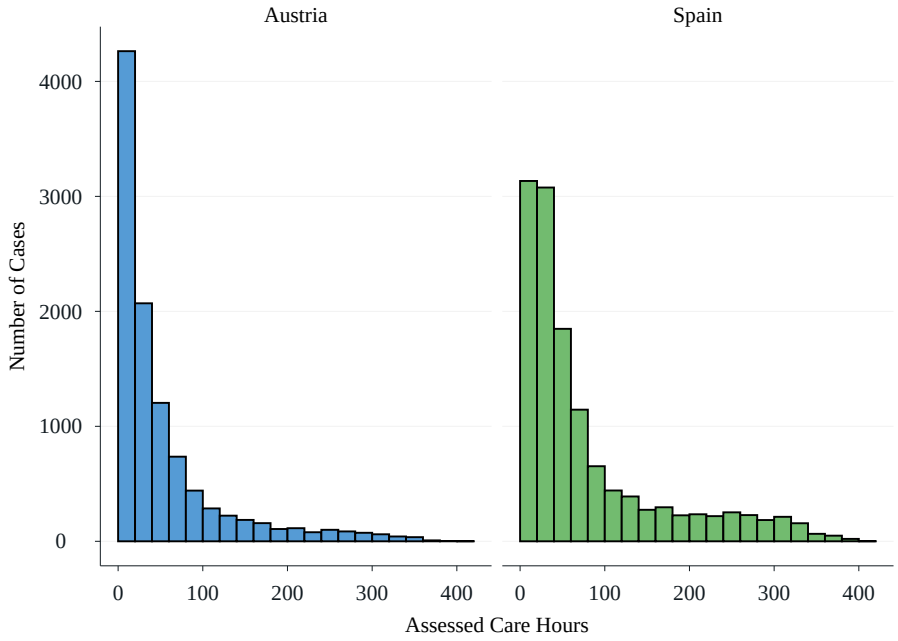
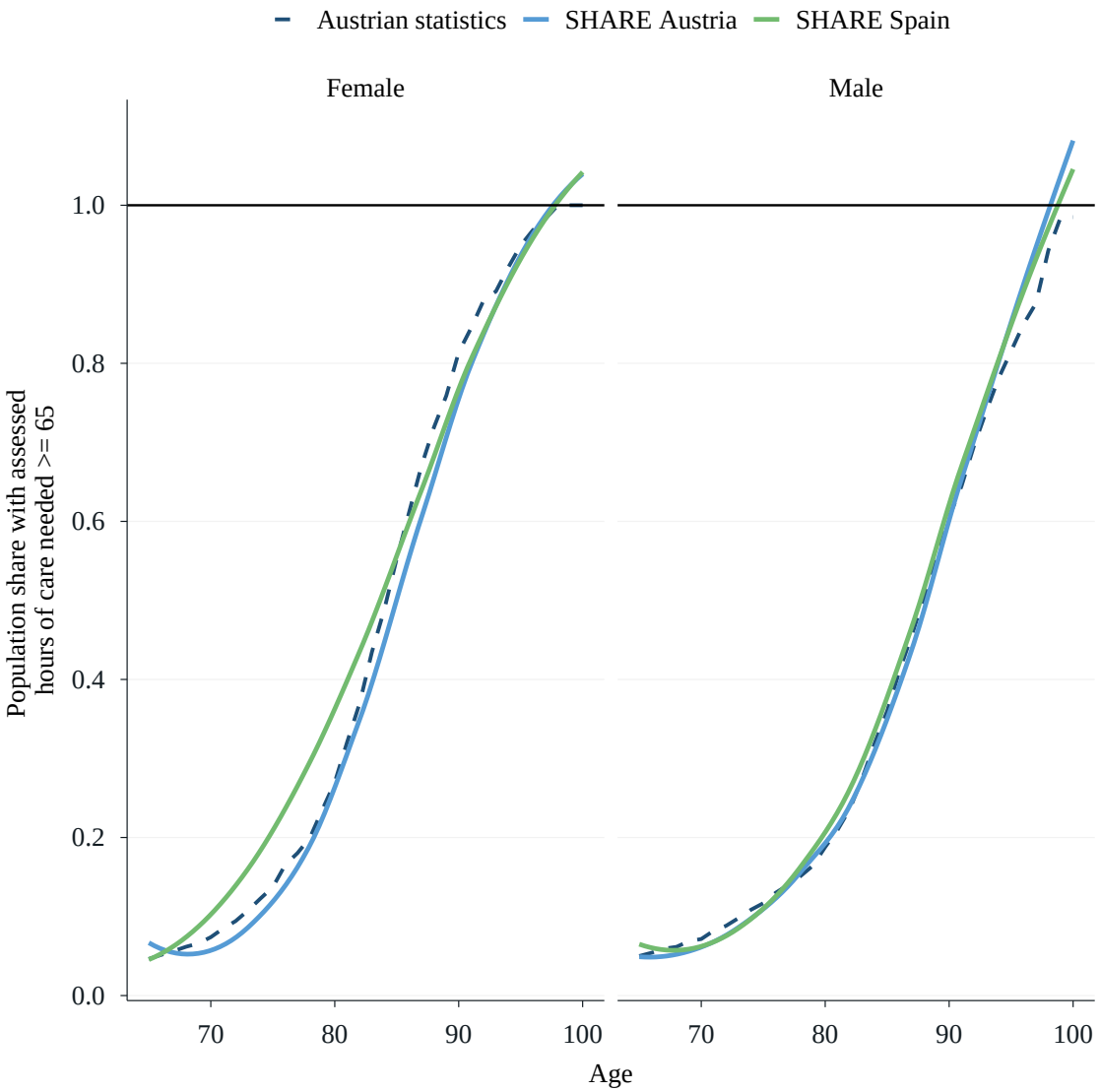
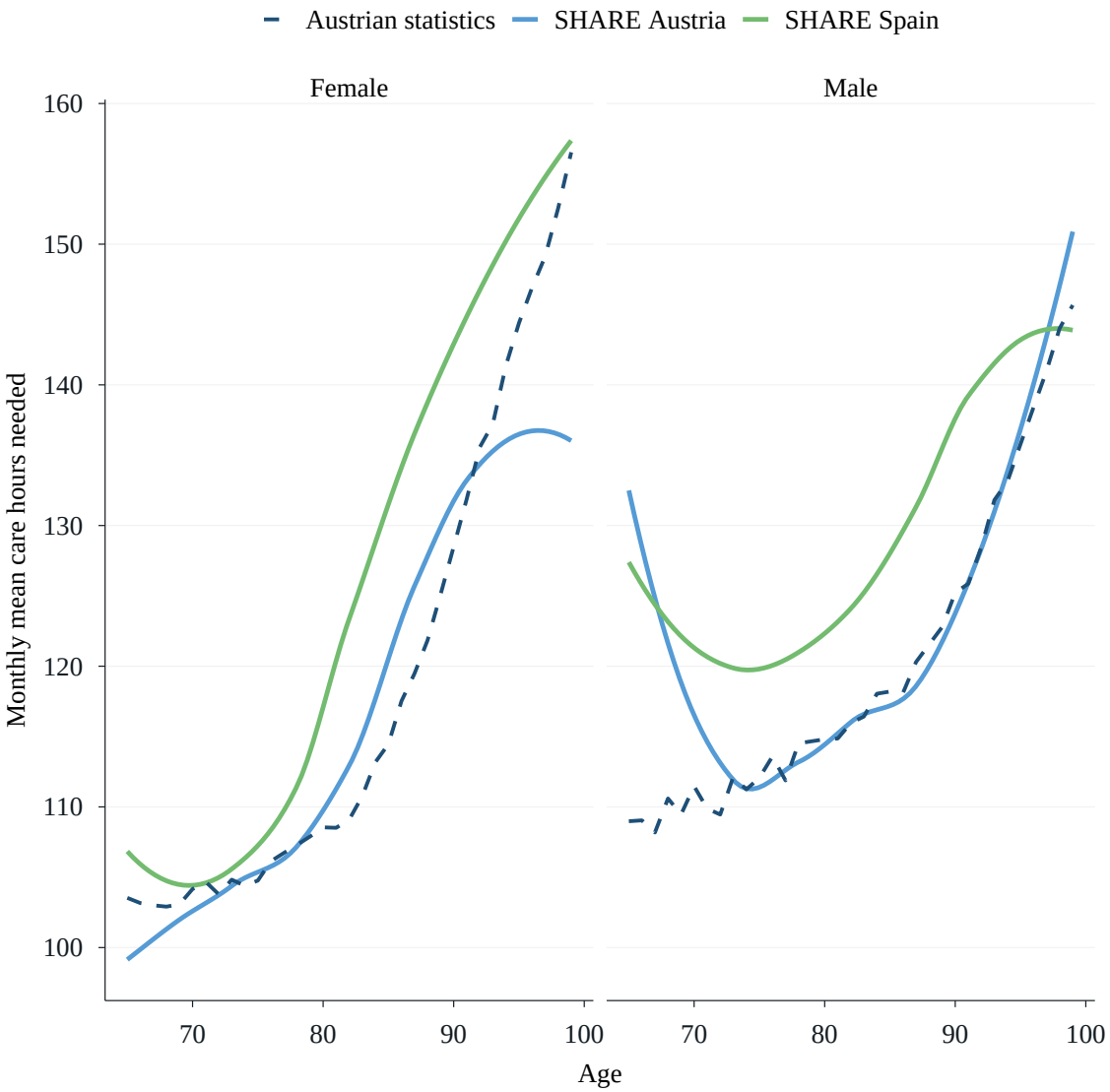


Figure 7: **Prevalence of assessed monthly care need larger or equal to 65 hours in Austria and Spain by age and sex**



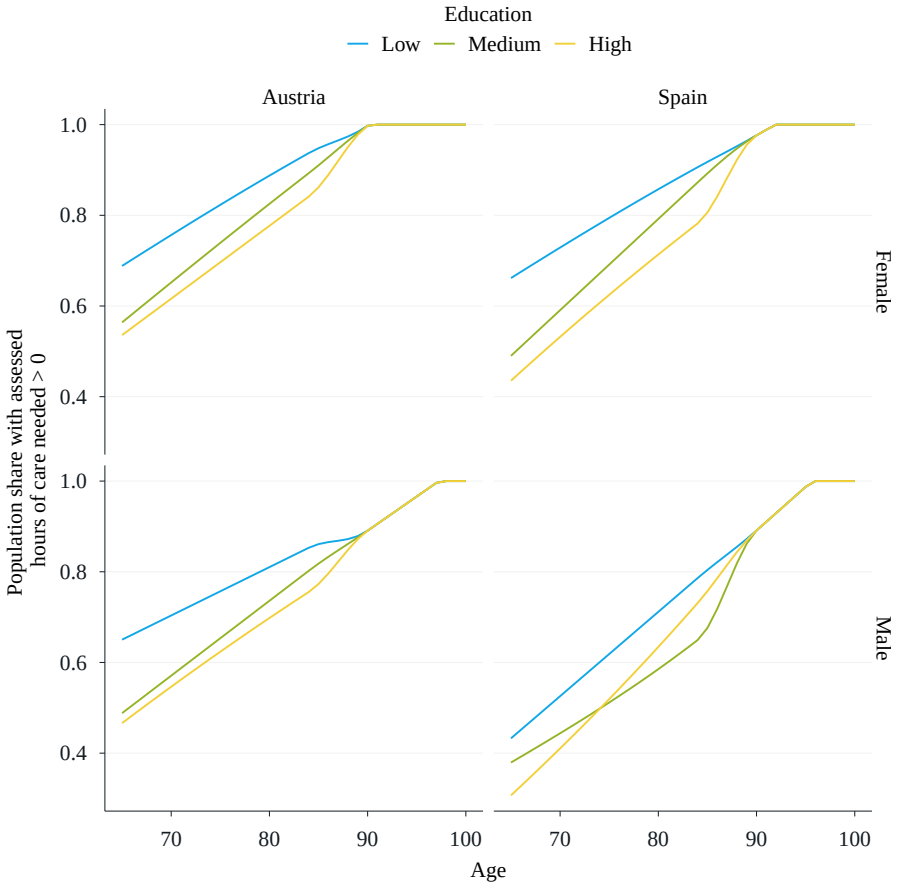
Note: We apply locally estimated scatterplot smoothing (LOESS) to weighted shares of survey respondents with 65+ assessed hours by age in years and sex. The dotted line provides a comparison with Austrian administrative data on care allowance prevalence of level 1 or higher, which is equivalent to a care need of 65 hours or more.

Figure 8: **Average assigned hours for those with 65+ hours of care need in Austria and Spain by age and sex (weighted)**



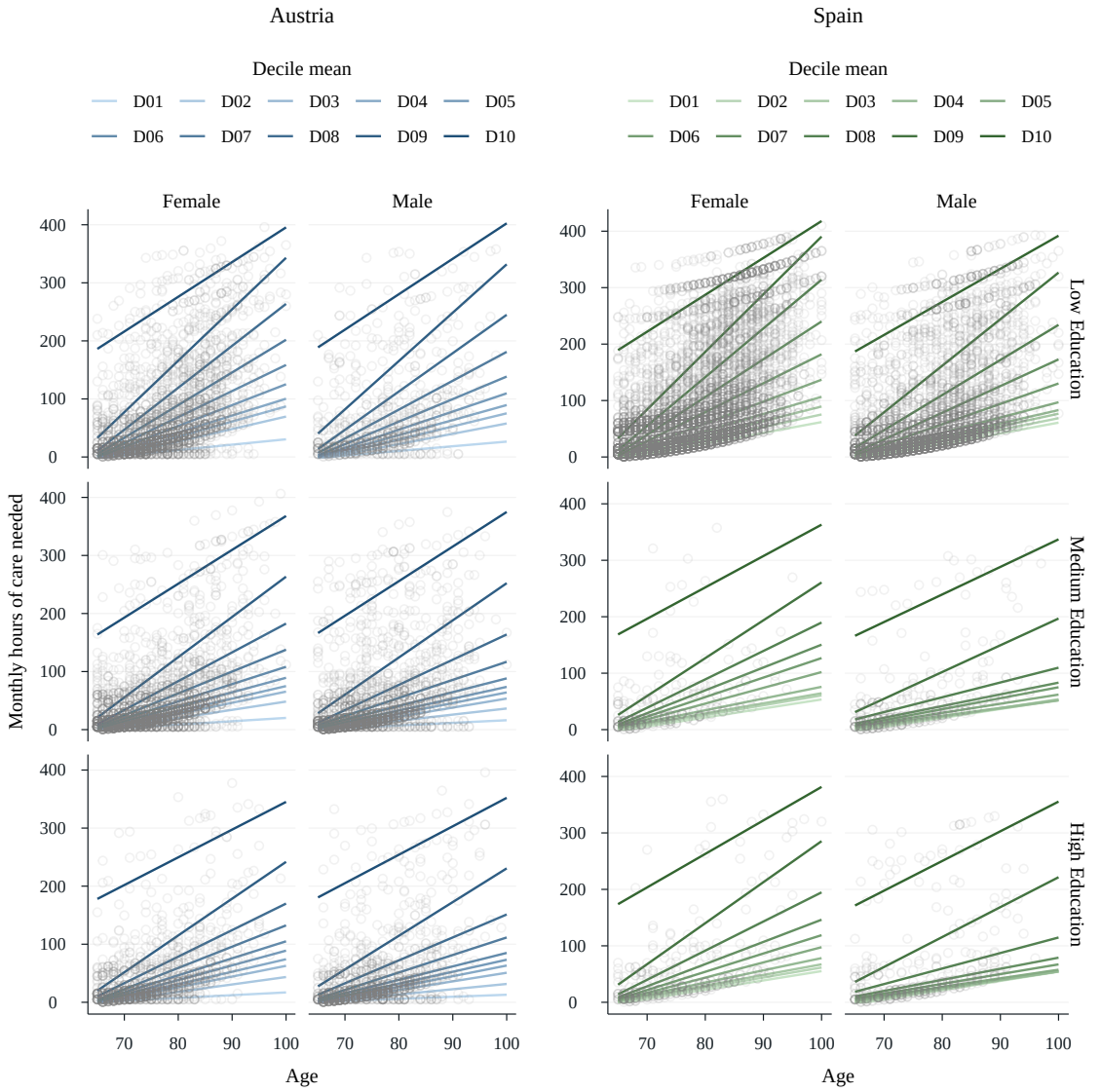
Note: Comparison of assessed hours with average hours from Austrian statistics (dotted line) calculated by multiplying the minimum hours per care allowance level times its prevalence. Subsample: respondents with 65+ hours of care need. Comparability with Austrian statistics is enhanced by assigning each assessed value of monthly hours into a care allowance level before calculating weighted averages and applying LOESS.

Figure 9: **Step 1 - Prevalence of positive assessed monthly care need by age, sex, education in Austria and Spain (weighted)**



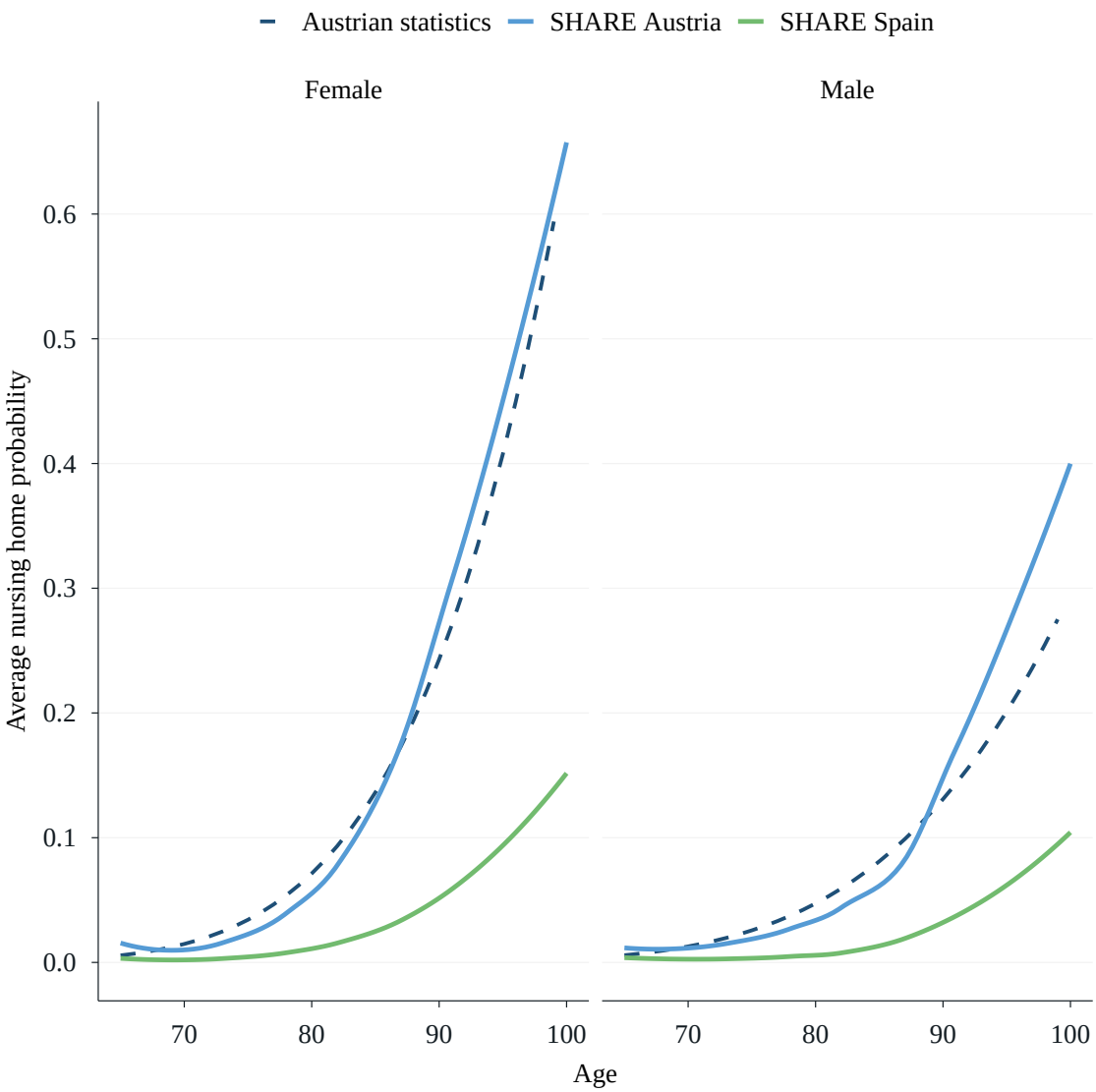
Note: We use monotone increasing P-splines to estimate smooth functions and stop differentiating by education from age 90 due to data sparsity at the upper end of the age range.

Figure 10: **Step 2 - Distribution of care need in hours by age, sex, education in Austria and Spain (weighted)**



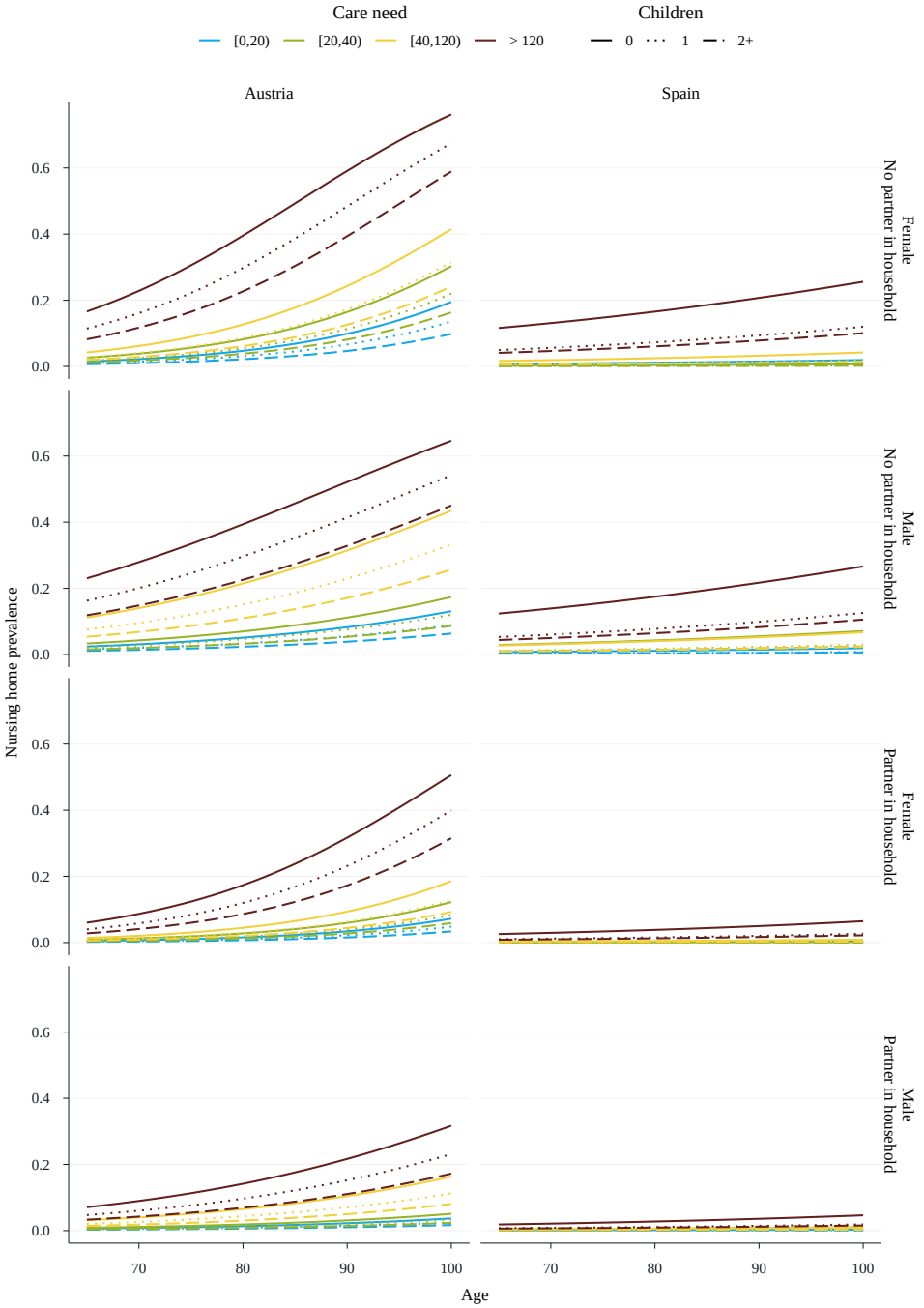
Note: Subsample: respondents with positive care need. Decile means computed from predictions of quantile regressions. As independent variables, we include age, sex and education as well as interaction terms between age and sex as well as age and education.

Figure 11: **Nursing home prevalence in Austria and Spain**



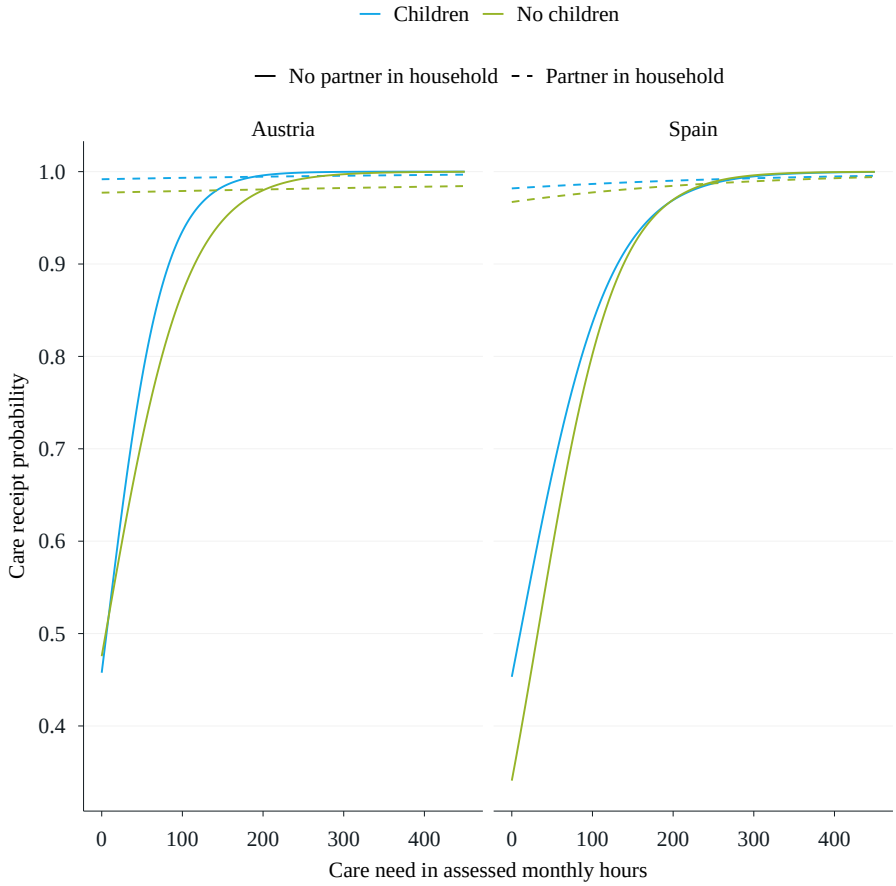
Note: The nursing home indicator is the dependent variable in a logistic regression that controls for age, sex, assessed hours of care need and whether an individual's partner is living in the household. The previous terms are allowed to vary by sex via an interaction term and we also add a separate categorical variable for the number of children. We plot smoothed (LOESS) trend lines through average predicted nursing home probabilities by age and sex against the nursing home prevalence from Austrian care service statistics (dotted line).

Figure 12: **Step 3 - Nursing home prevalence in Austria and Spain by age, sex, hours needed, partner, and children**



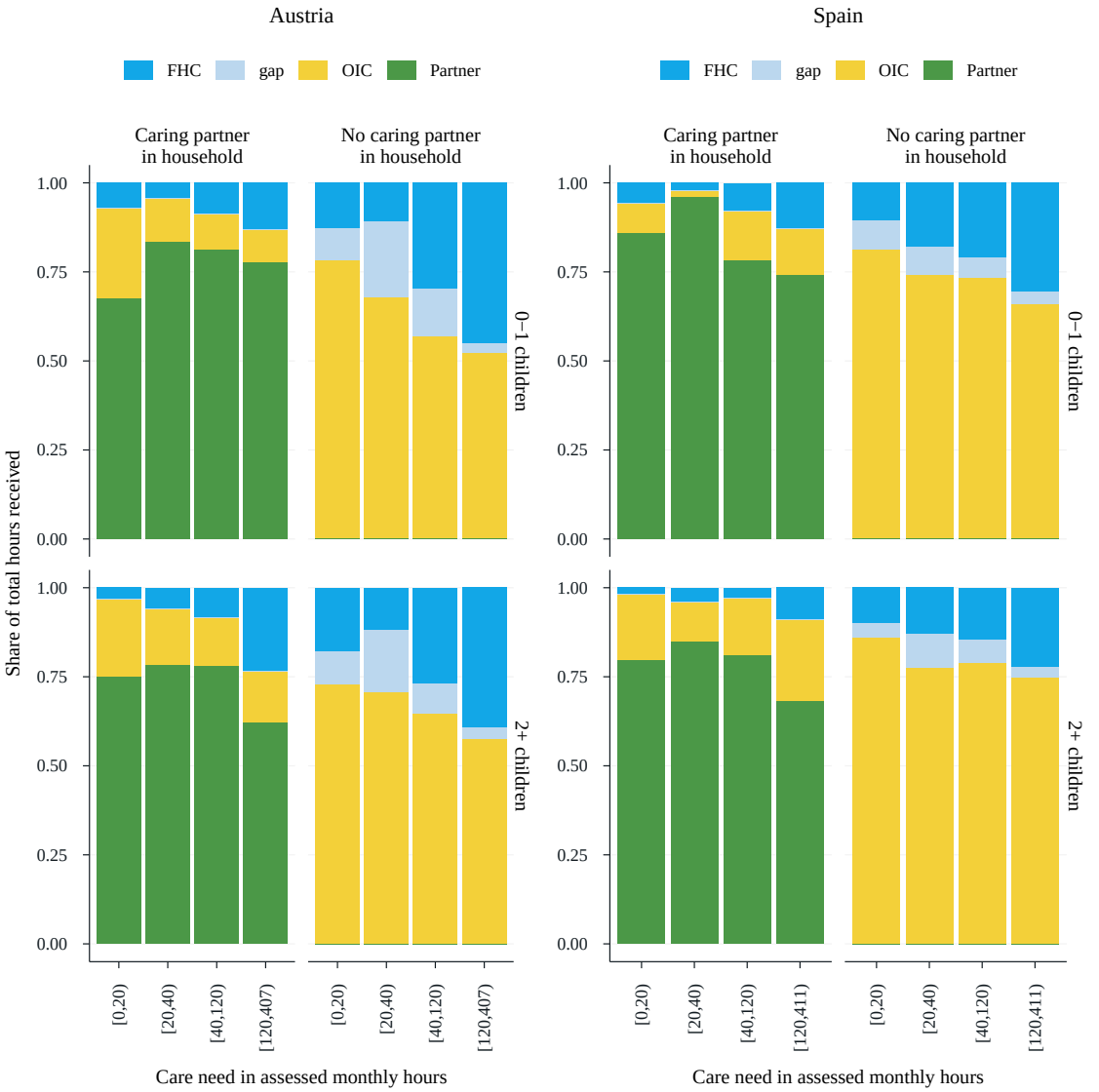
Note: The nursing home indicator is the dependent variable in a logistic regression that controls for age, sex, assessed hours of care need and whether an individual's partner is living in the household. The previous terms are allowed to vary by sex via an interaction term and we also add a separate categorical variable for the number of children.

Figure 13: **Step 4 - Care receipt probability within the care need sample in Austria and Spain by assessed care hours, presence of a caring partner and number of children**



Note: We report predicted care receipt probabilities from a logit model interacting the covariates assessed care need, partner and children.

Figure 14: **Step 4 - Care mix in Austria and Spain by grouped assessed hours of care need, presence of a caring partner and the number of children**



Note: Subsample: respondents who receive home care. We report shares of total hours received by type of care and distinguish Formal Home Care (FHC), the care gap, Outside Informal Care (OIC) and care received from partners.

Figure 15: Decision tree illustration of our approach to obtain the individual care mix in hours from SHARE for Austria. *Notes:* care received: (limited info, full info, none) refers to the care variables available per respondent. We distinguish Formal Home Care (FHC), Outside Informal Care (OIC), full or partial gaps and care from partners or other household (HH) members.

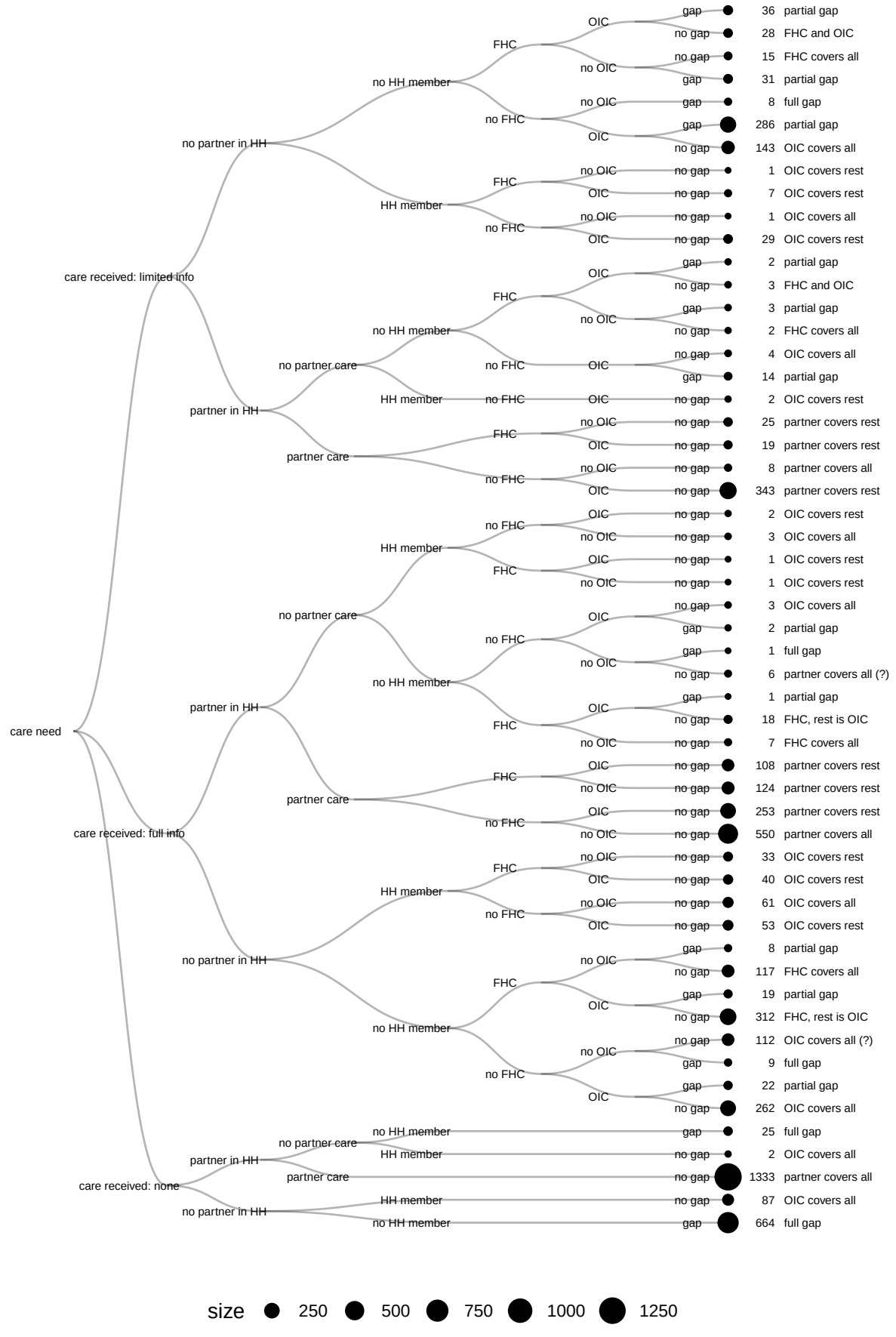


Figure 16: Decision tree illustration of our approach to obtain the individual care mix in hours from SHARE for Spain. *Notes:* care received: (limited info, full info, none) refers to the care variables available per respondent. We distinguish Formal Home Care (FHC), Outside Informal Care (OIC), full or partial gaps and care from partners or other household (HH) members.

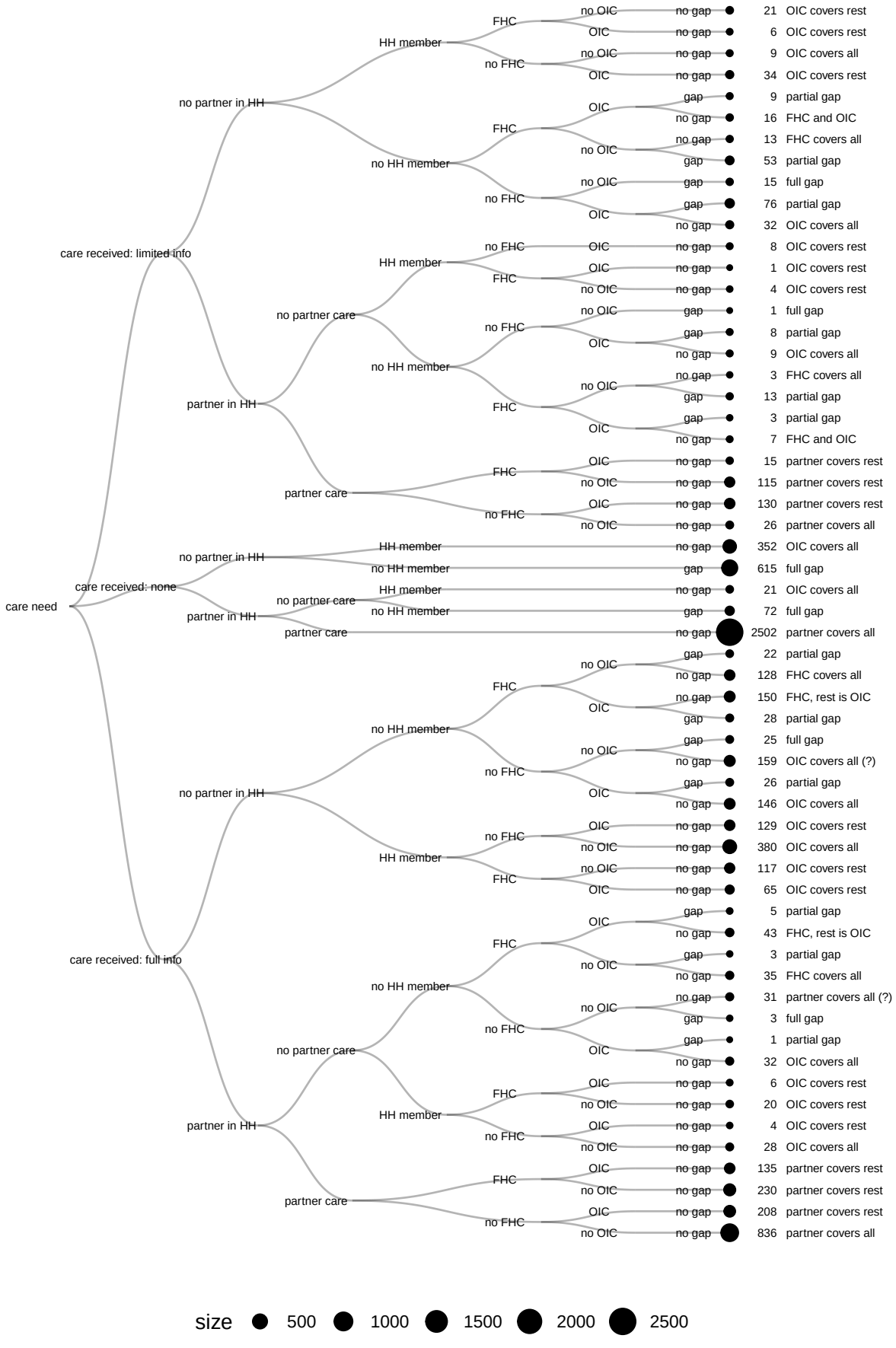
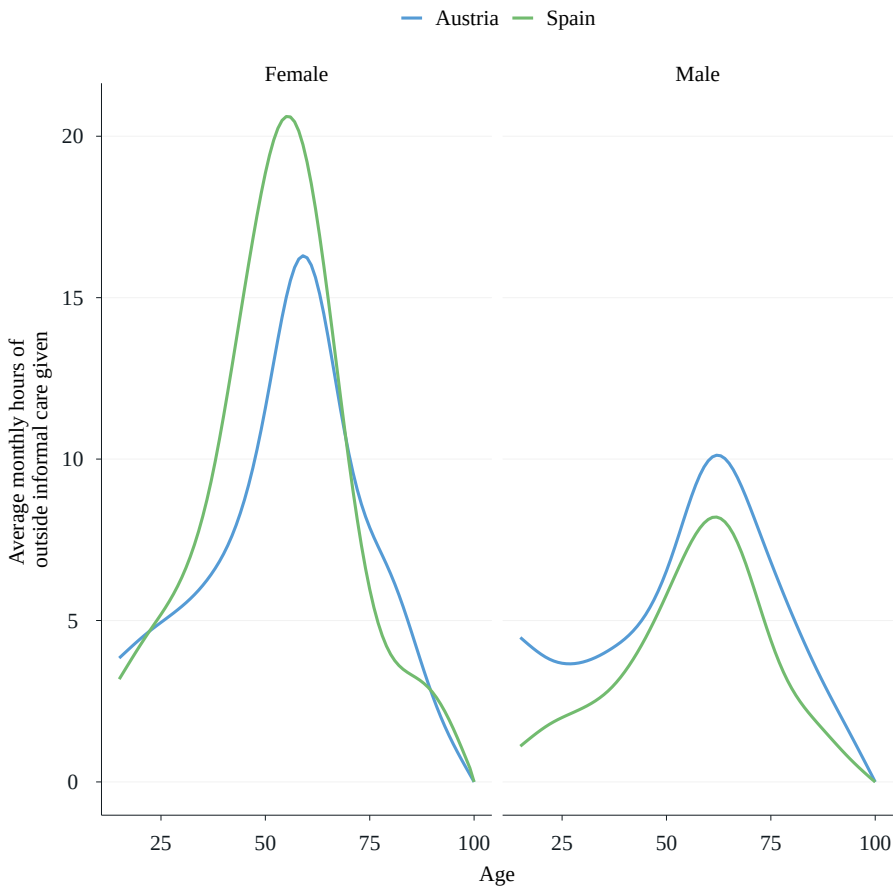


Figure 17: **Step 5 - Average hours of care given in Austria and Spain by age and sex**



Note: We combine data from SHARE for the 50+ population with data from EHIS for the population younger than 50 and apply statistical smoothing techniques.

C Simulation Results: Scenarios

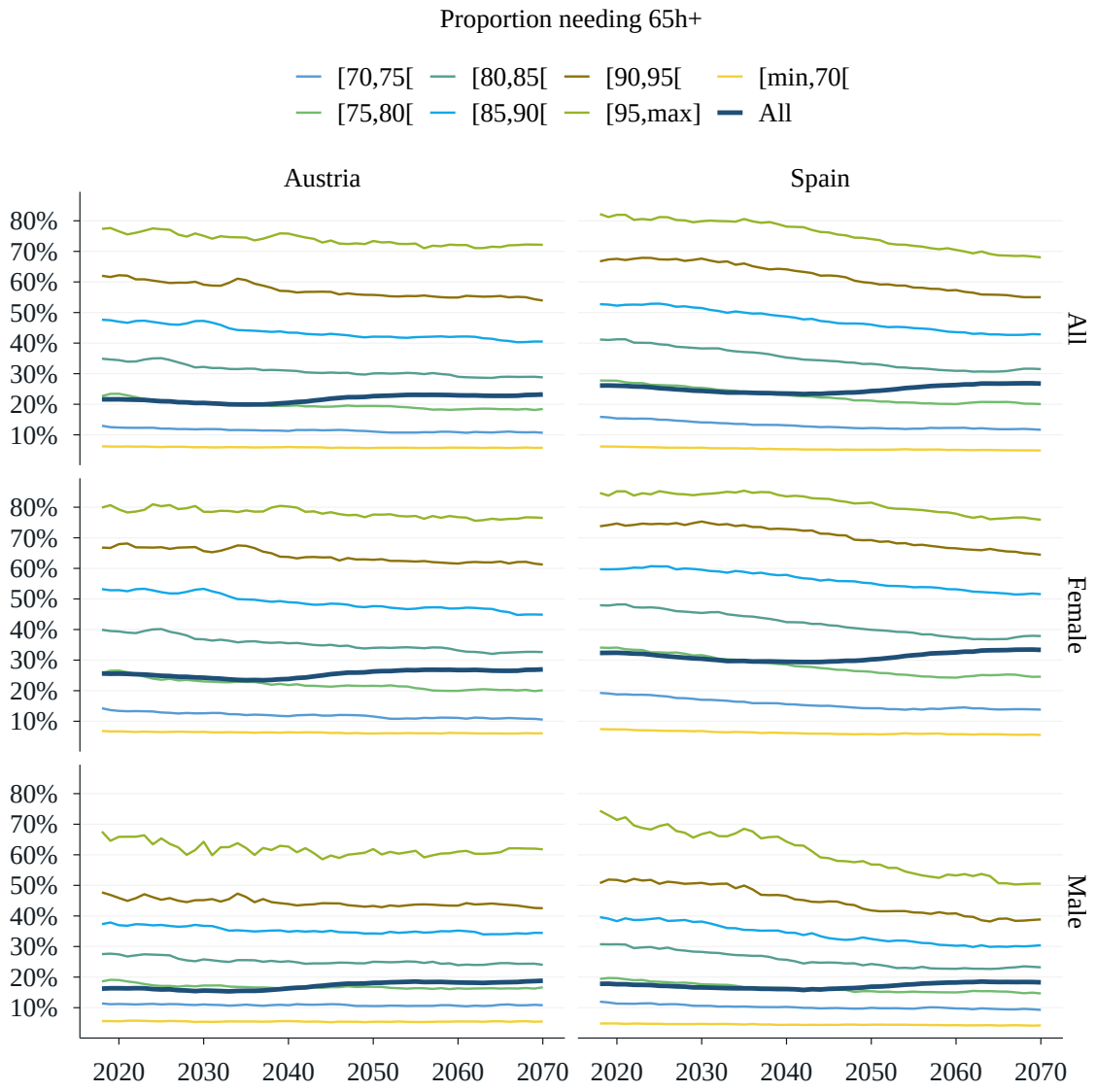


Figure 18: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 0-7.

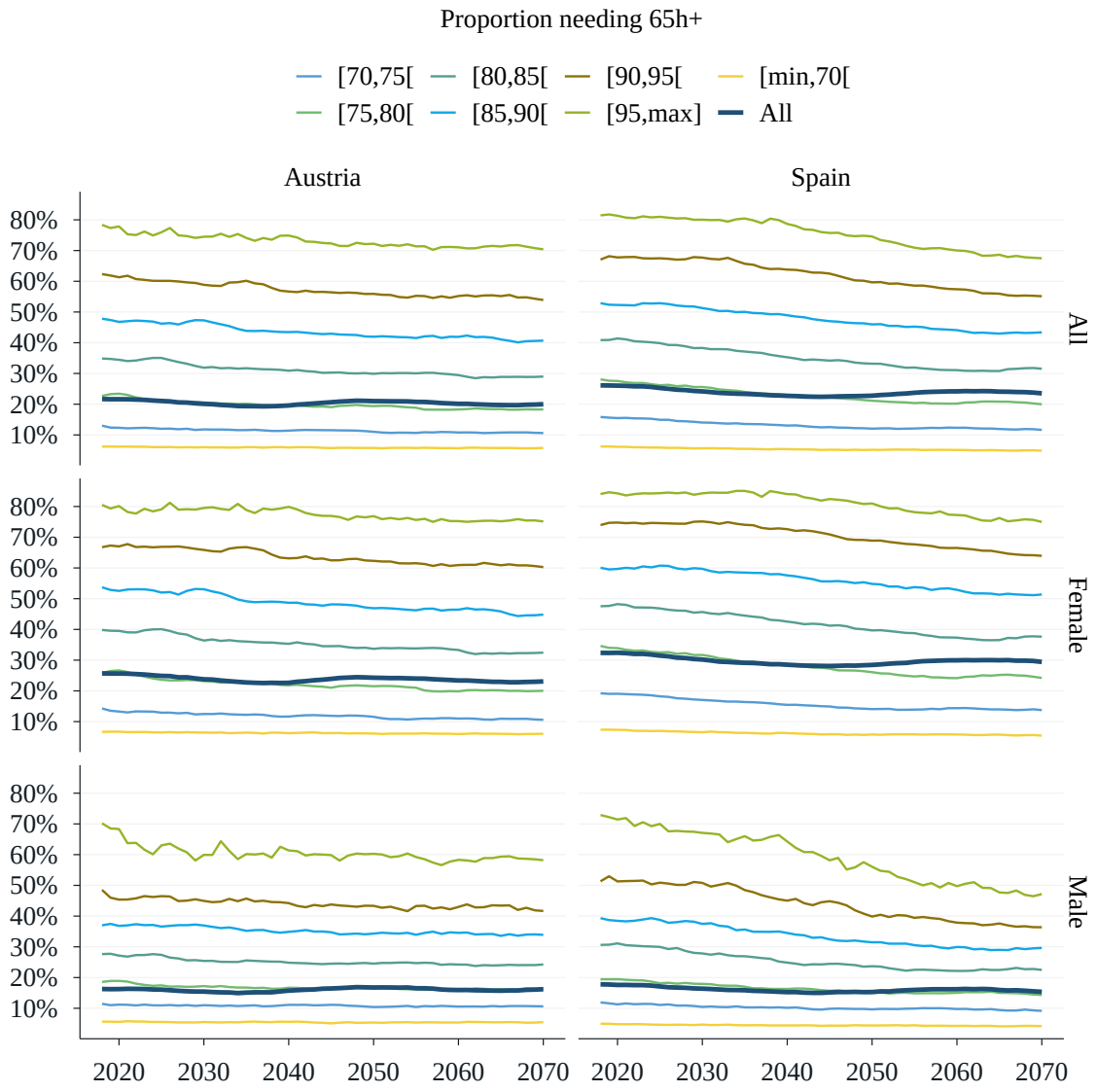


Figure 19: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 8.

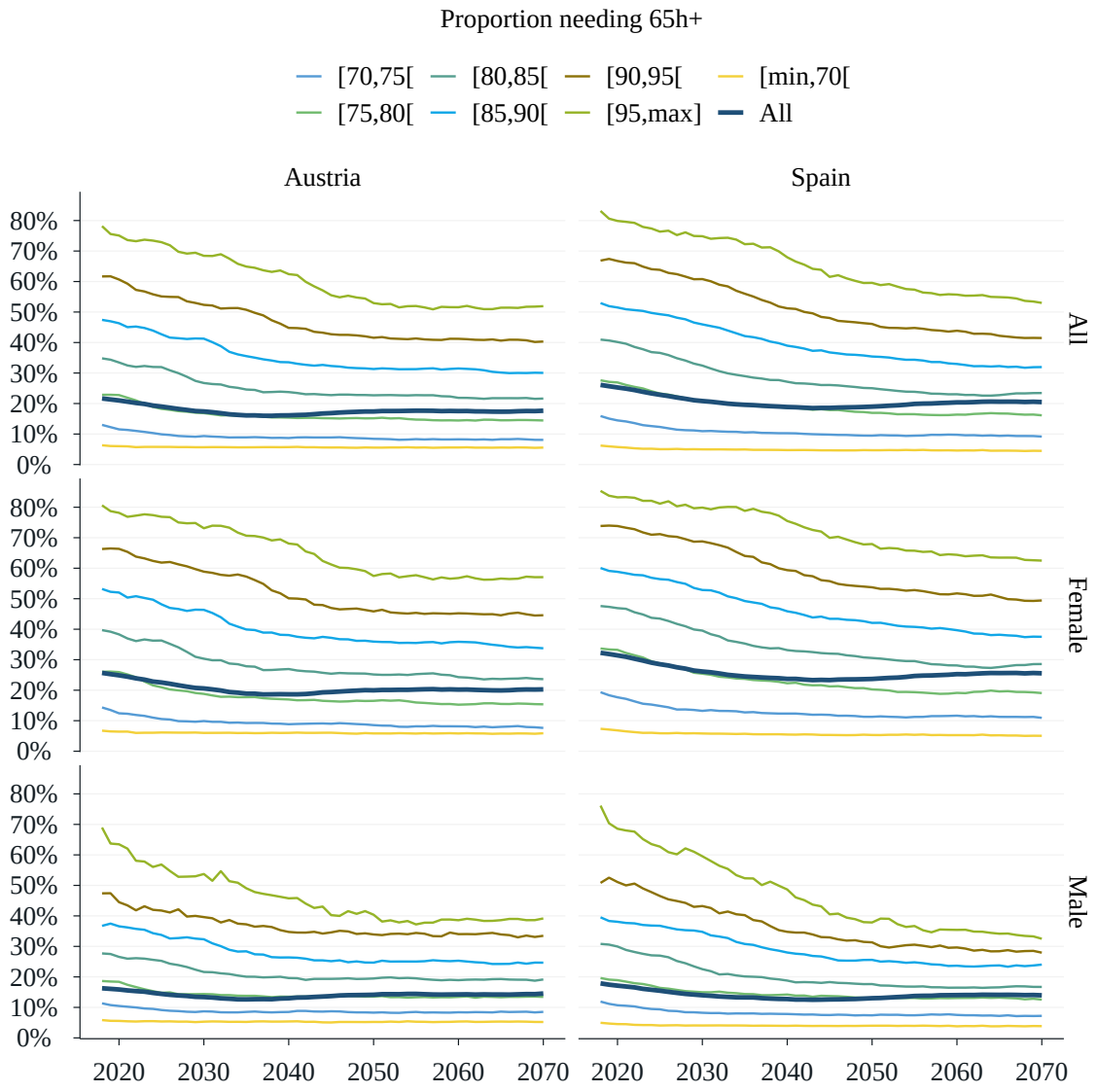


Figure 20: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 9.

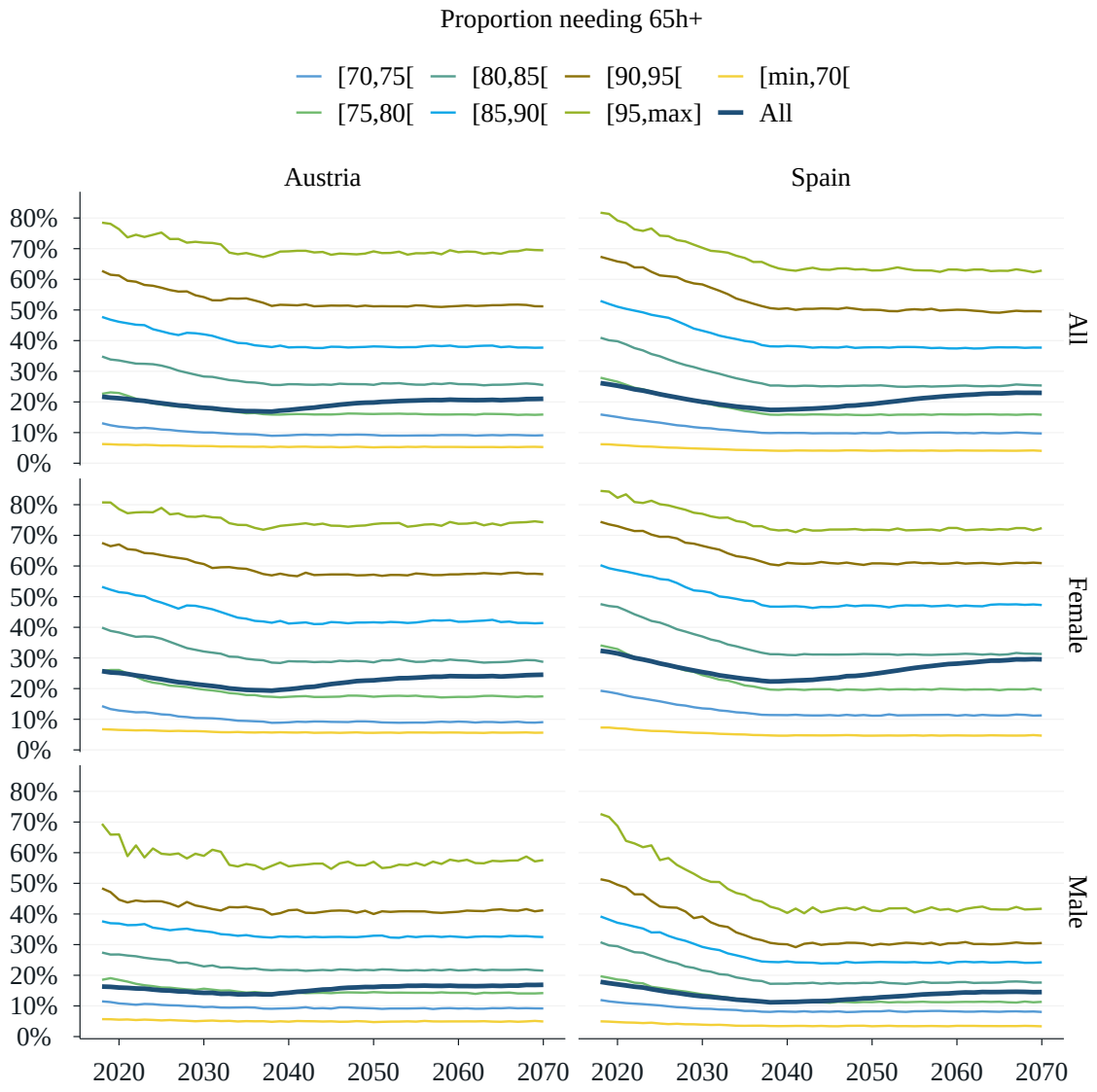


Figure 21: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 10.

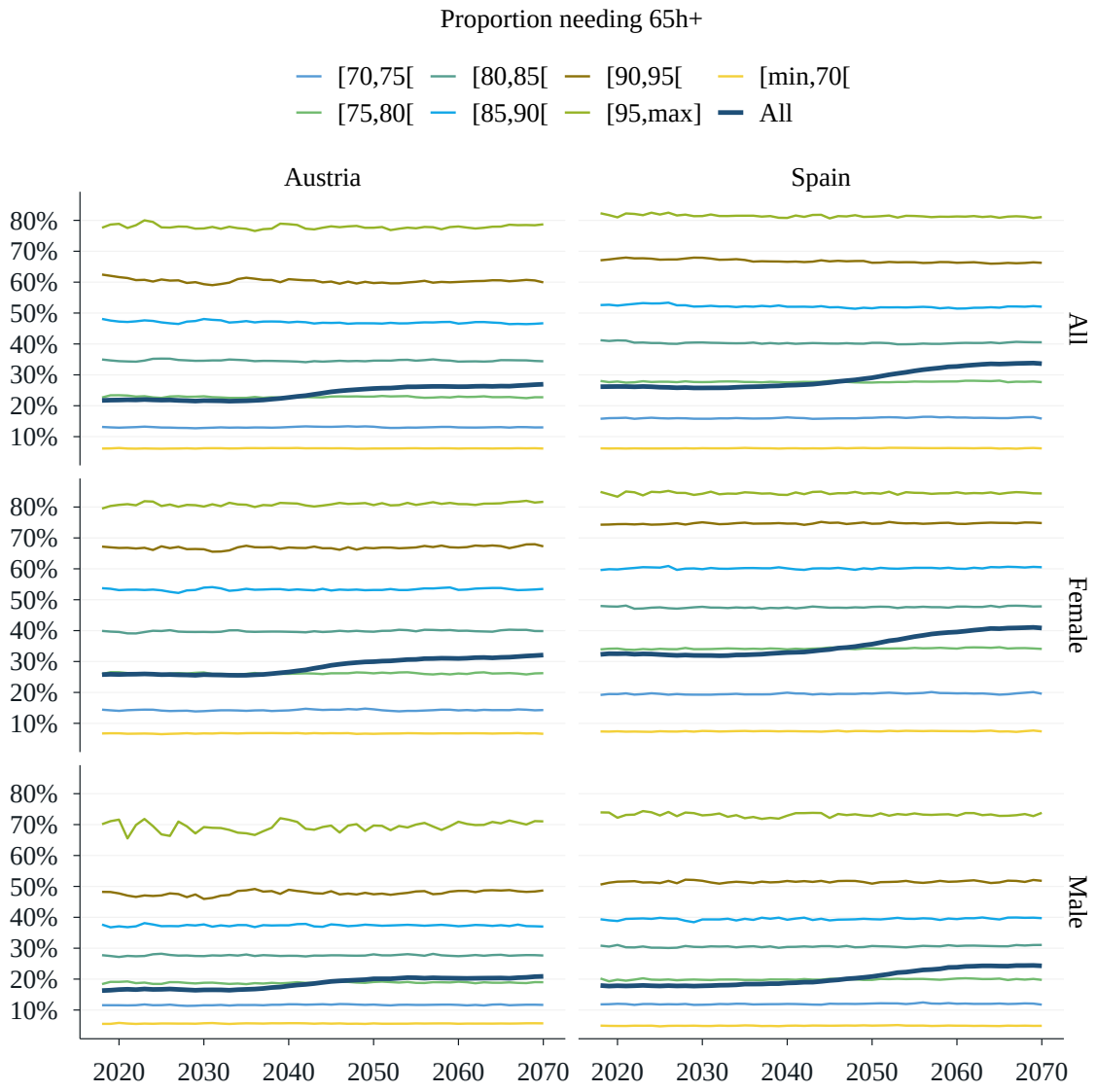


Figure 22: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 11.

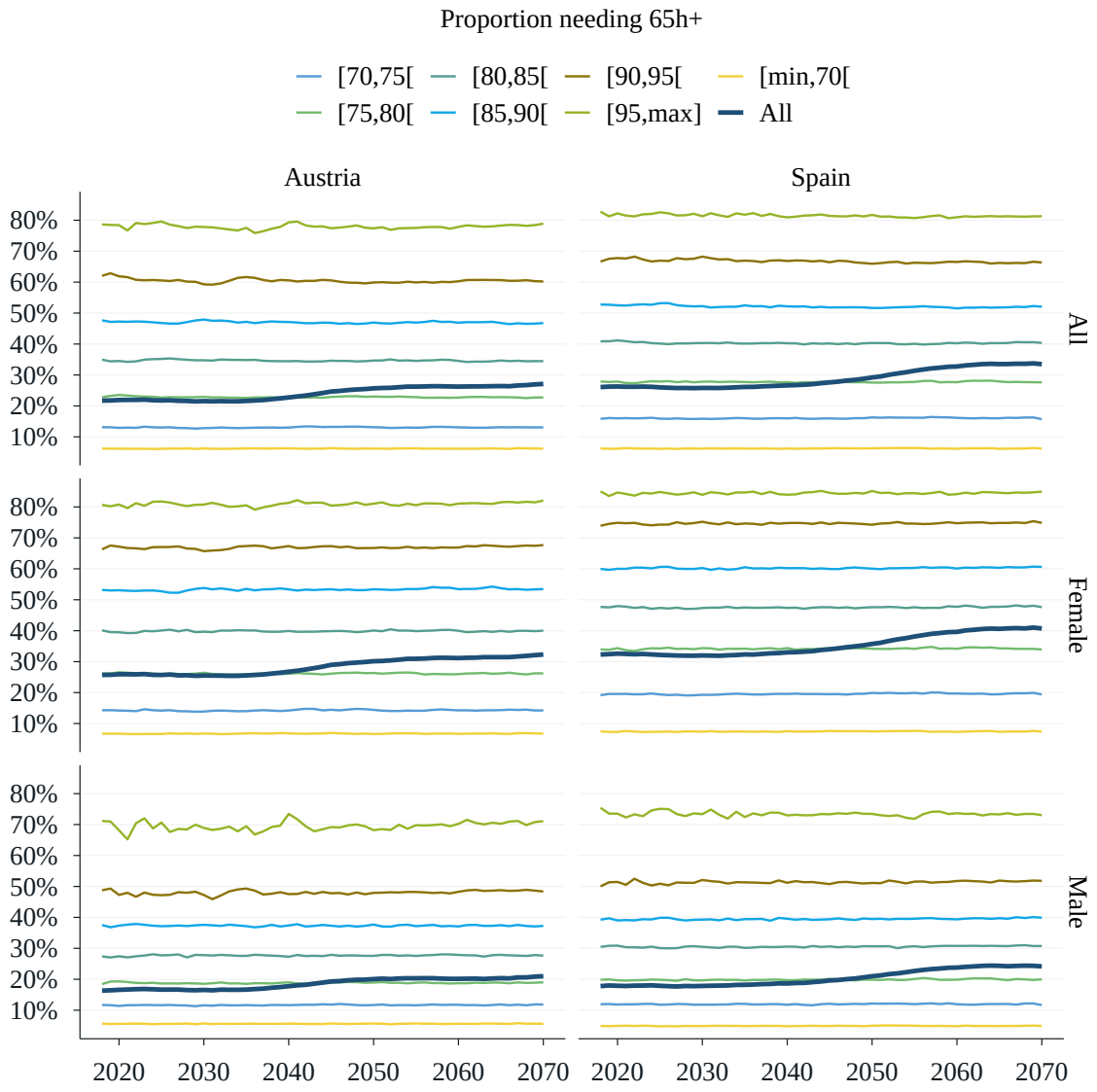


Figure 23: Projected changes in population proportions with care need of 65+ hours by age group and sex in Austria and Spain. Scenario 12.

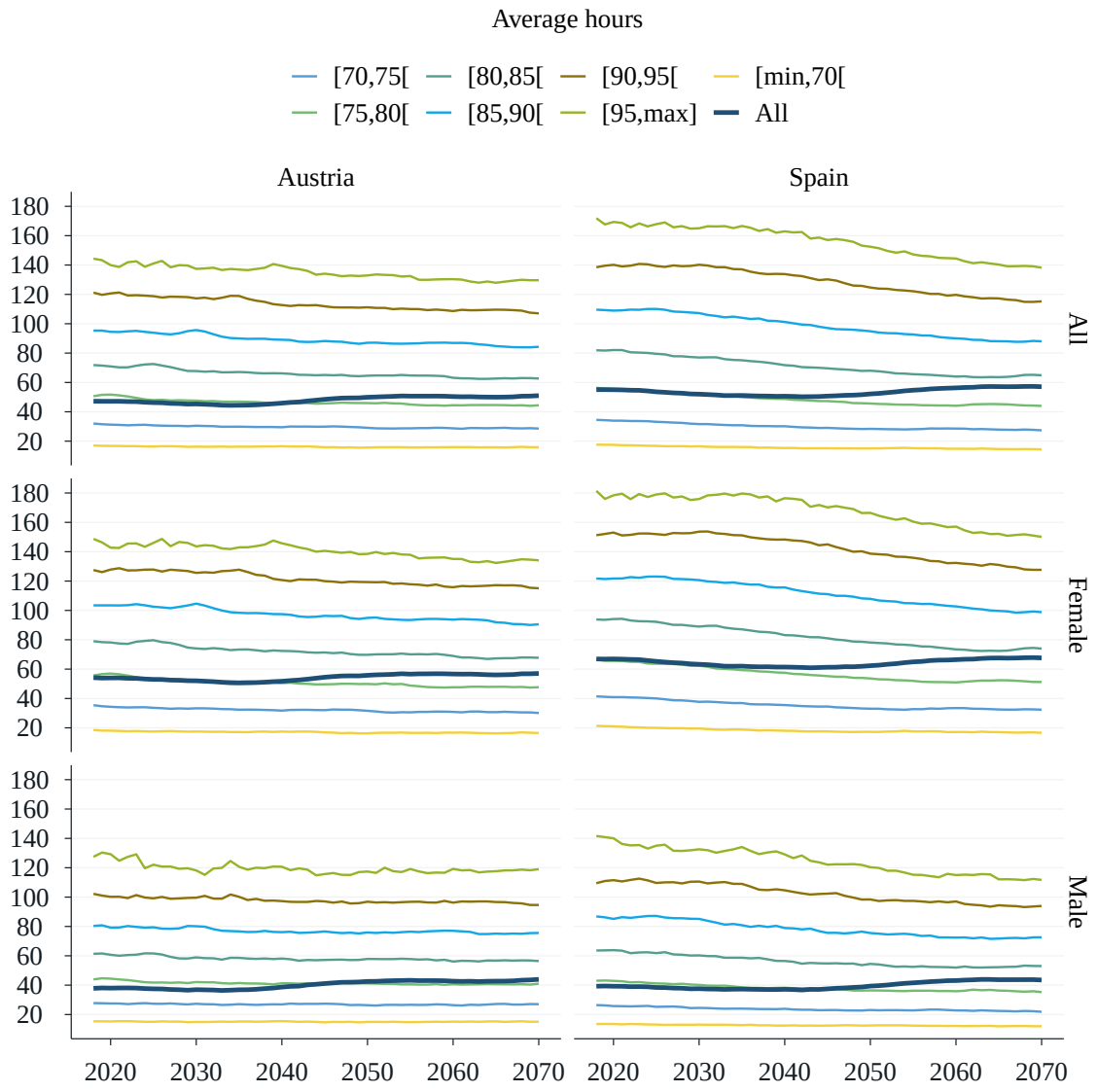


Figure 24: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 0-7.

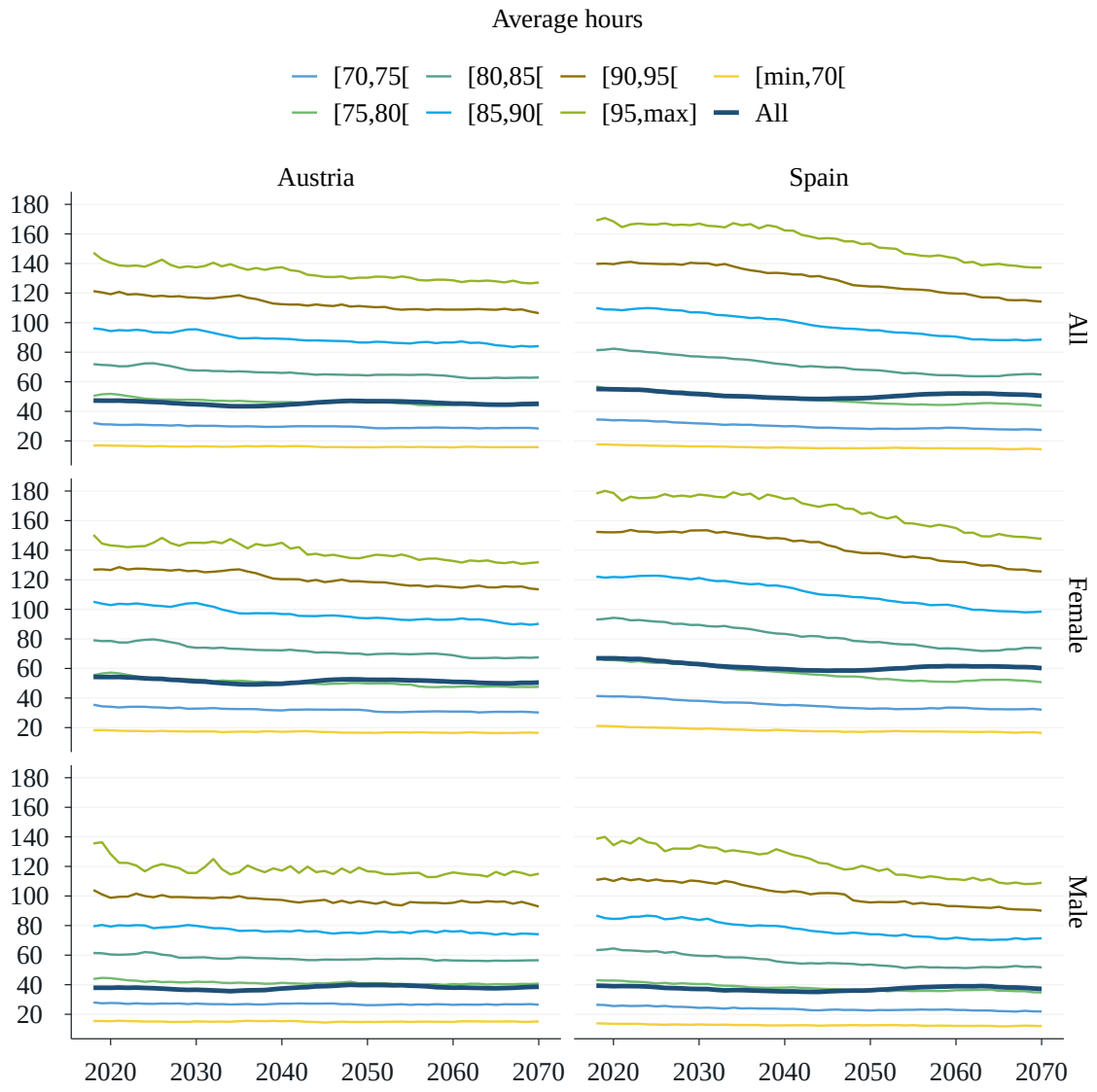


Figure 25: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 8.

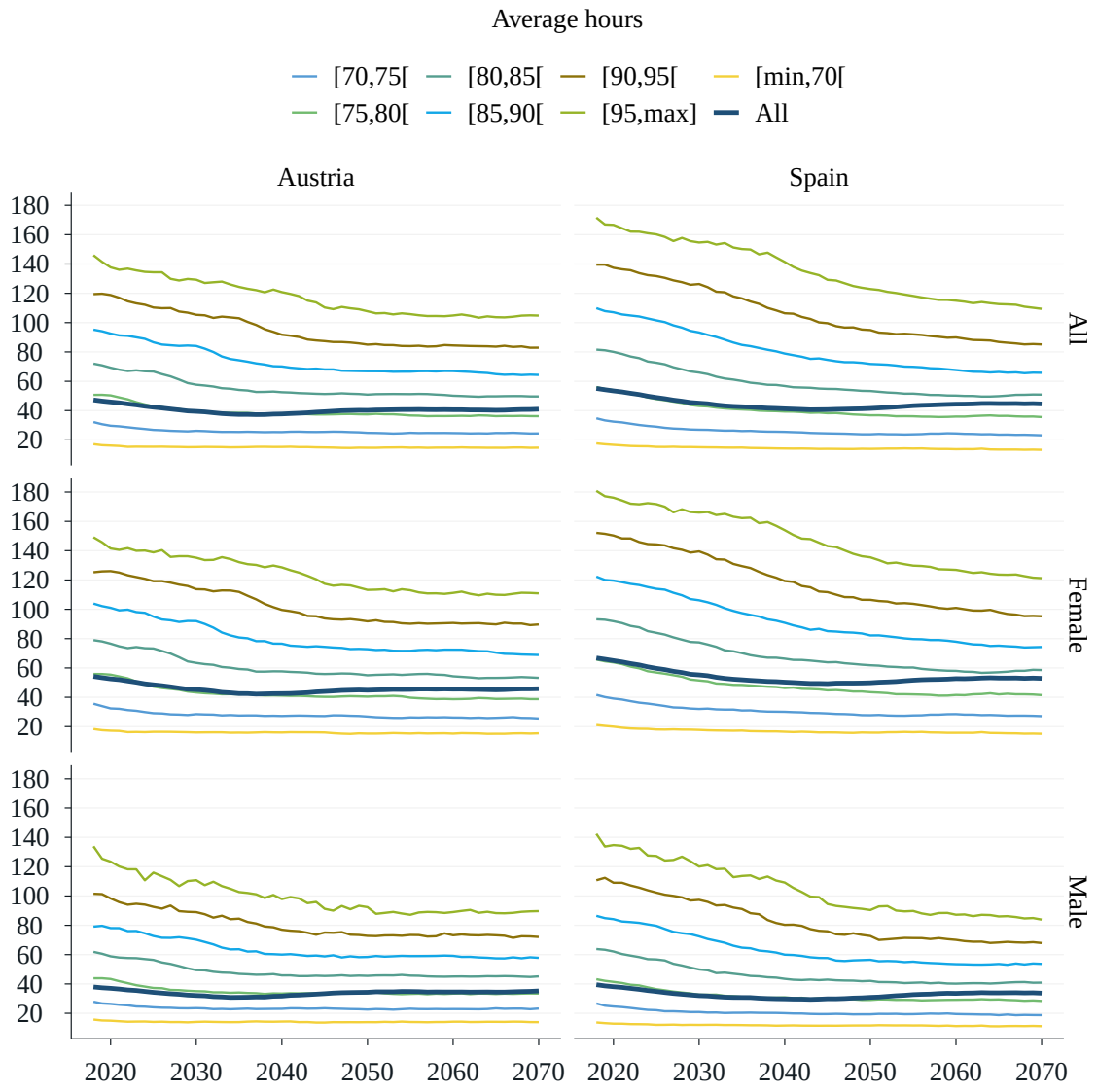


Figure 26: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 9.

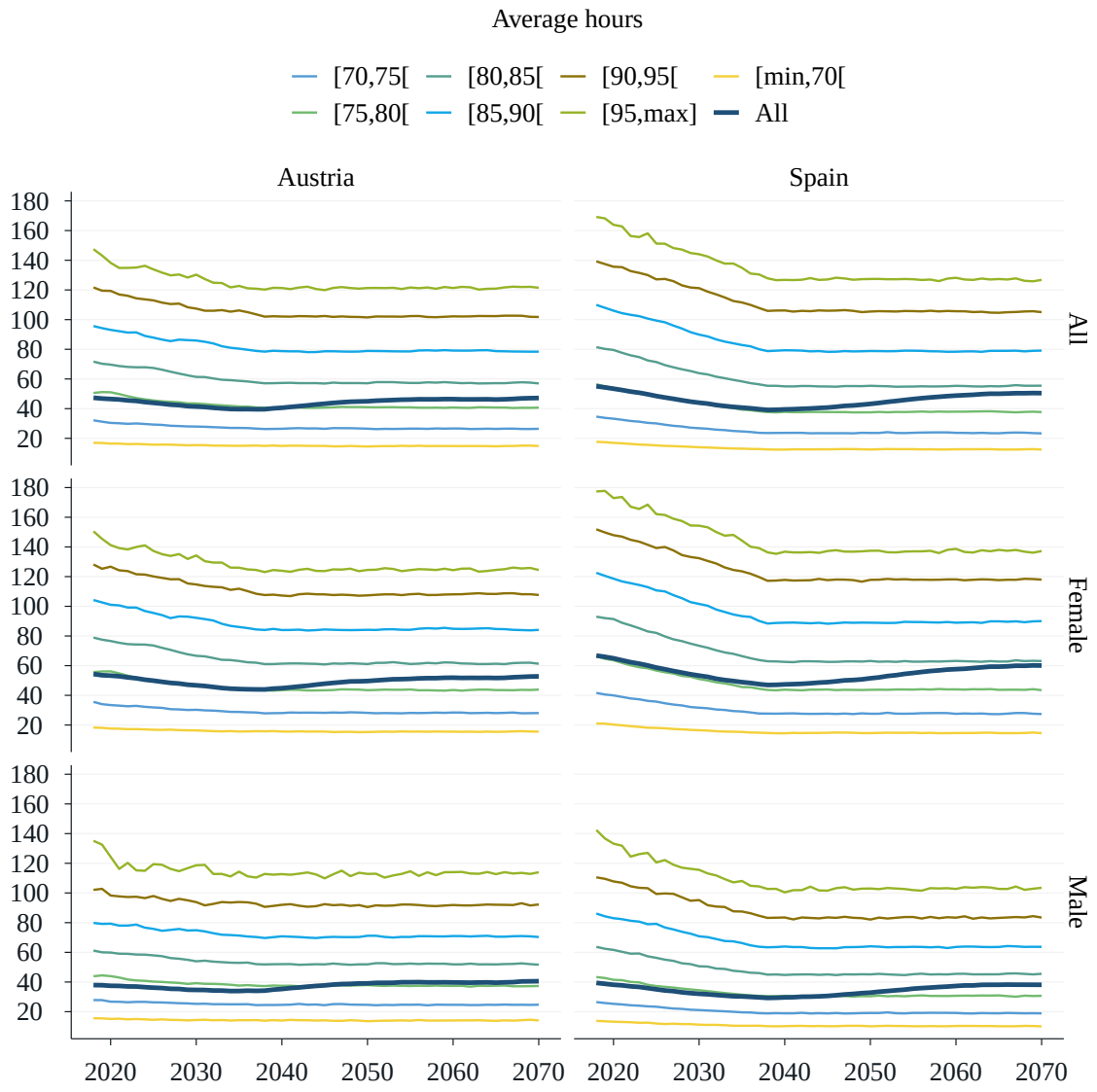


Figure 27: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 10.

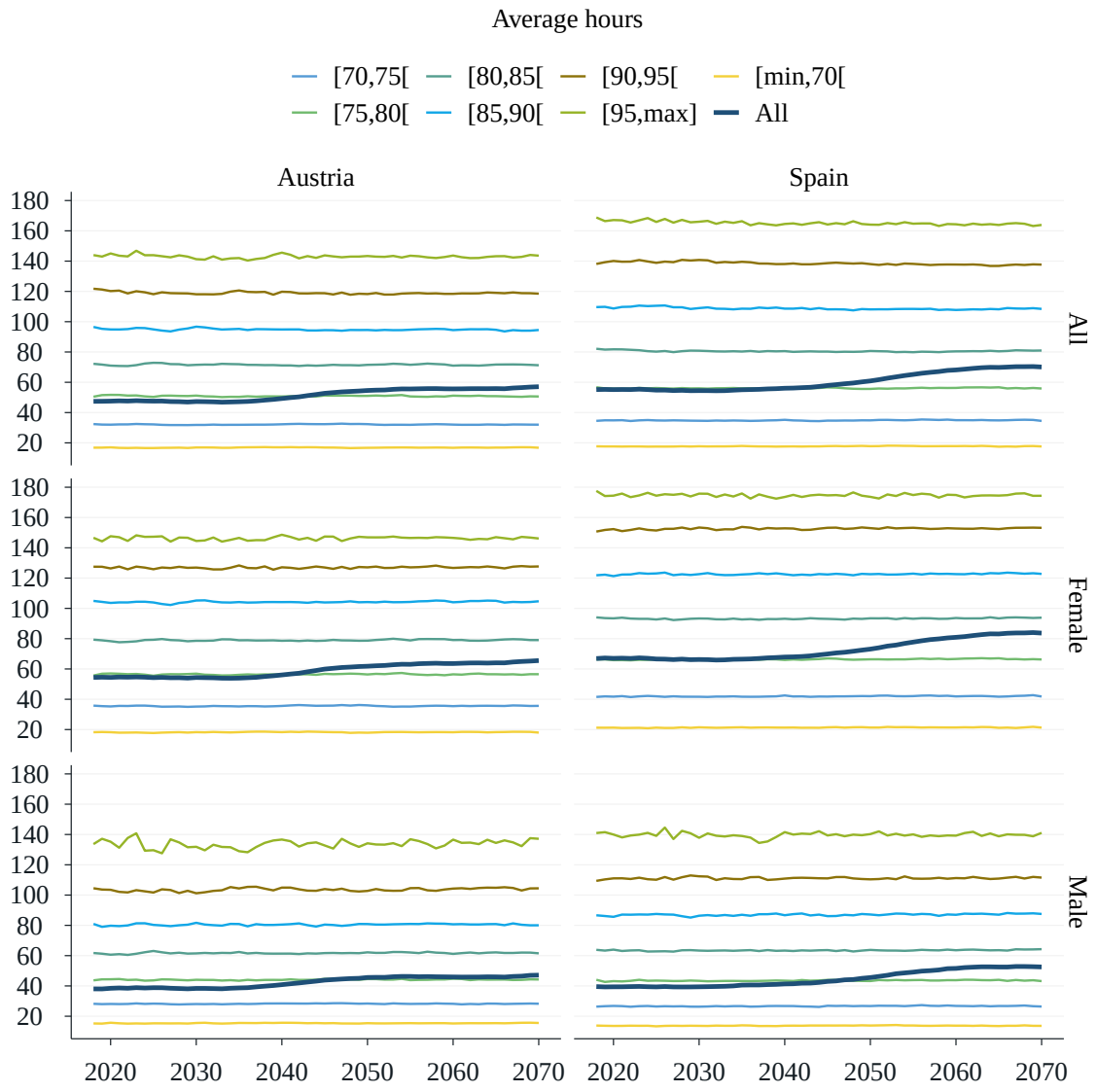


Figure 28: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 11.

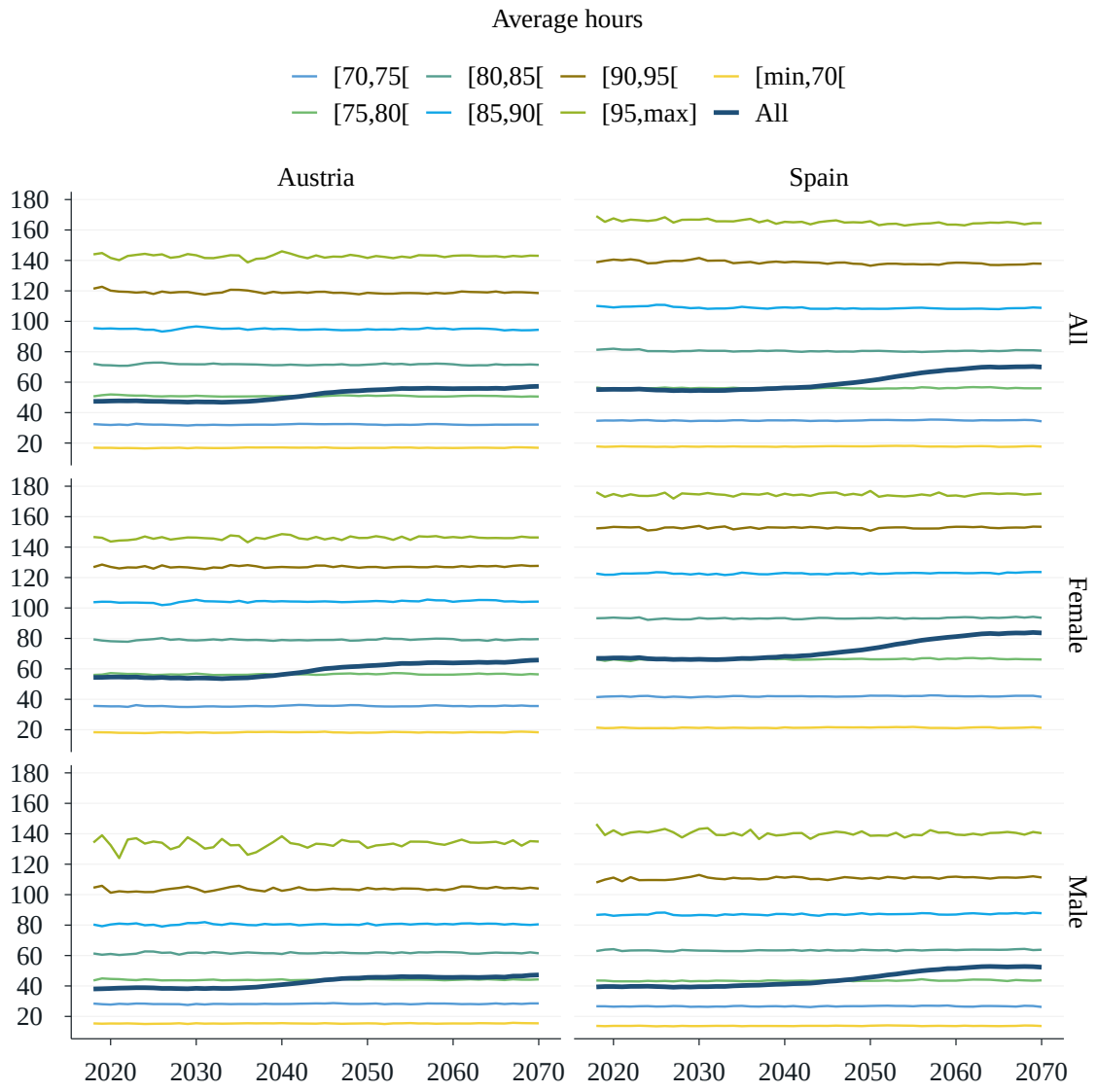


Figure 29: Projected changes in average hours of care needed by age group and sex in Austria and Spain. Scenario 12.

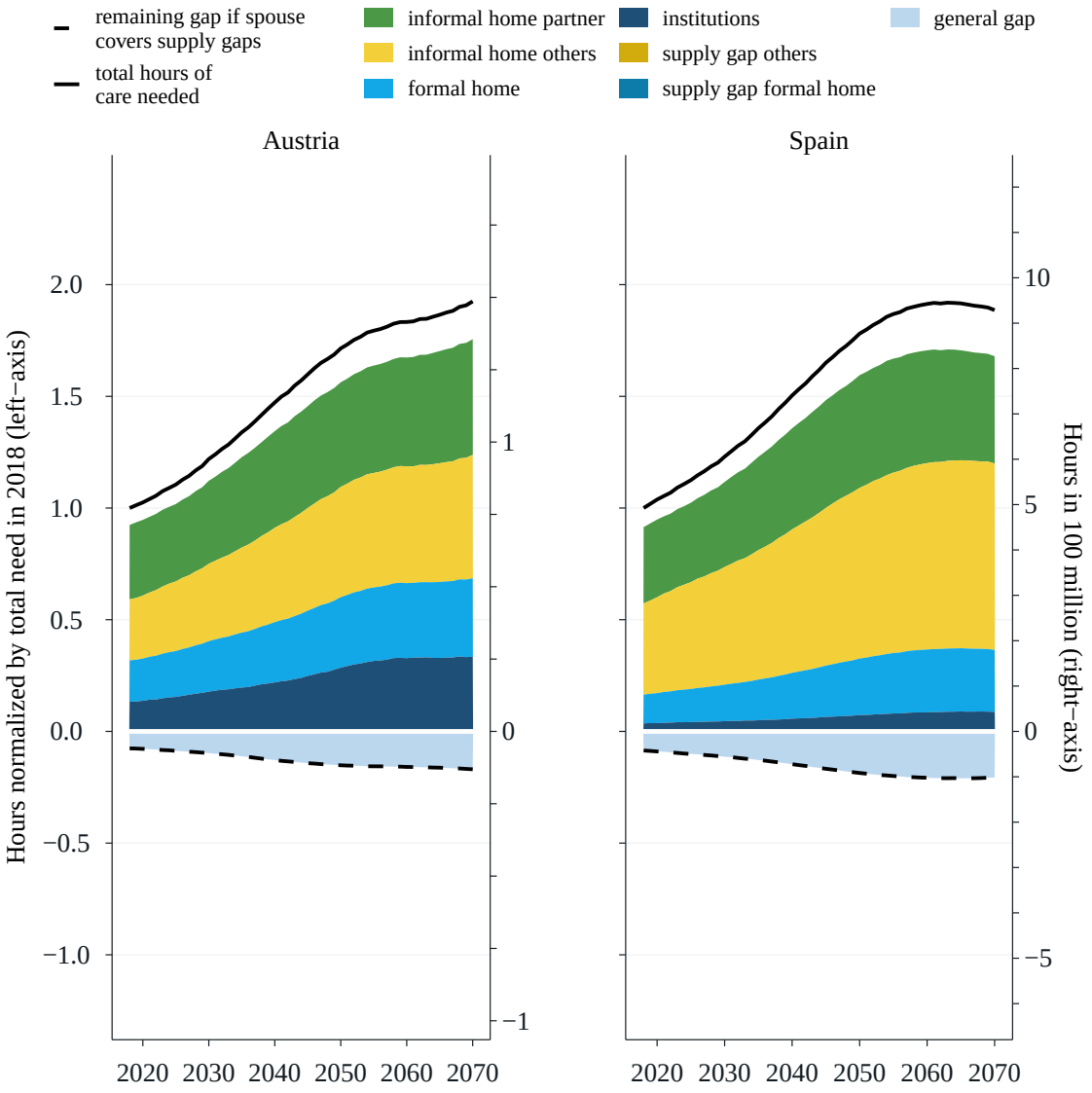


Figure 30: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 0.

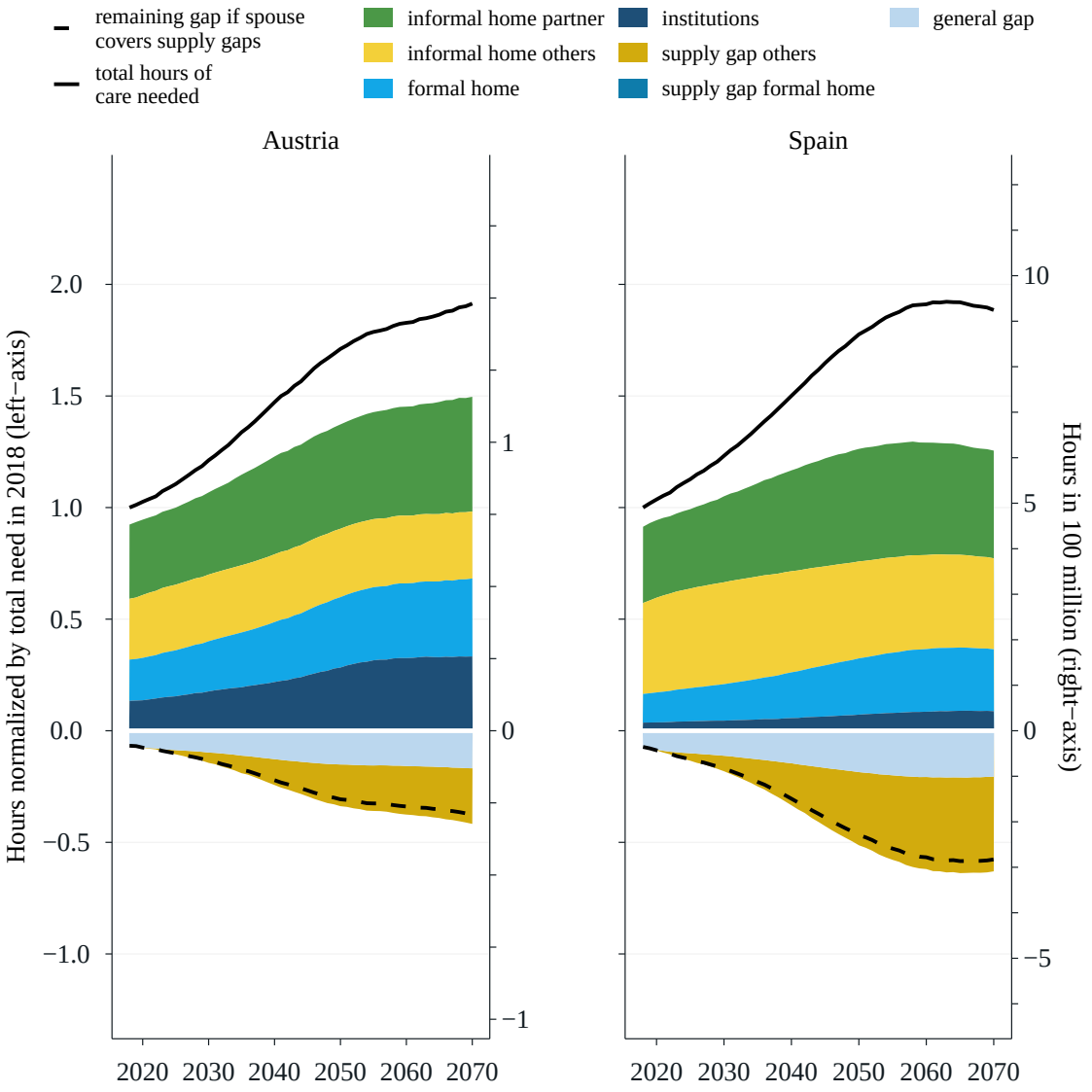


Figure 31: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 1.

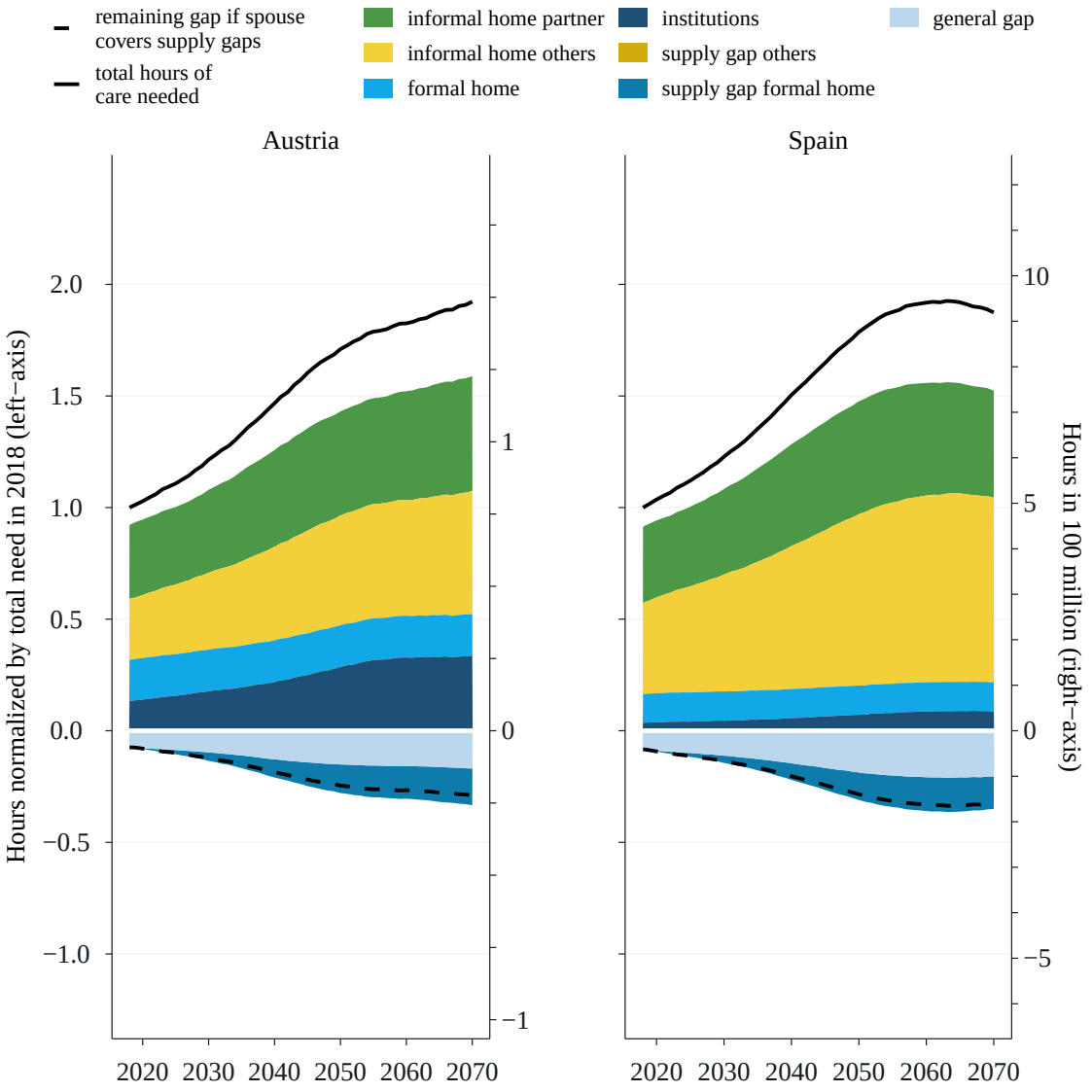


Figure 32: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 2.

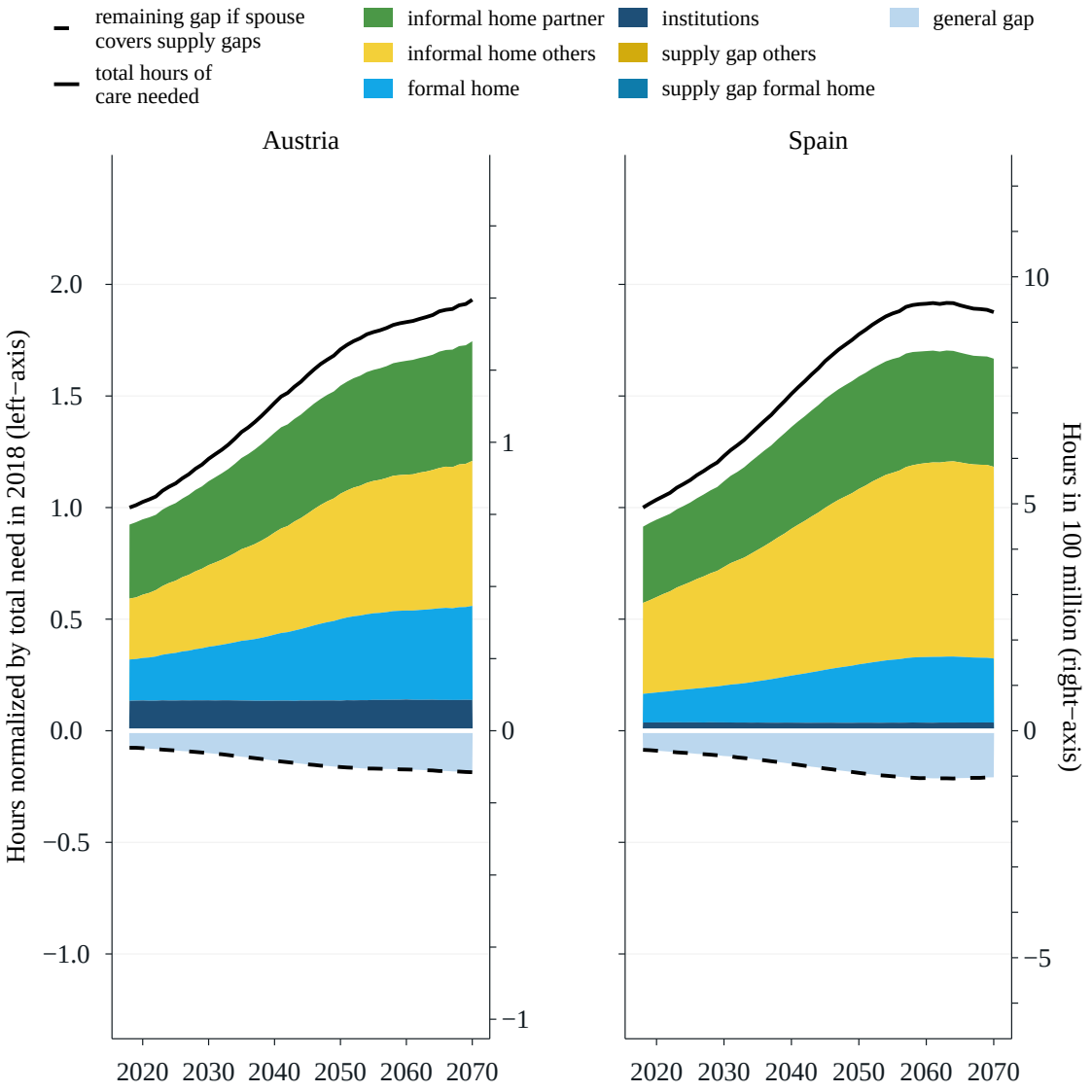


Figure 33: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 3.

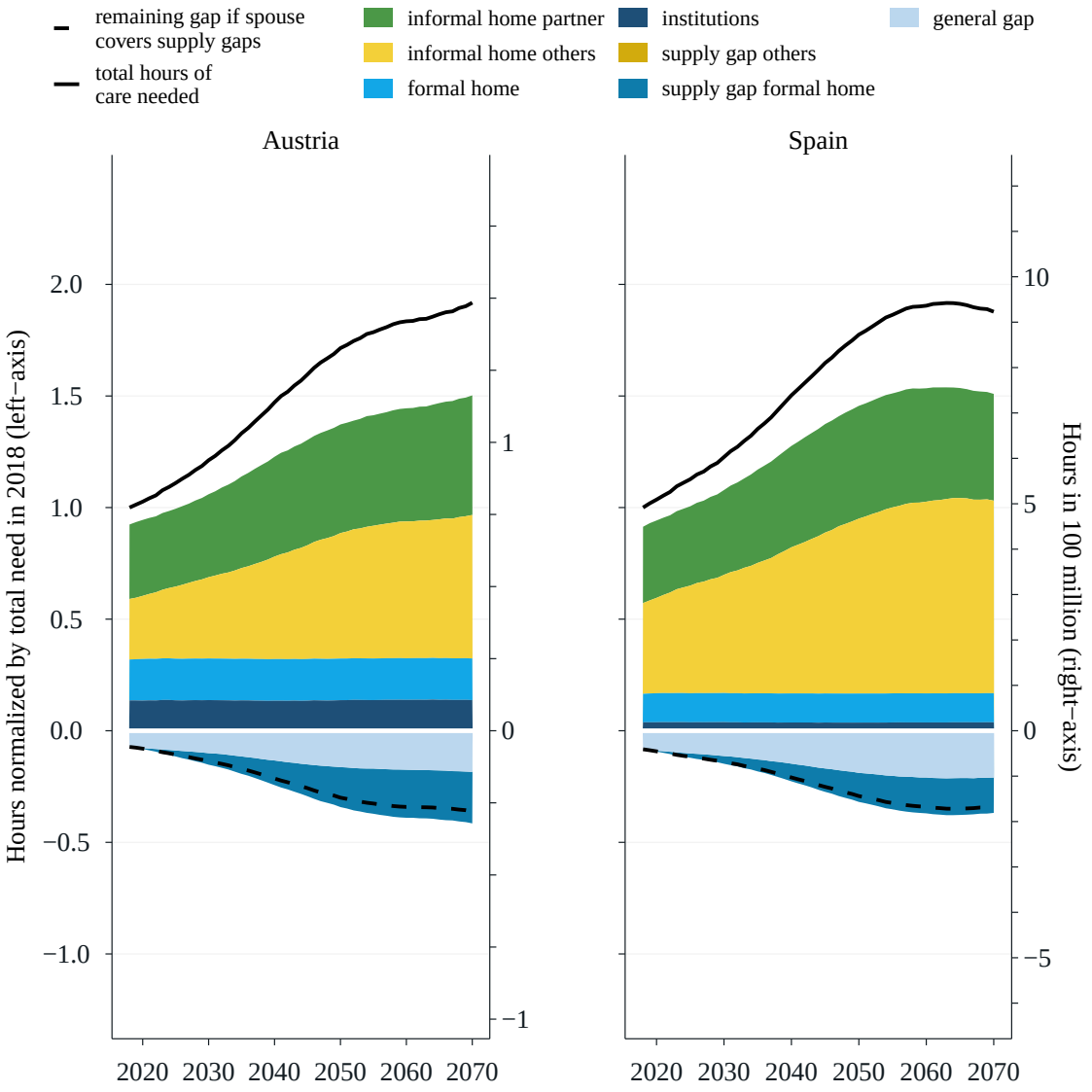


Figure 34: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 4.

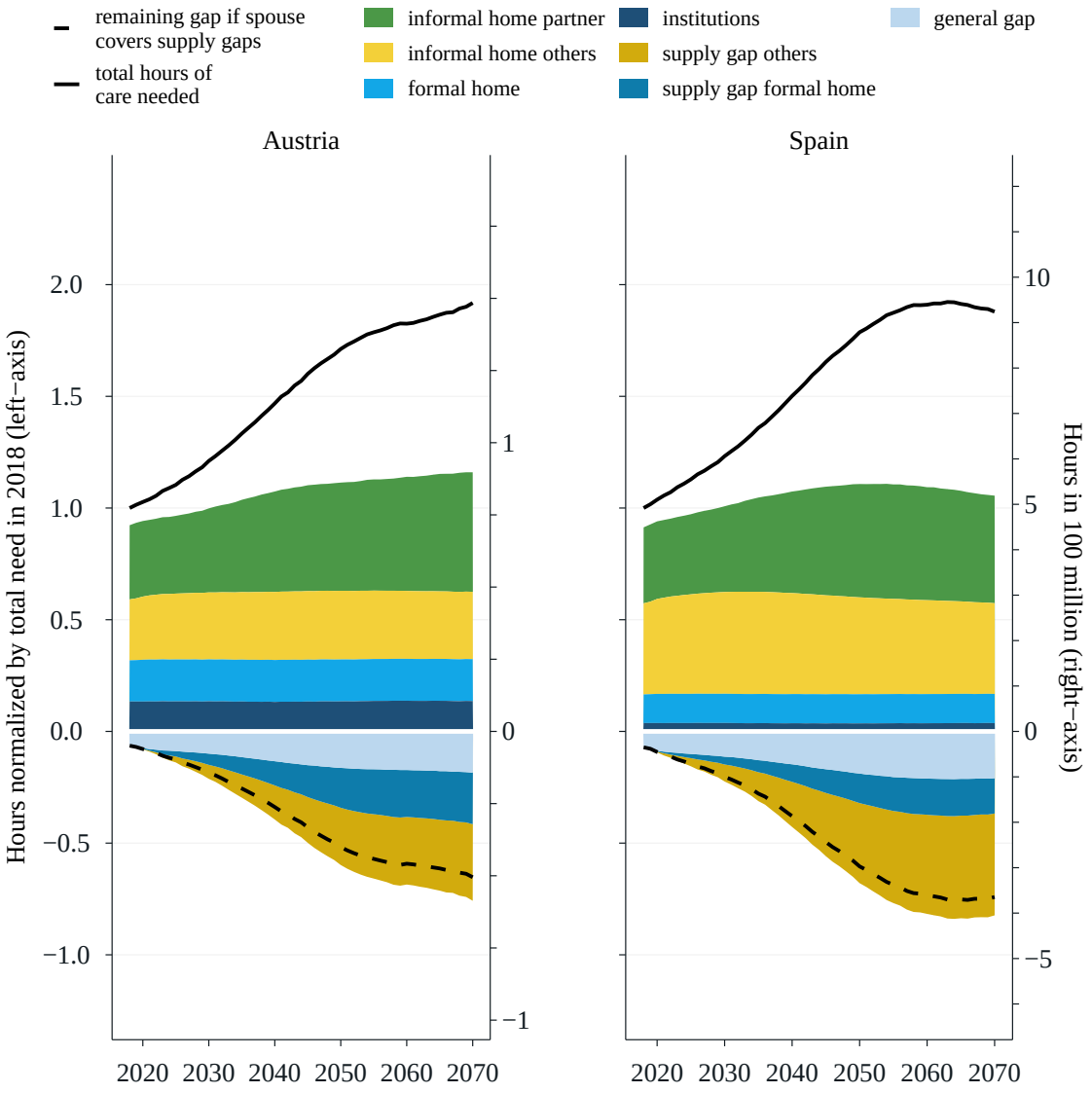


Figure 35: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 5.

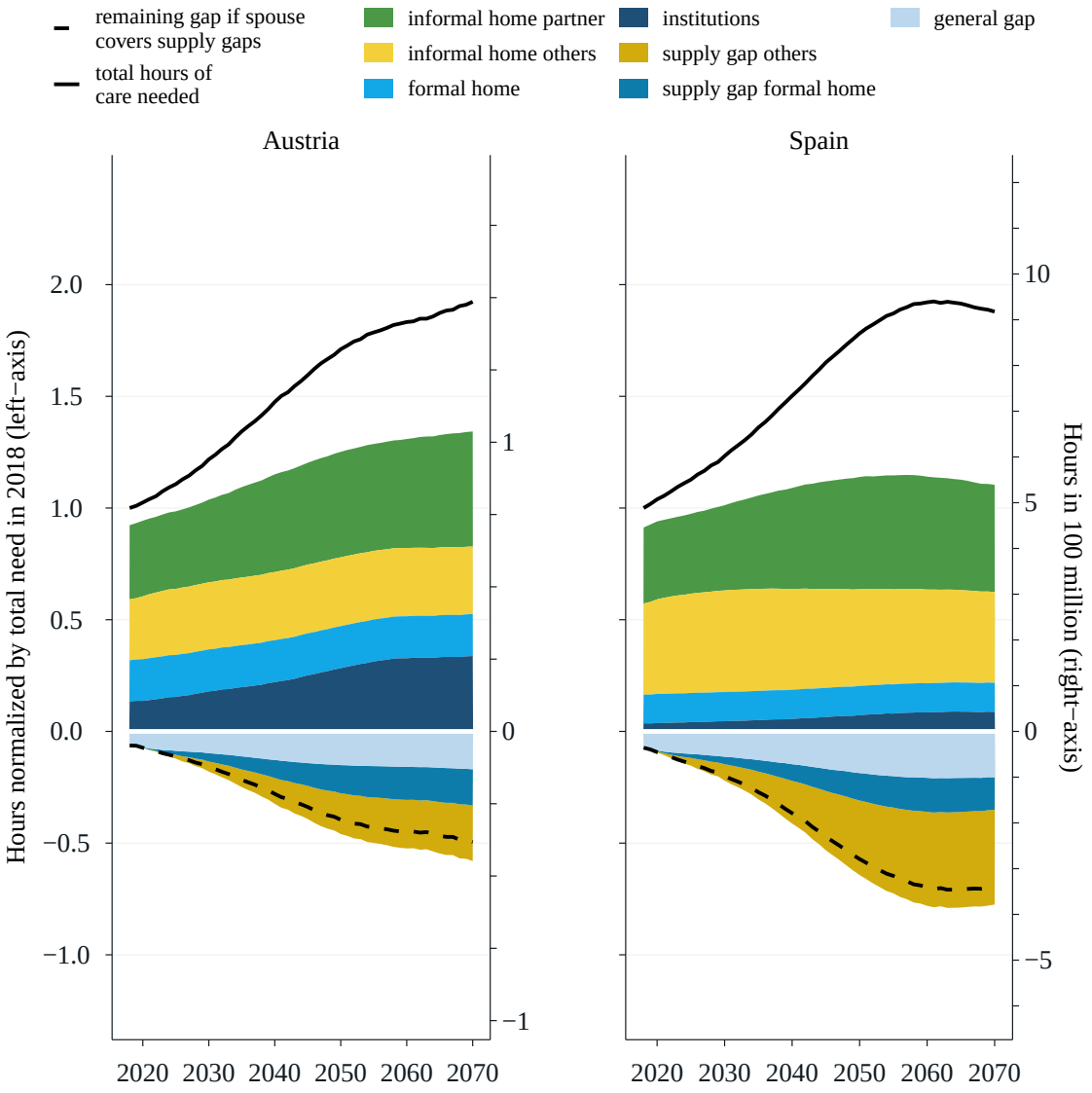


Figure 36: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 6.

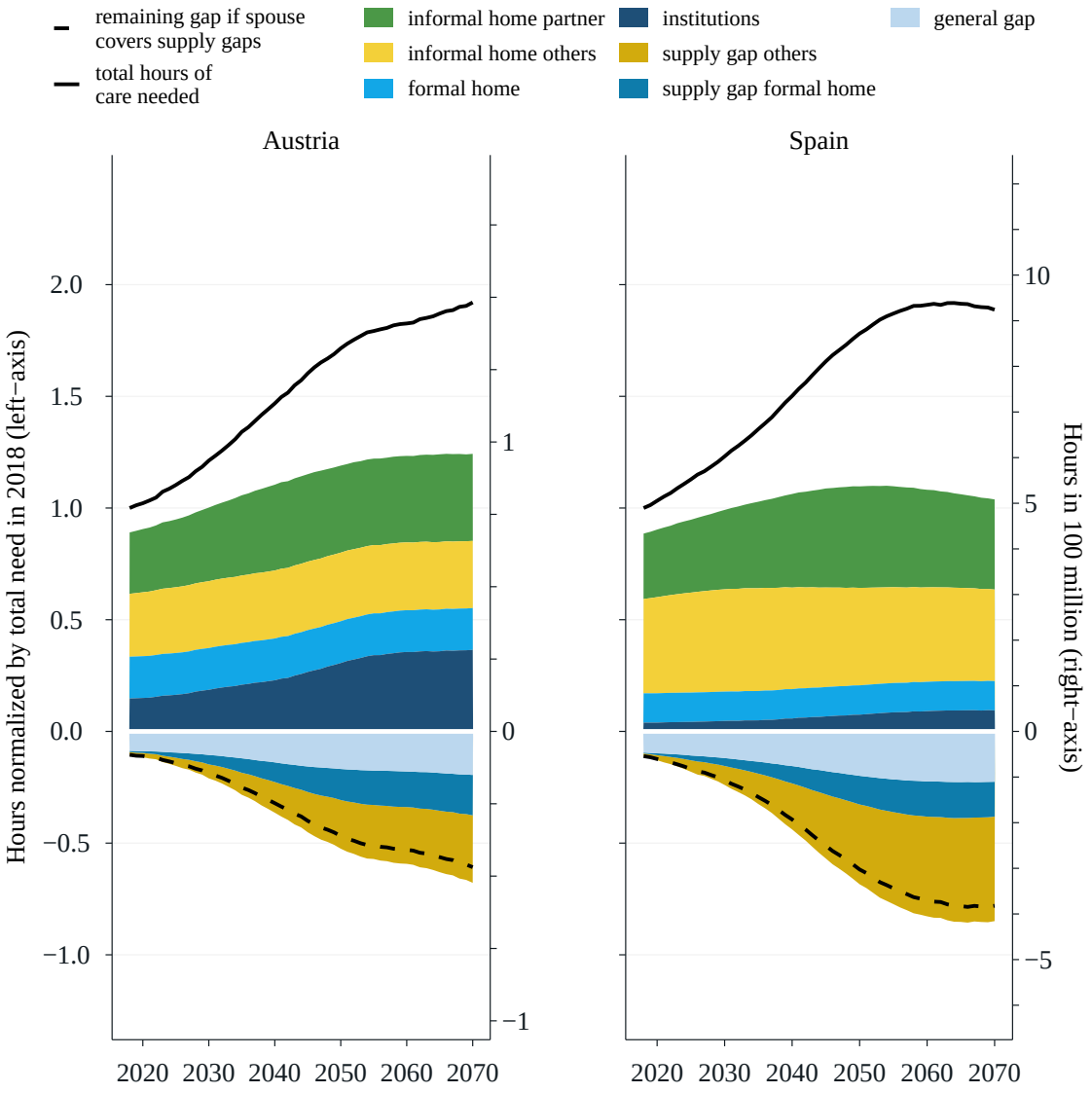


Figure 37: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 7.

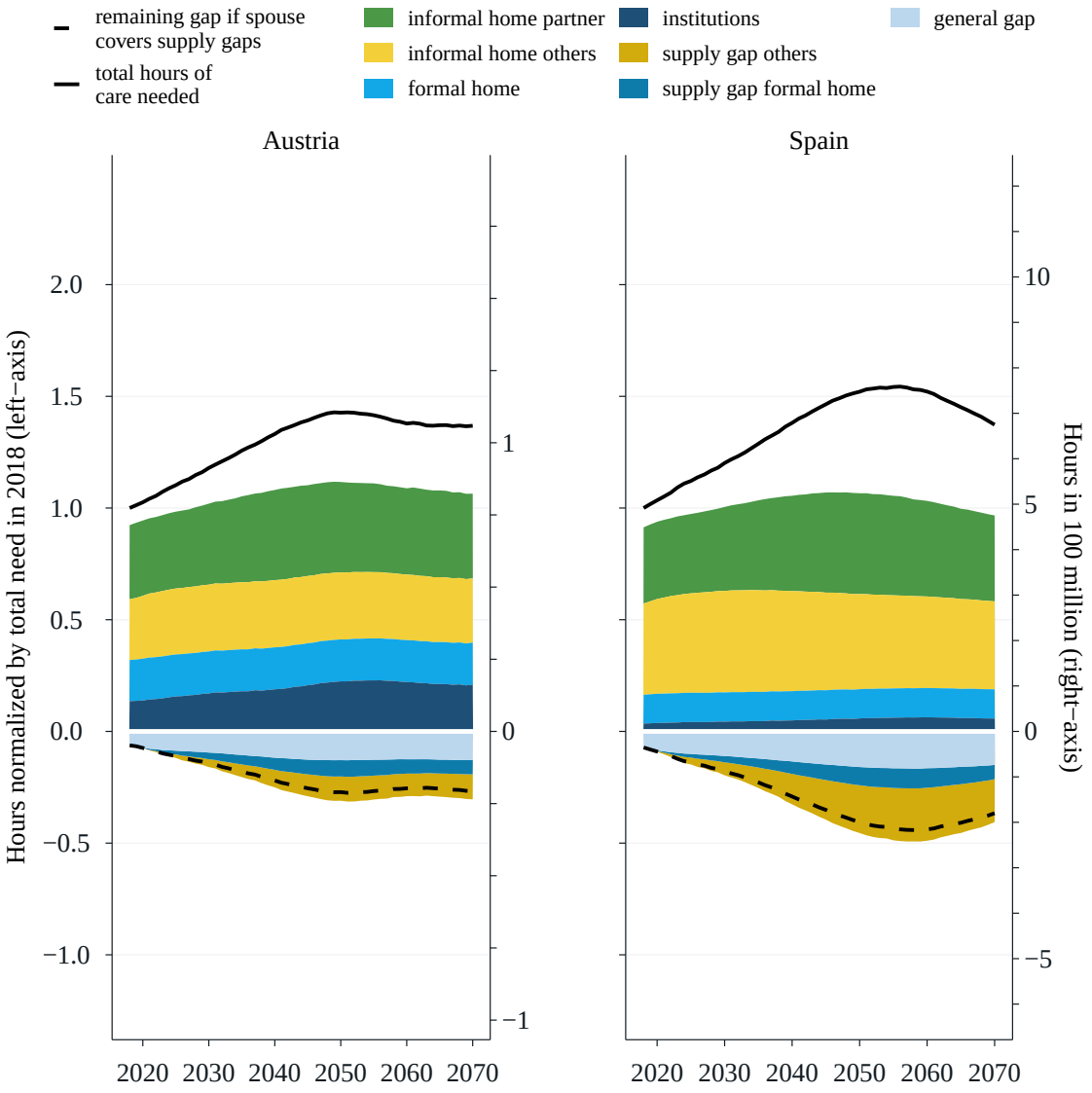


Figure 38: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 8.

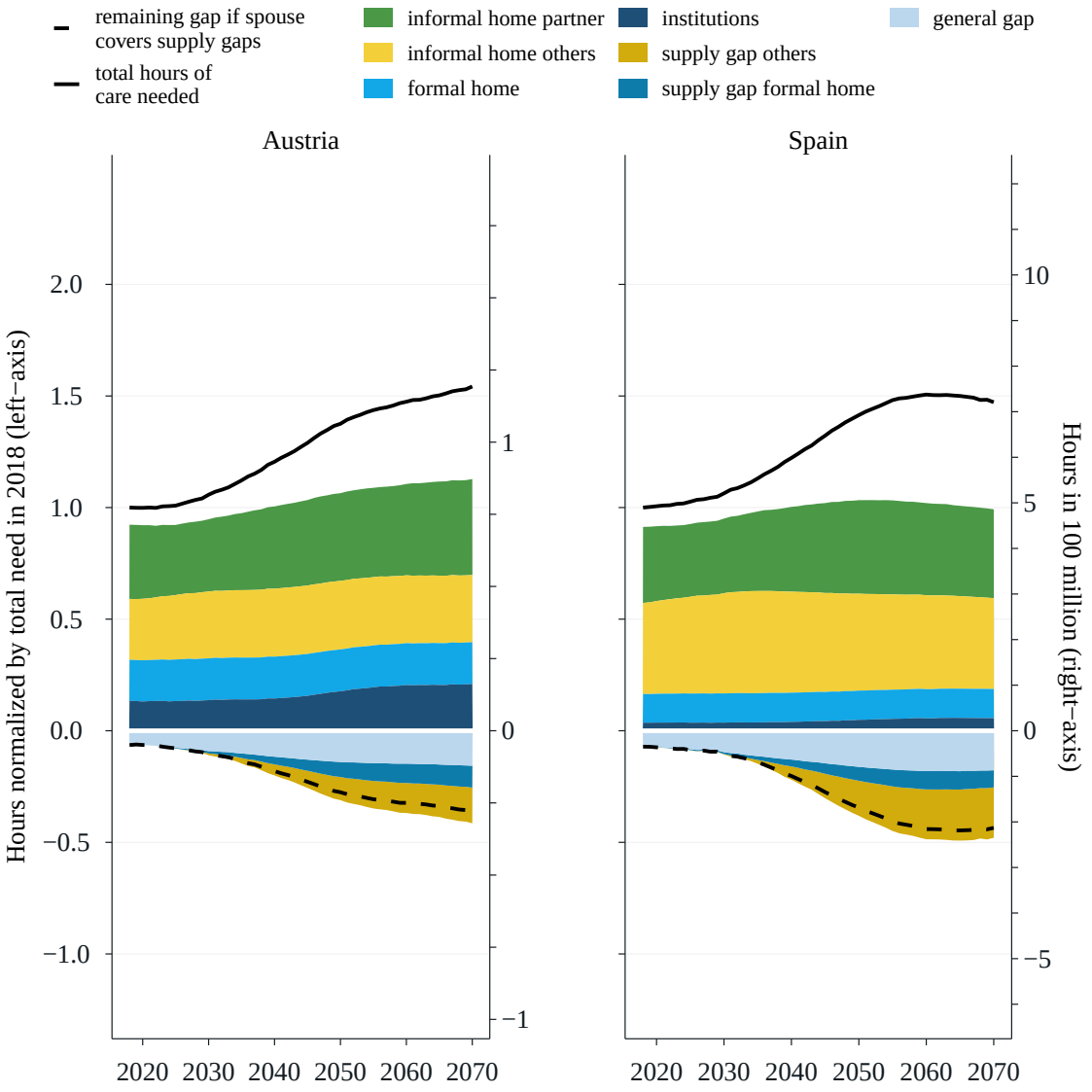


Figure 39: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 9.

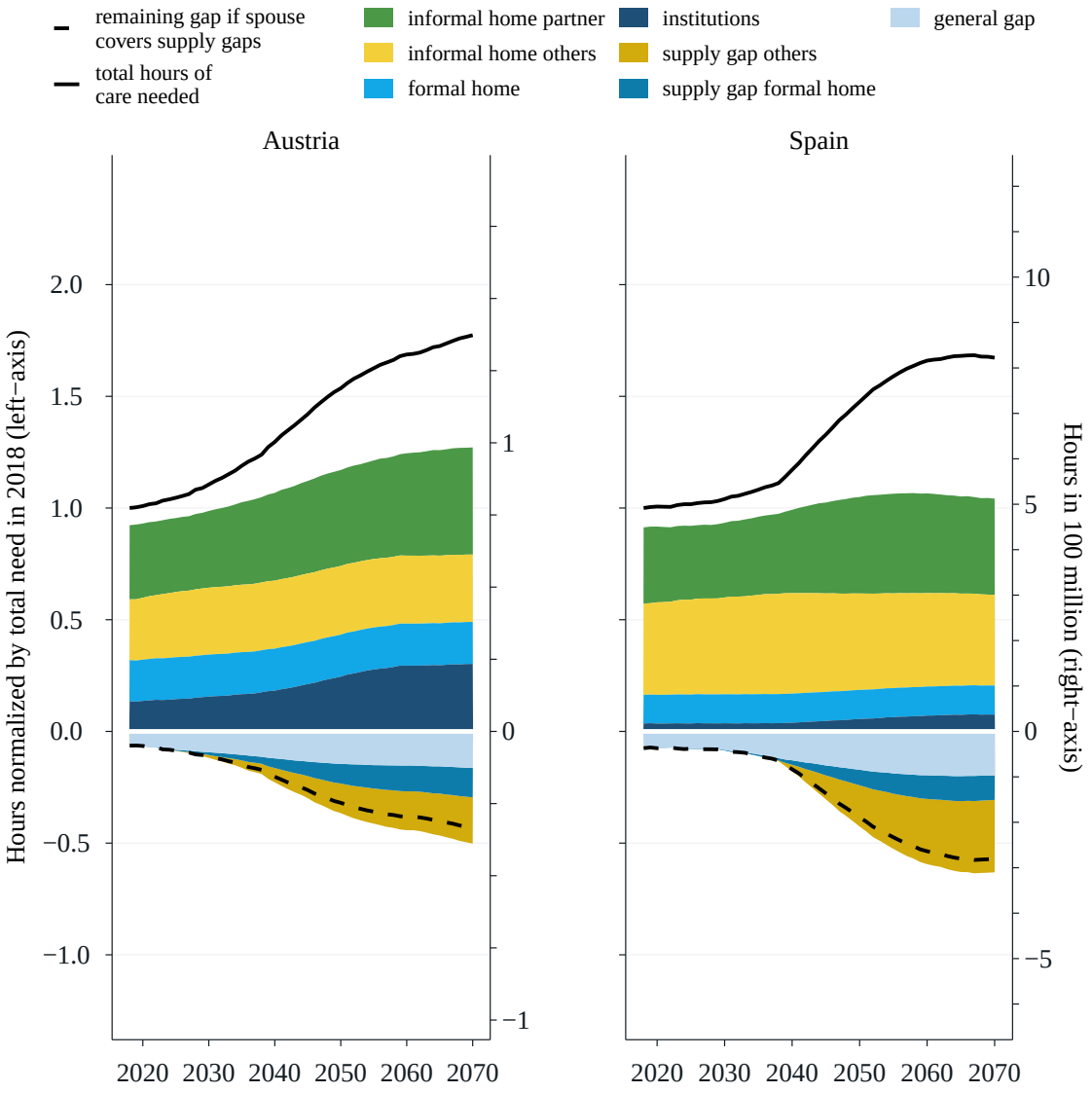


Figure 40: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 10.

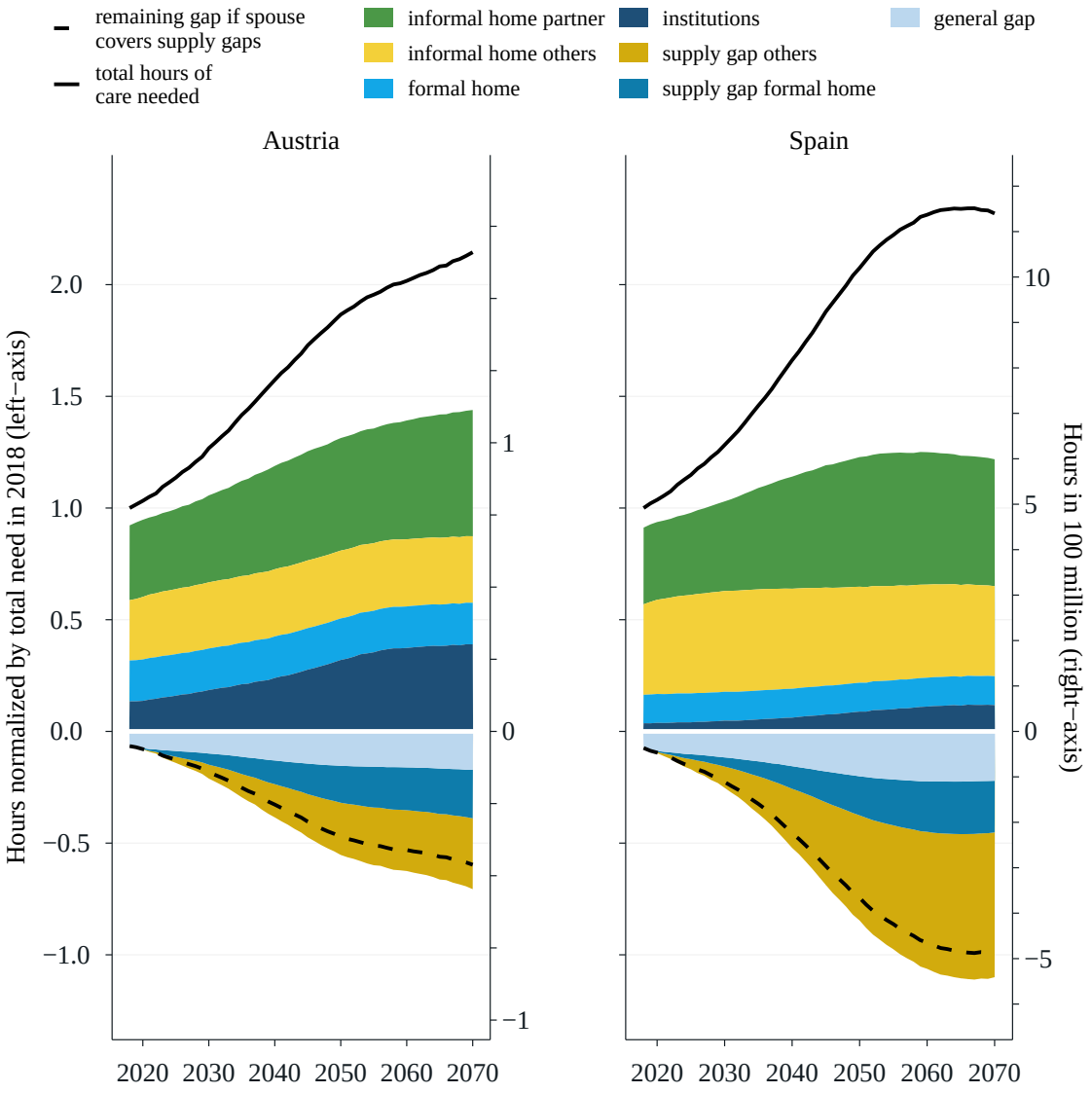


Figure 41: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 11.

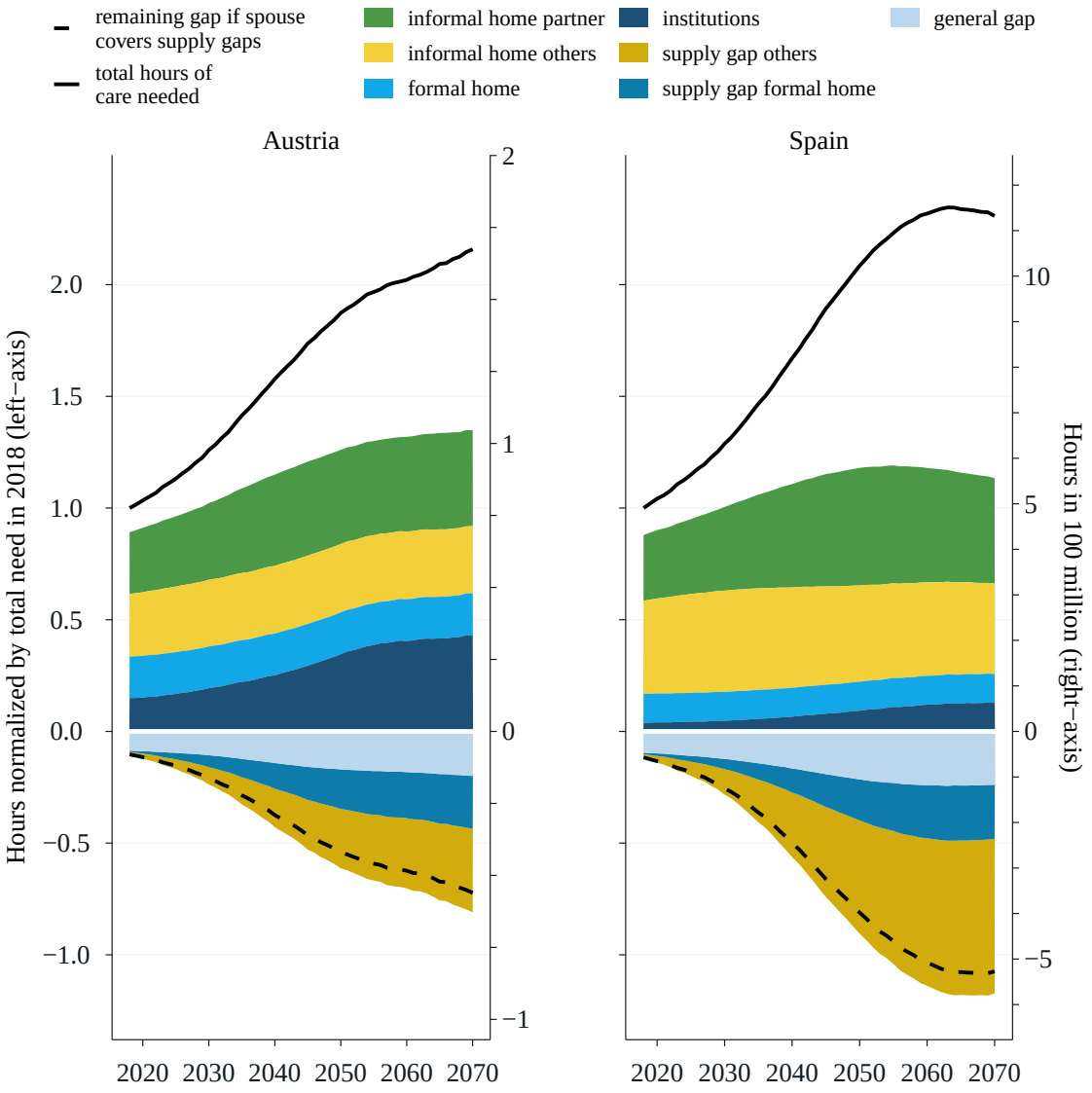


Figure 42: Projected changes in hours of care needed and the care mix received in Austria and Spain relative to the base year 2018. Scenario 12.

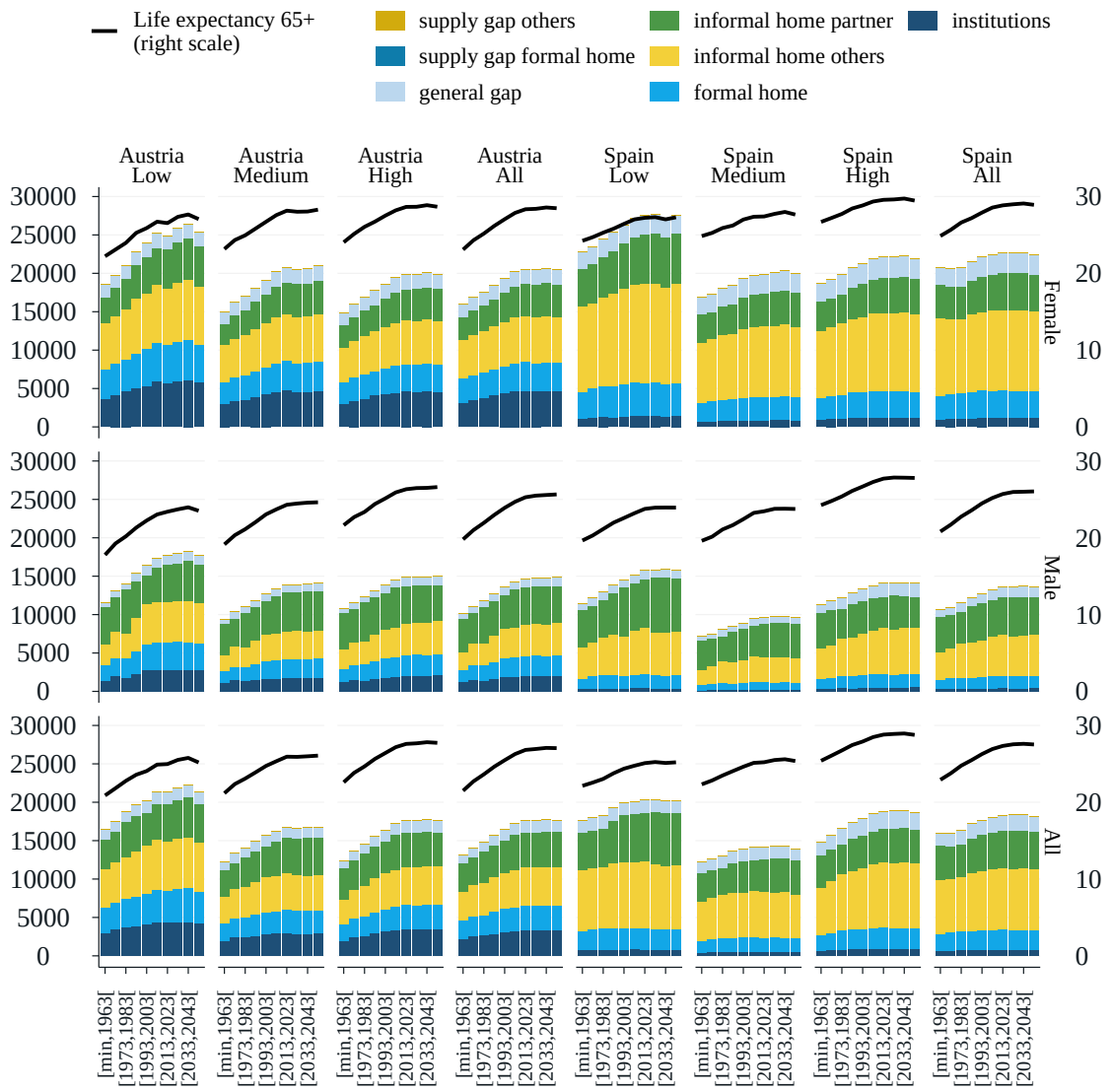


Figure 43: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 0.

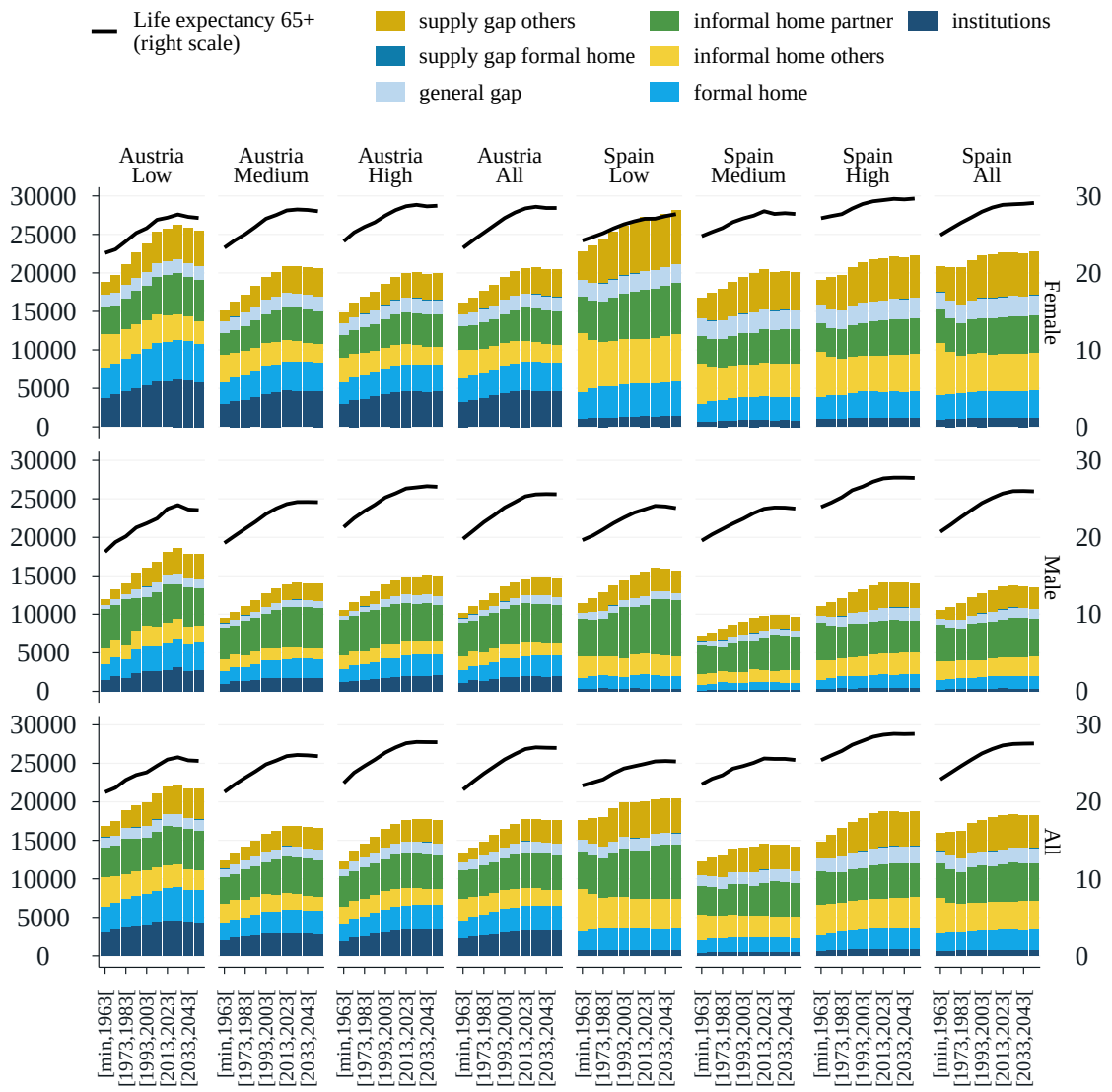


Figure 44: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 1.

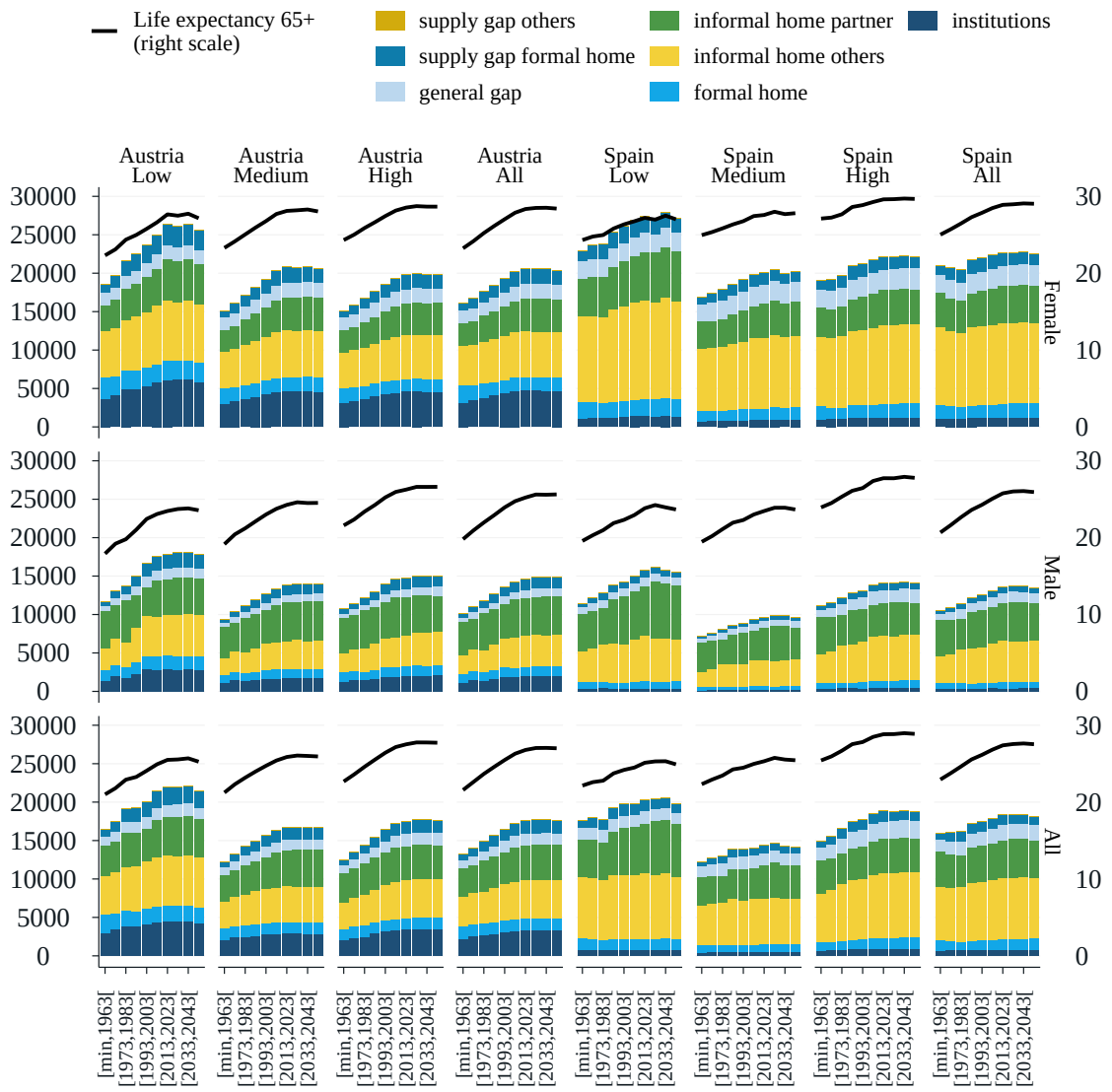


Figure 45: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 2.

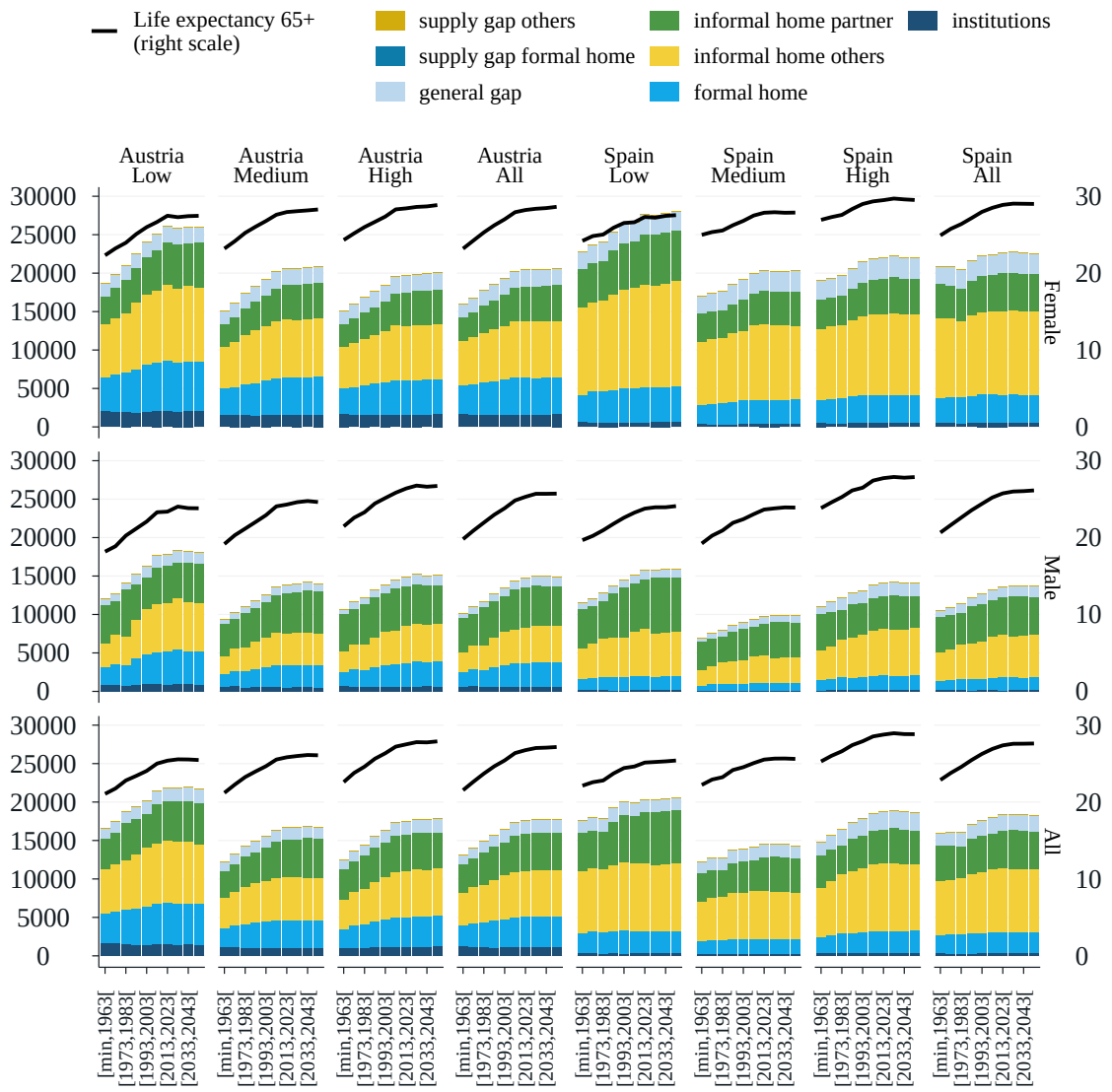


Figure 46: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 3.

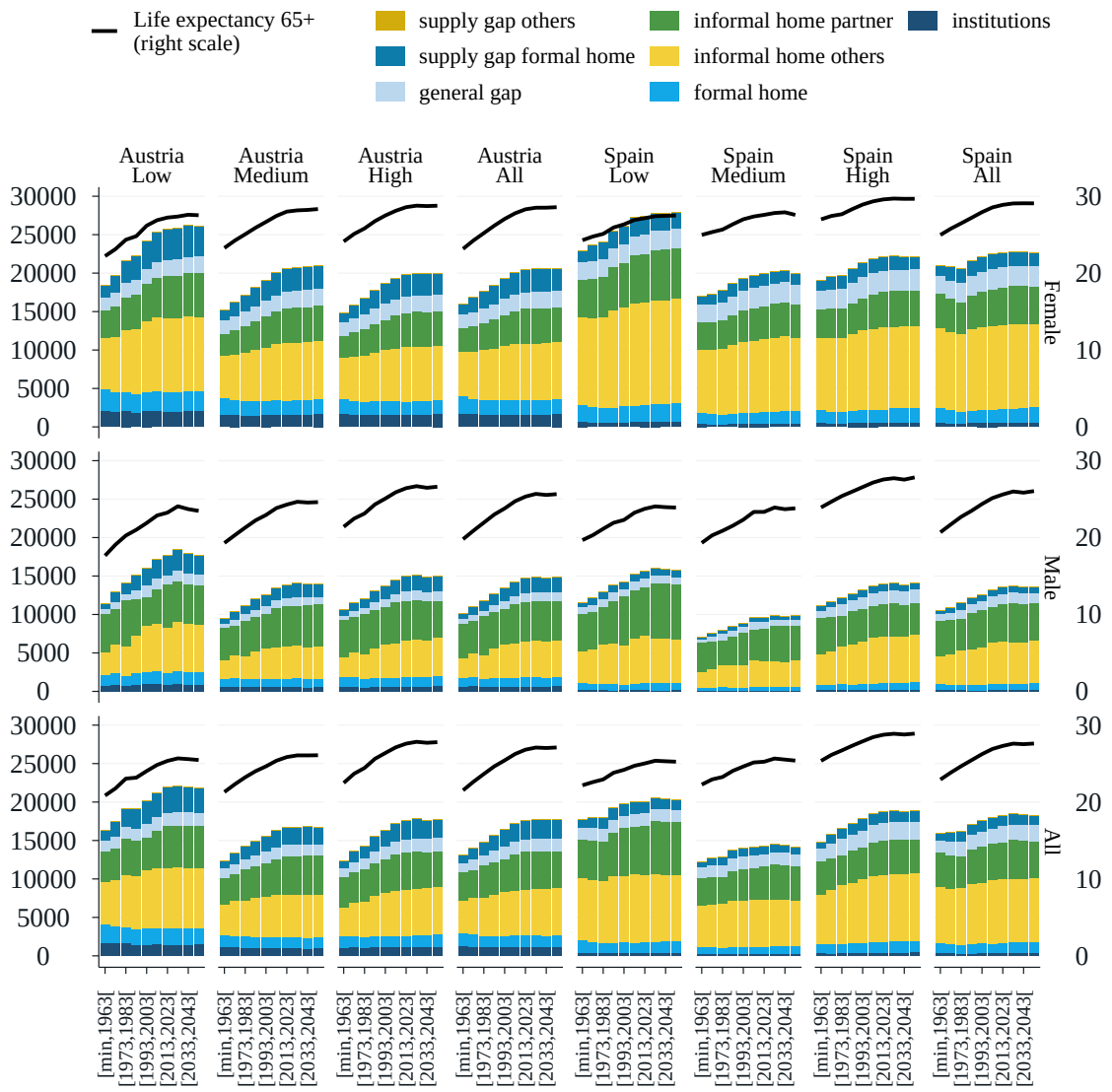


Figure 47: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 4.

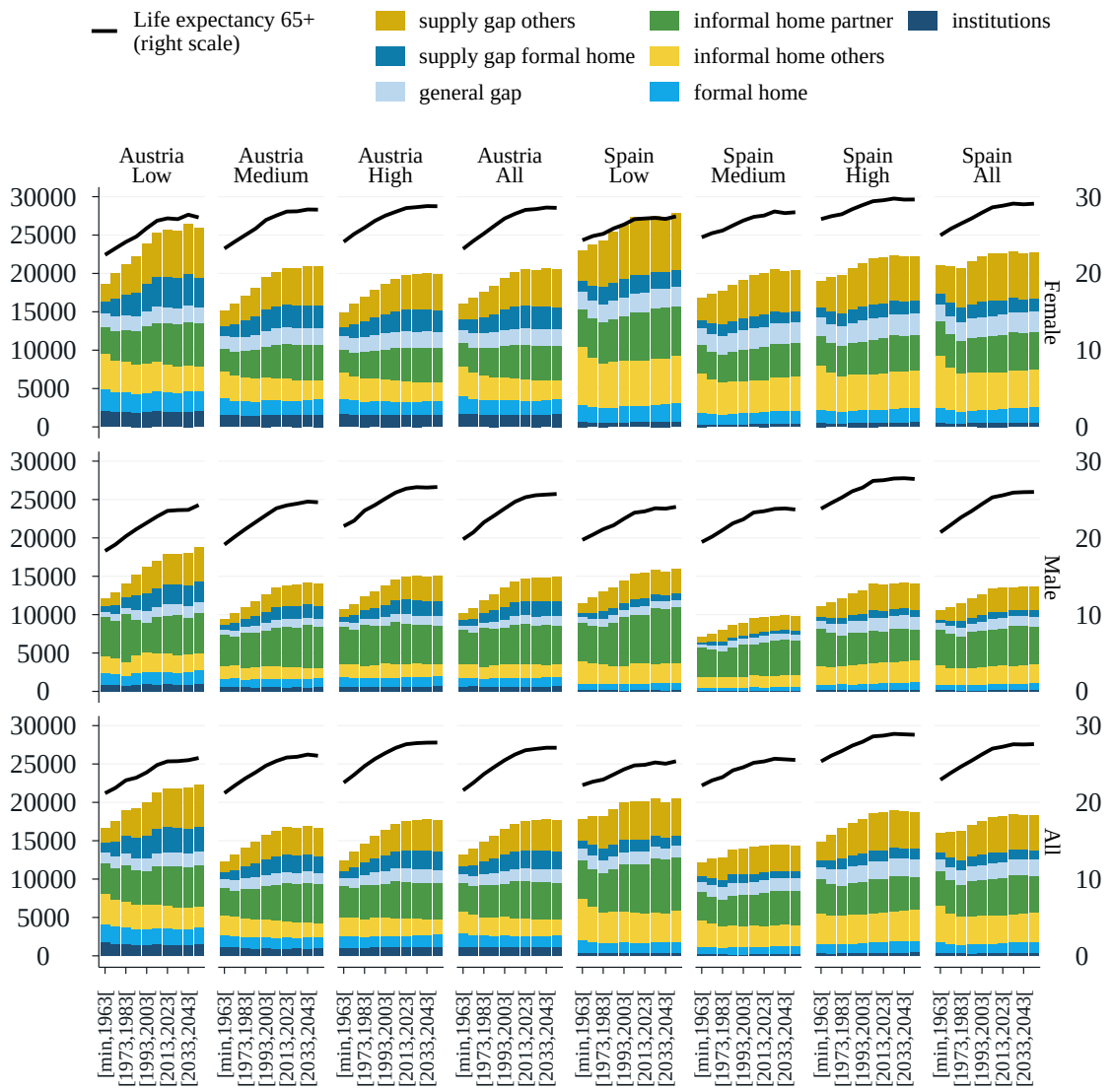


Figure 48: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 5.

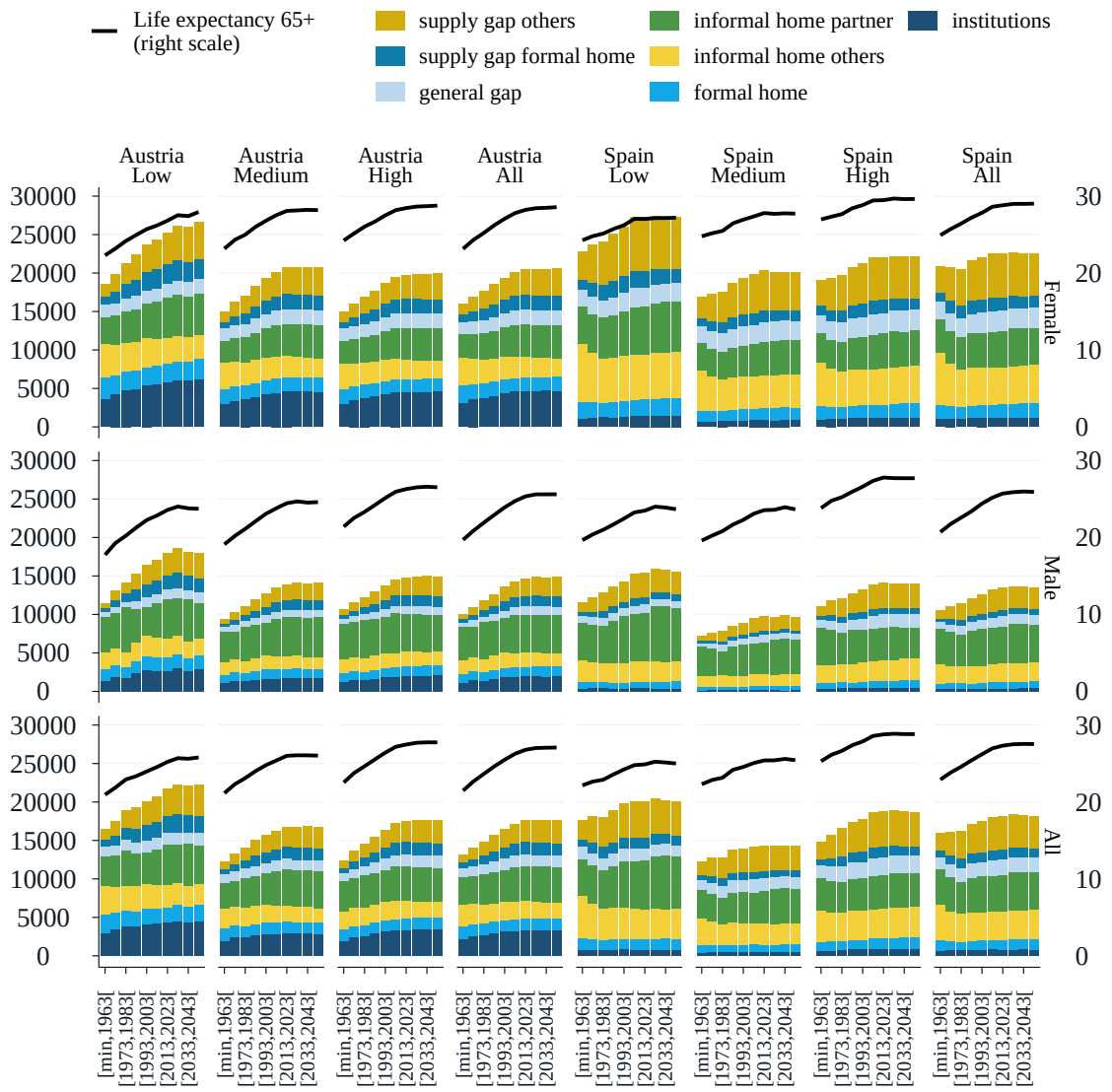


Figure 49: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 6.

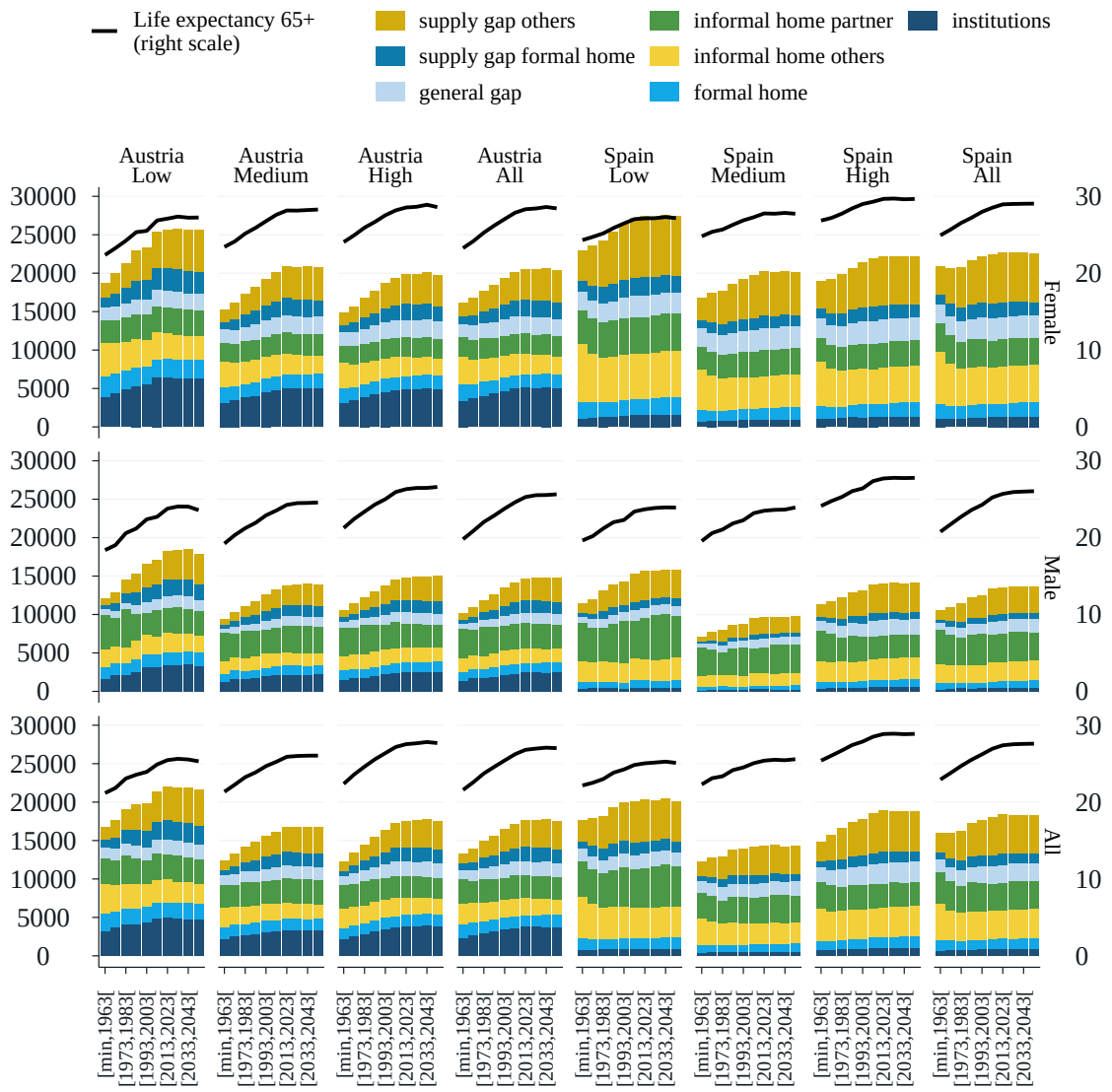


Figure 50: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 7.

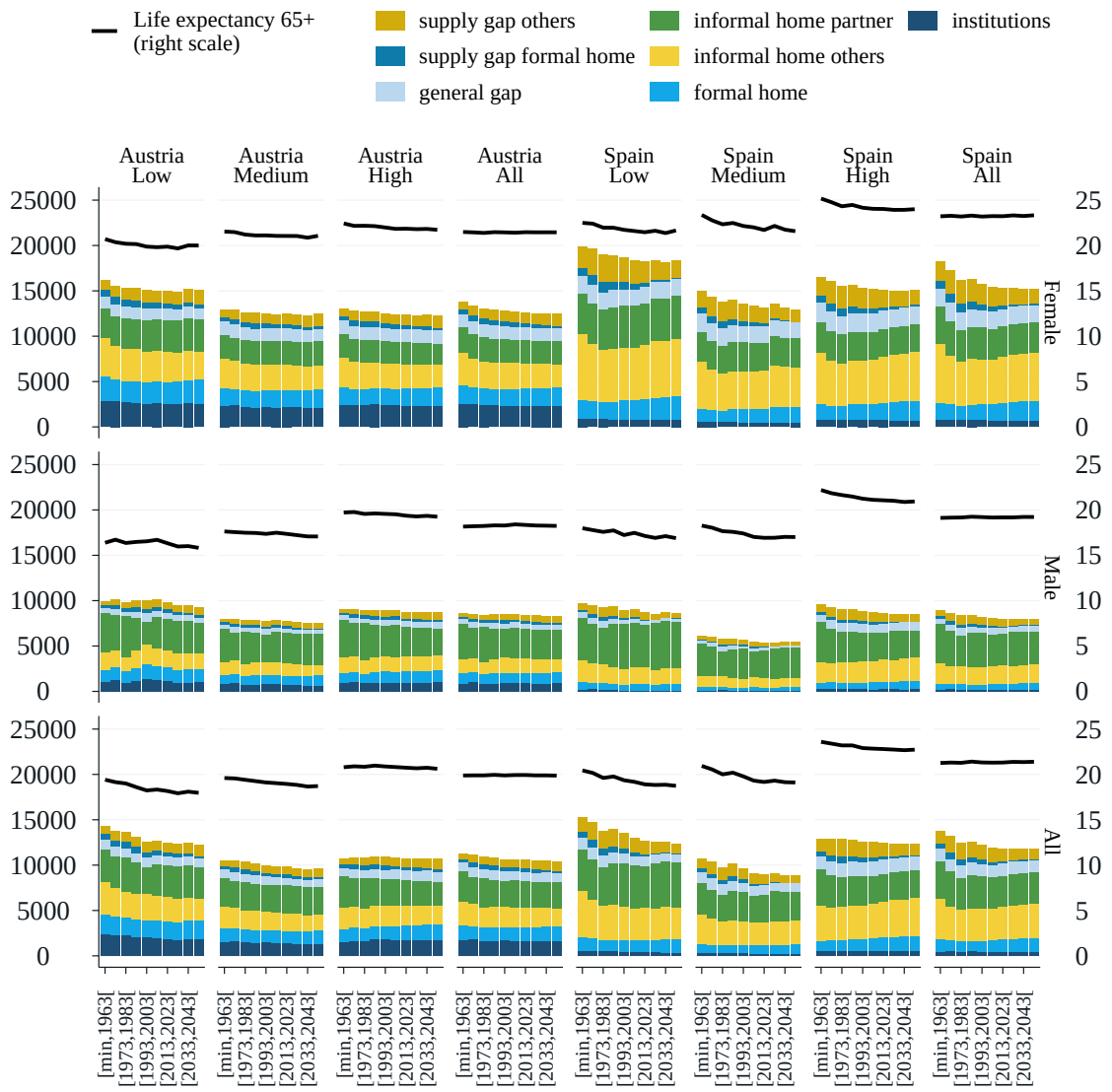


Figure 51: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 8.

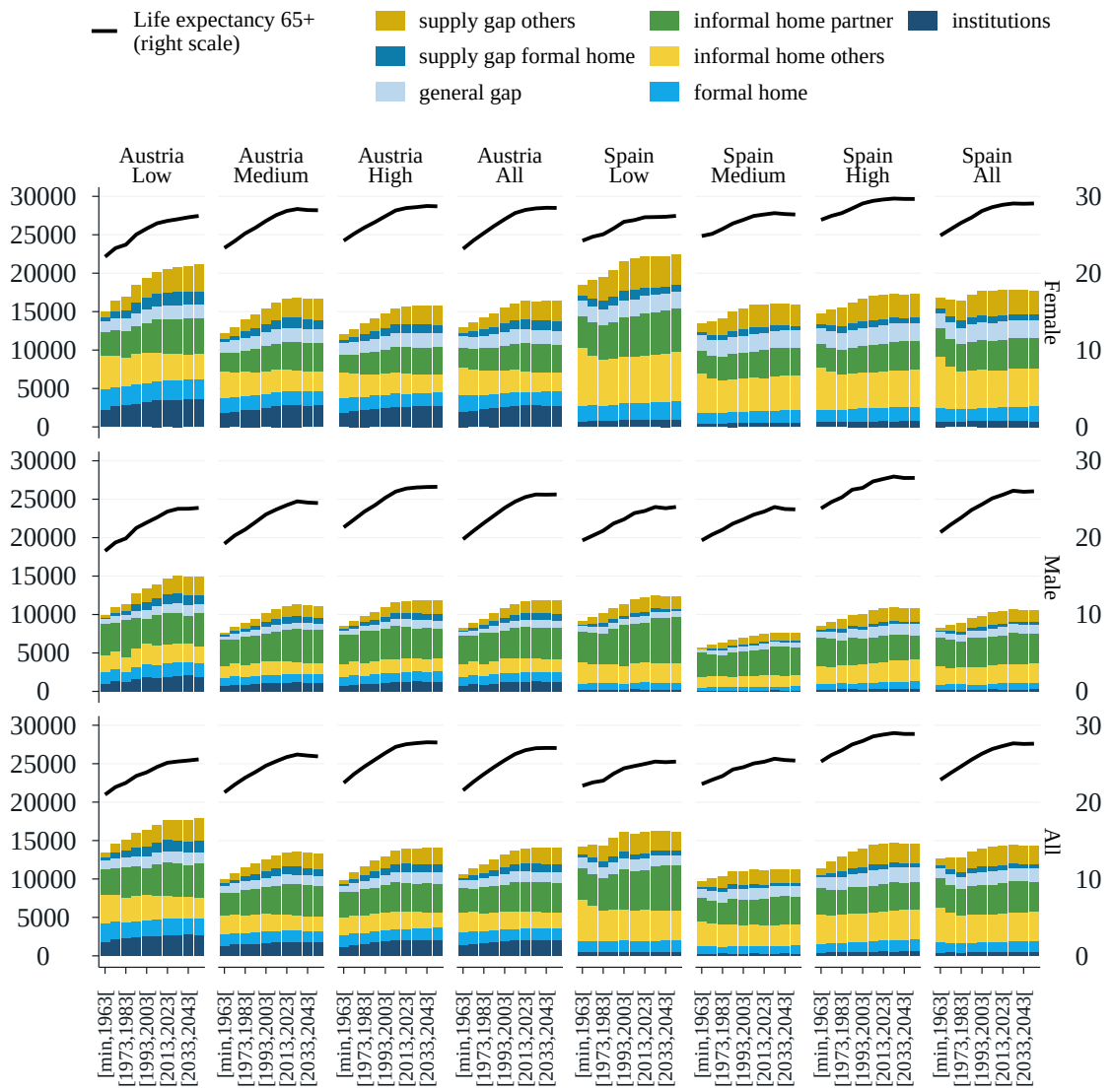


Figure 52: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 9.

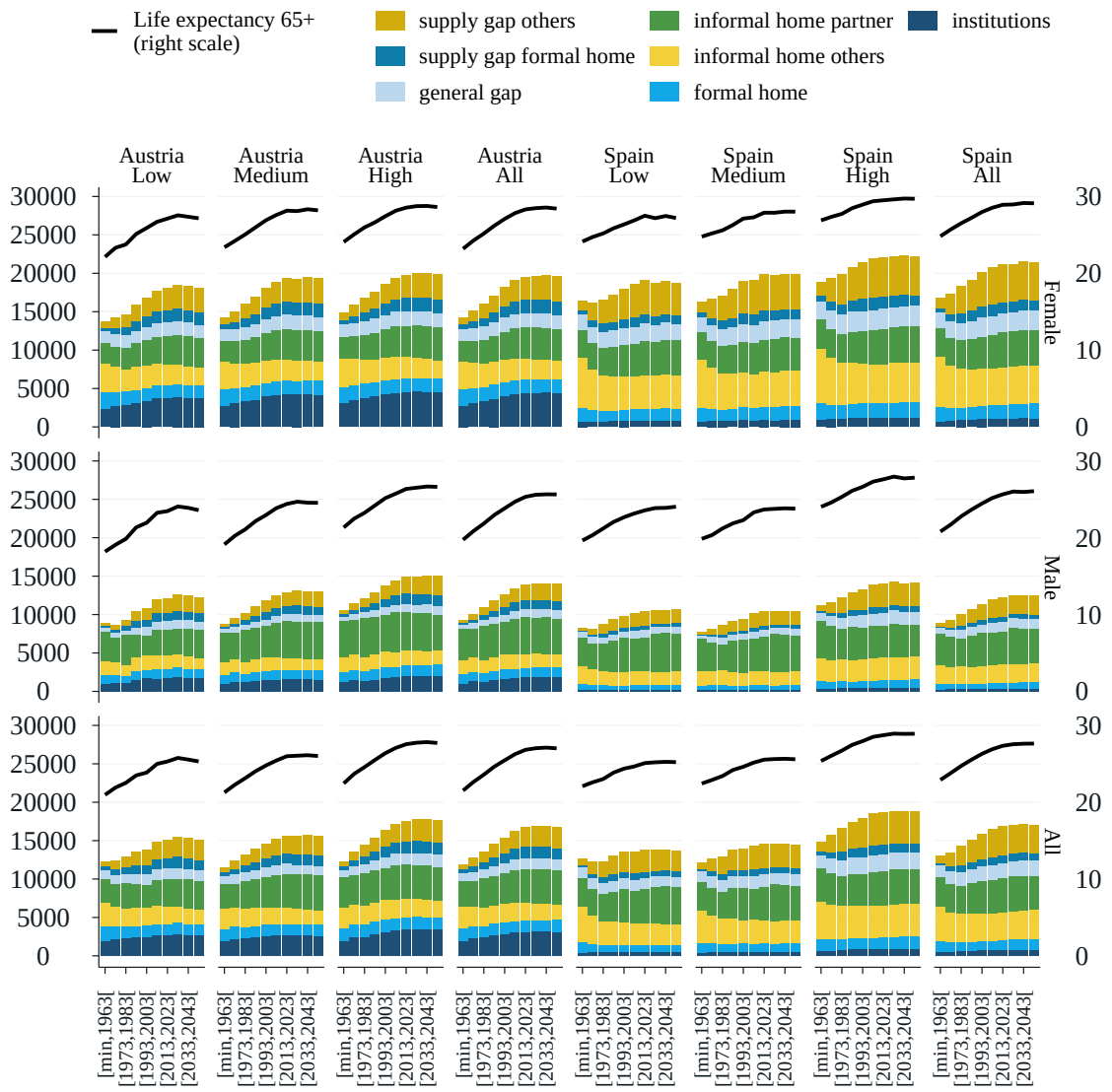


Figure 53: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 10.

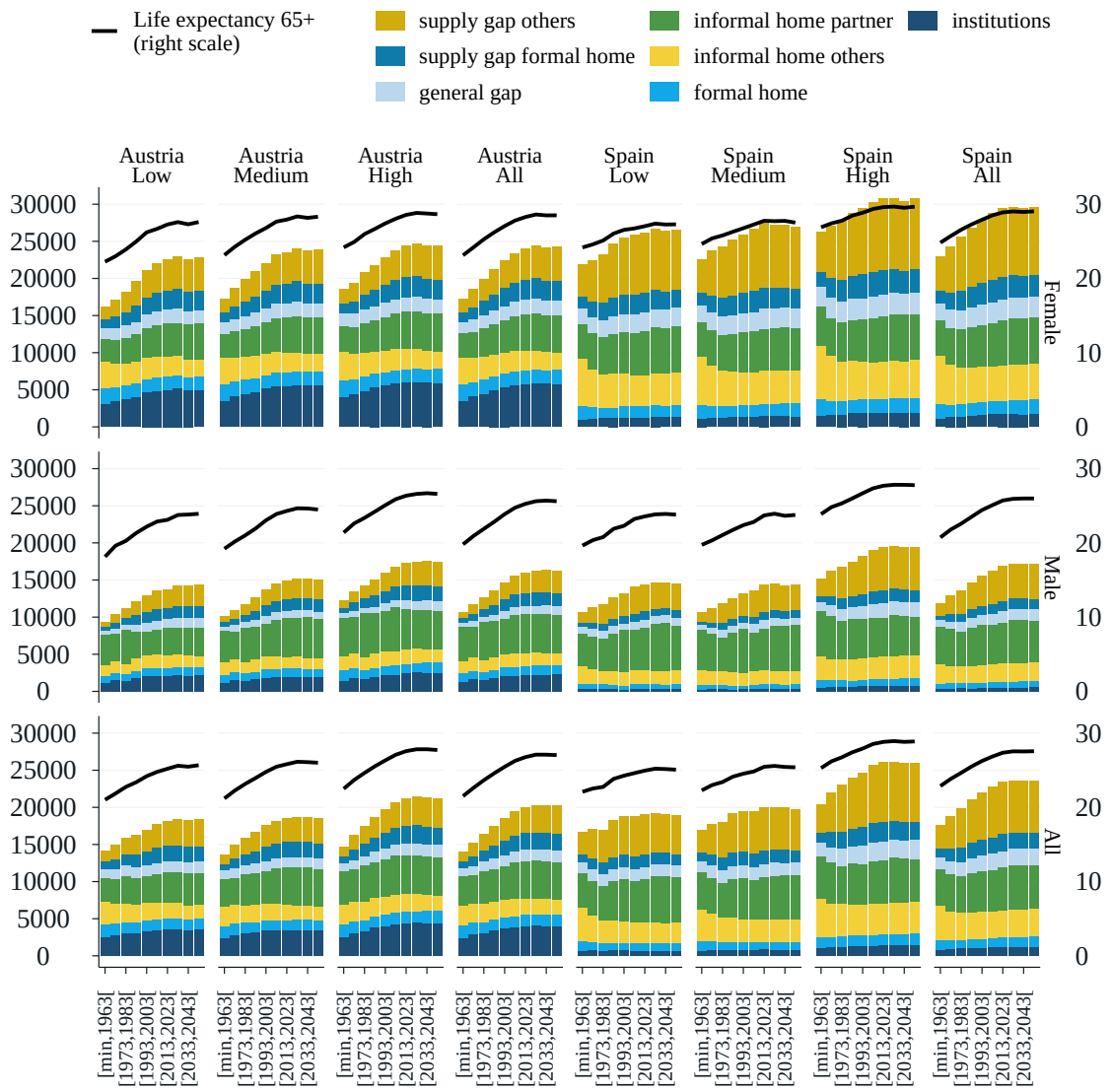


Figure 54: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 11.

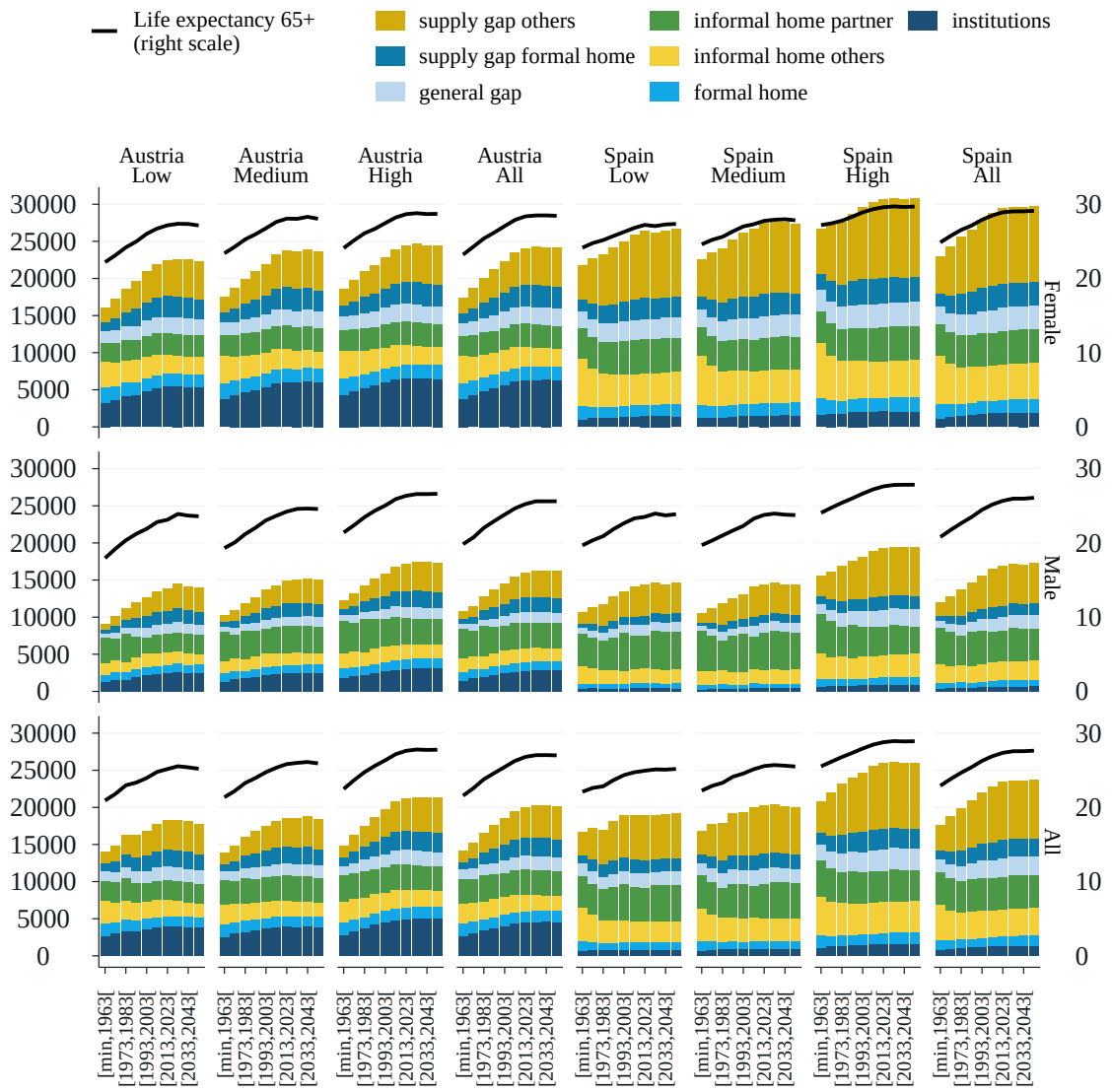


Figure 55: Projected lifetime hours of care needed and the care mix by cohort, sex and education in Austria and Spain (left scale). The graph also shows the life expectancy at age 65 by cohort, sex, education and country (right scale). Scenario 12.