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Modelling and Forecasting Changes in the Cost of Long-Term Care

A Critical Inventory and a Case Study for Austria

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Content

1. Projecting the Cost of Population Ageing

The marked and continuous increase in life expectancy is a major driving force of population ageing in all industrialized countries. At the same time, recent evidence for Europe from the Lancet study (see Jagger/Gillies et al. 2008) shows that a significant share of the remaining life years from the age of 50 is likely to be troubled by health problems and functional limitations. These developments raise questions about the sustainability of pension, health and long-term care systems in the EU and other OECD countries. Projections of costs and revenues are an important prerequisite for answering such questions. While there are common issues for projections in general such as balancing the projection's time frame, level of detail and accuracy, projections for specific branches of social security are characterized by idiosyncratic challenges. In the area of long-term care, four major issues deserve close inspection, namely (i) whether to assume an increase or decrease in morbidity, (ii) the role of technology and the productivity gap in the care sector (iii) the various types of future care defined along the lines institutional/non-institutional care and formal/ informal care and, last but not least (iv) regional heterogeneity in ageing and long-term care policies.

Against this backdrop, this paper discusses the state of the art in long-term care cost projections and presents findings from such projections for Europe. More specifically, in presenting a macrosimulation for Austria as an illustration, it sets out to demonstrate the added value of regional disaggregation in projecting the future costs of care in ageing societies.

Austria makes an interesting study case for several reasons. To begin with, Austria is aging quite rapidly. According to projections by the United Nations Population Division (2002), the median age in Austria will increase from 38 in 2002 to 54 in 2050, drawing level to Japan by this time. Secondly, the country is among the few which has introduced a universal system of care allowances, going well beyond social assistance payments. Other countries are still considering the introduction of well-defined long-term care policies – a choice that can be informed by the Austrian experience. Thirdly, Austria is a show-case for sub-national policy variation. One may well ask to what extent provincial responsibilities in providing for service-infrastructures counteract efforts to guarantee an equitable access to services and whether differences in population ageing might finally create a need (and pressure) for policy convergence. Accounting for sub-national differences in service systems also presents a technical challenge in projecting the cost of long-term care. These issues concerning sub-national policy variation are certainly of interest to researchers and politicians in other de-federalized settings.

The following discussion is structured as follows: Section two summarizes the state-of the art in long-term care cost projections, emphasizing the European context. Section three presents the projection model Section four provides some background on the long-term care system and findings for Austria. Section five concludes with a summary of key findings and a brief policy discussion.

2. State of the Art in Long-Term Care Projections

A number of previous studies have investigated future trends in costs of long-term care (hereafter referred to as LTC). From a theoretical point of view macro and microsimulation models are the most common methods used in this field of research.

The main idea of microsimulation models is to analyze the behavior of a system by using characteristics of micro units. Within these models each individual evaluates his or her environment, reacts to it and thereby changes the environment by his or her behavior, which is a function of individual, household or socioeconomic characteristics. (see Spielauer 2001) One can distinguish data-based and agent-based models or static and dynamic models. In context with policy recommendations data-based dynamic models seem to be an adequate toolkit as they allow forecasting the effects of alternative policies using socio-demographic data. In general microsimulation models have the advantage to control for more variables than macroeconomic models and to avoid bias caused by aggregation. On the other hand implementing such models is very time-consuming and cost-intensive. The need of high data quality is an additional drawback. (see Spielauer 2001)

By contrast, macrosimulation models start at the level of aggregated units, which are grouped by common characteristics. In most cases the variable of interest is linked to other aggregated variables, which exhibit explanatory power to it and are suited to illustrate the model's underlying environment. Again static models can be distinguished from dynamic ones, where dynamic models are able to account for endogenously defined trends or shocks. Compared to microsimulation models they have the advantage that they are easier to implement and do not necessarily need that highly structured data. However, their results are based on rigorous assumptions which standardize individual behavior and they are unable to consider complex interactions. Younger empirical work tries to overcome the drawbacks by integrating elements of micro level research into macrosimulation under the synonym micro-macrosimulations. (see Zuttion/Di Bidino et al. 2004)

In this line of research the work of the Personal Social Service Research Unit (see Comas-Herrera/Costa-Font et al. 2003) can be identified as a milestone. It consists of four cell-based macrosimulation models that are used to project until the year 2050 the long-term care expenses of the United Kingdom, Germany, Italy and Spain under the same basic assumptions and methods. Although there are static elements (prevalence rates) the model can be classified as dynamic macrosimulation determining future trends in variables endogenously by applying existing projections or assessing scenarios. However, cross-national differences in service provision, in the quality of data and in the definition of relevant variables (e.g. dependency) limit comparability of the results for the four countries under study.

This macrosimulation approach was complemented by the dynamic data-based microsimulation model CARESIM, projecting the costs and distributional effects of alternative funding regimes for long-term care in the UK up to 2050. (see Hancock/Wittenberg et al. 2007) In order to account for the socio-economic background (housing tenure, income, marital status) the British Family Resources Survey was grossed up with data concerning the future number of dependent elderly persons and their care arrangements taken out of the PSSRU projection. Thereafter varying funding and charging systems were modelled reducing the assets and incomes of persons receiving services in different ways. Finally the individuals were grouped by age, income quintiles and by whether they pay LTC privately or receive (some amount of) public support in order to detect distributional effects.

The last section of the PSSRU model raises the question whether the projected future demand for informal care could be met by the future supply. (see Pickard 2008) In this case GHS[1] data from 1985 to 2000 was used to capture the trends in the probability of providing informal care for 20 hours a week or more. A logistical regression confirmed that there is no correlation between providing informal care and socio-economic factors. In addition no significant changes in the probability of providing informal care for 20 hours or more could be identified in cases where LTC is given by children of the person. Holding this probability constant and linking it with demographic developments up to the year 2041, the number of elderly people in need of informal care in the UK was found to increase by 90% while the number of potential care-givers only rose by 27.5%.

The EU Commission's "Ageing Report" focused on LTC costs of the EU 27 countries. (see European Commission 2009) Again a macrosimulation model was used. The Ageing report is the first country comparative study that projects the costs under standardized data sources

[1] General Household Survey

(EUROSTAT and SHARE) and terminology. Yet, most of the variables that influence LTC costs (like prevalence rates, proportion of people receiving services, unit costs) are set to their 2008 values whereby the model becomes very static.

A slightly different approach compared to the studies discussed before, especially regarding econometric methods that have been used, was introduced by Badelt et al. (1995) in a projection of LTC for Austria. Based on the ADL concept he grouped older dependent persons by the level of care dependency into three categories and projected the number of older dependent persons until 2030. To this end a hierarchial cluster analysis was employed, based on the data of 119 dependent persons. The supply side was captured via empirically regressed cost functions of care arrangements that were typical for frail older persons with a level one, two or three care dependency. In addition three scenarios reflect possible trends in morbidity and in the expansion of LTC services. Despite the implementation of innovative concepts and methods, the small samples (five service providers and 119 dependent persons) that were used to obtain the empirical parameters for the projection reduce the representativeness of the results.

In the Austrian context LTC costs were also analyzed by Streissler (2004) and Mühlberger et al. (2008) within a macrosimulation model. The first approach used a demographic projection, constant prevalence rates of care dependency and average unit costs for LTC services. In contrast to most of the other projections the costs of informal care were estimated by an opportunity cost calculation based on a wage rate of € 9.33 per hour. In addition, Streissler assumed that 80% of dependent elderly people in private households received informal care, which is in line with findings from Badelt (1995) and recent evidence from the “österr. Gesundheitsbefragung 2006/07” (Austrian Health Survey) (see Klimont /Kytir et al. 2007). Mühlberger et al. started her macrosimulation approach with an estimate of the present LTC costs on the provincial level. As a next step future trends regarding to key variables (future number of dependent persons, trends in informal care, morbidity) were projected or fixed by constructing scenarios. The percent changes of these scenarios were then combined into a worst case, a base line and a best case with a total growth rate for each of them. These three growth rates build the basis to calculate the future costs. The results of the two analyses underline the argument of high sensitivity of findings with regard to underlying assumptions or data. While the model of Streissler yields a growth in LTC costs of 185.36% (or 109.85% excluding informal care) under a base line scenario, Mühlberger et al. suggest 160%.

3. Forecast of the Long-Term Costs in Austria

3.1. Long-Term Care in Austria

In Austria, long-term care is still considered a primary responsibility of families. About 80% of older dependent persons receive help from family members or their extended social network(see Klimont /Kytir et al. 2007). In the majority of cases, the care arrangements do not even involve any care professional or support service. However, the country has taken major steps in offering public support to persons in need of long-term care and their families (see Federal Ministry of Social Affairs and Consumer Protection 2007):

In 1993 a law was passed which introduced a universal tax-funded care allowance system. This system grants universal (non-means tested) benefits to person who need at least 50 hours of care per month. Benefits are scale-graded, starting with a monthly allowance of € 154 for the lowest level of care need and reaching about € 1.655 for those in the highest (seventh) category of need. Those in need round-the-clock care, are eligible for another benefit, which was introduced in 2008 in order deal with the growing number of illegal care workers in the country. They receive up to € 1.100 if they decide to employ a care worker and up to € 550 if a (freelance) care worker delivers services on the basis of a contract for work and labour. In addition to care allowances, long-term care policies also concern access to professional long-term care services, quality-of-care regulation and information and referral services.

Responsibilities of public authorities for long-term care have been established on the federal and the provincial level. Most importantly, the provinces are in charge of securing access to long-term care services, which is achieved in a variety of ways including government aids to nursing homes or contracts with providers of home care services(see Trukeschitz/Buchinger 2007). There are nine provincial long-term care laws, indicating the importance of sub-national players in that Austrian long-term care policy. The cost projection for long-term care in Austria to be presented in the following sections accounts for this political context. A major part of the data for the projection has been collected on the provincial level. Also, we conducted separate projections for each Austrian province that were merged in the end to deliver results for the entire country.

3.2. Conceptual Framework, Limitations and Methodological Novelties

In order to forecast the full costs of long-term care to elderly dependent persons for Austria up to the year 2030 we developed a macrosimulation model, which follows the UK Personal Social Services Research Unit's LTC projection model (see Comas-Herrera/Costa-Font et al. 2003) To this end a dynamic macrosimulation model is employed. In this model trends in relevant variables can be modelled endogenously, analyzing quantitative and qualitative data. Following the Austrian legal framework, our model is disaggregated to the level of the nine provinces. This approach allows controlling for differing regional trends in morbidity, in the present and future availability of long-term care services and in the unit costs of the various services. For each of the Austrian provinces, the forecast of long-term care costs is divided into three parts. The first step is to forecast the number of elderly people over 65 years in need of long-term care, accounting for demographic trends, the household context of older people and the age-specific prevalence of long-term care dependency. In a second step we explore regional differences and future trends in the provision and unit costs of long term care services. Finally, supply and demand will be combined and the full costs of long-term care will be calculated and forecasted as the sum of nine individual evaluations.

In the projection dependency is defined following the eligibility rules for the Austrian care allowance (*Pflegegeld*), which implies that we focus on person in need of at least 50 monthly hours of care. Since we are interested in the future cost of LTC we focus on care allowance beneficiaries aged 65 and older. The forecast of the number of dependent elderly people is based on three key variables: demographic changes of the age cohort 65+, beneficiaries's living arrangements and the probability of becoming dependent on care. As a data basis we use the population forecast of the National Statistic Agency (see Statistik Austria 2007), micro (from 2004 to 2007) and population census (1981, 1991 and 2001) data, the household projection of Statistik Austria and statistics regarding the number of persons receiving the federal care allowance (*Bundespflegegeld*) from 1996 to 2007 provided by the Association of Austrian Social Insurance Providers ("Hauptverband der österreichischen Sozialversicherungsträger")

Initially, the projection was reduced to persons aged 65+ and disaggregated by federal state, gender and five years age groups. Thereafter five relevant household types (living arrangements) were defined and the distribution of the older people during the last 25 years concerning these household types was estimated. Using alteration rates, the trends in living arrangements over this time period were identified and extrapolated into the future. Furthermore seven prevalence rates were constructed for each federal state indicating the

different levels of dependency. The constructed 63 time series were forecast via Double Exponential Smoothing for each federal state and year. Regarding morbidity, it is assumed, that a rise in life expectancy of one year delays the prevalence of being dependent by one year.

As a result of this step in the analysis we obtained for each federal state and year the future number of dependent elderly people categorized by gender (*i*), five year age groups (*j*), the level of dependency (*k*) and household type *(h*) until the year 2030, which is displayed in matrix A (1).

$$(1)\ A_{j(hik)}$$

The second part of the forecast starts with an investigation of regional differences in the provision of long-term care services, their respective unit costs and projected developments in service supply. To this end we analyzed information material and appraisements from experts of the nine federal governments. The information concerning the regional availability of LTC services is combined with the forecasted number of dependent elderly people in order to obtain the probability of receiving LTC services. In the absence of adequate data, our model does not include costs of informal care.

The information about regional services and their unit costs are transformed into the price matrix P illustrating the price of service d. (see (2)) and the matrix S (4) which indicates the probability of receiving service D from a person living in household type h with the dependency level k.

$$(2)\ P_d = diag\ (p_d)$$

The last part of the forecast defines general conditions regarding changes in unit costs, trends in informal care and possible policy changes belonging to the provision of services. Furthermore, the LTC costs of the nine provinces were calculated by connecting the matrices of the future number of elderly dependent people (see (3)) with the probability of receiving LTC services (see (4)) and the matrices of services and unit costs (see (5) and (6)). The model allows dividing the aggregate of LTC costs into the costs of the different services and additionally separating building costs, which were calculated separately from running costs.

$$(3)\ \vec{a} = \sum_i \sum_j A_{j(hik)}$$

$$(4)\ E_{(hk),d} = diag(\overrightarrow{a})S_{(hk),d}$$

$$(5) C_{d,(hk)} = E'_{(hk),d} P^d$$

$$(6) \vec{c} = \sum_{hk} C_{d,(hk)}$$

4. Results

4.1. Forecast of the Number of Dependent Elderly People

4.1.1. Household Situation

In the base year 2008 1,432,579 persons aged 65+ were living in Austria. Approximately two thirds of them (64.19%; 919,399 persons) shared their household with other people, whilst 31.35% (449,114 persons) were living alone and 4.47% (64.066 persons) stayed in institutions. In the subgroup of persons aged 65+ in multi-person households the largest part belongs to two-person households with persons aged 65+ (54.30%) followed by mixed multi-person households (households constituted by persons under and over 65 years) with 29.09% of the Austrian population aged 65+, age-mixed couple households (one person over and one person under 65 years) with 15.71% and multi-person-households with persons aged 65+ with 0.9% (8.310 persons).

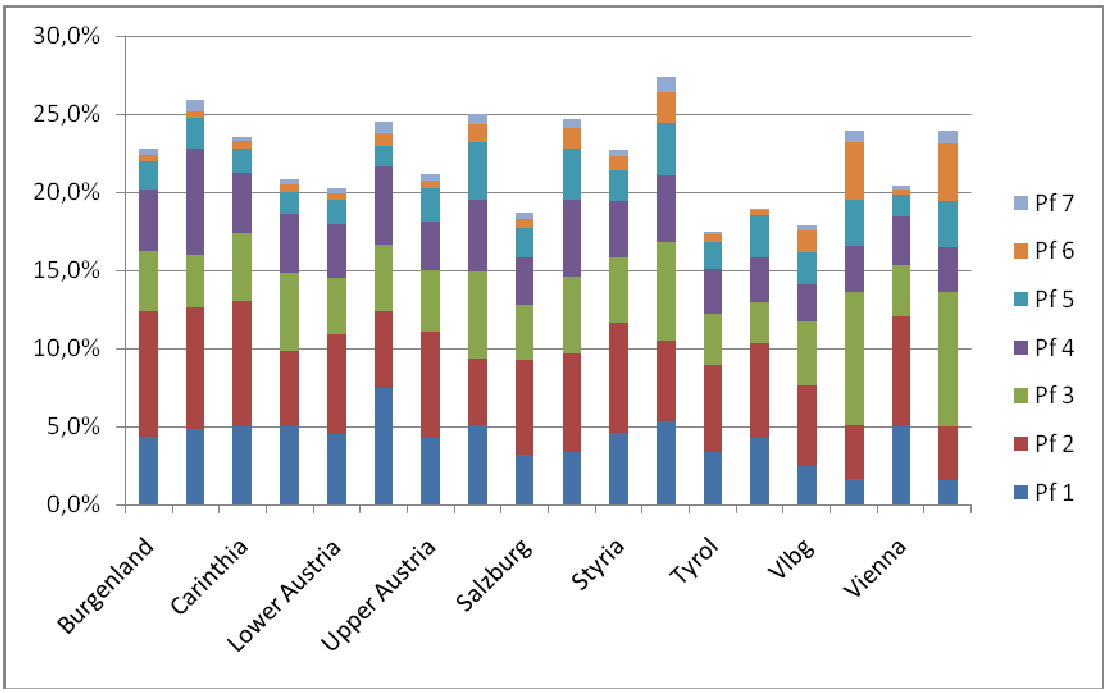
By 2030, no significant changes in the primer distribution was evident, meaning that the share of multi-person-households increases by 0.72% to 64.90% (1.396.289 persons), while proportions of persons in institutions and one-person households decrease by 0.52% to 3.95% and 0.2% to 31.15%. Contrary significant changes can be identified within the subgroup of multi-person households. Here we see a clear shift from age-mixed household arrangements to multi-person households with persons aged 65+. More specifically, the shares of persons in couple-households with persons aged 65+ and multi-person households rise by approximately 11% to 65.63% and 0.46% to 1.36, while age-mixed-more-person households and age-mixed-couple households decrease by 7.27% to 21.82% and 4.51% to 11.19%.

On the regional level the proportion of people aged 65+ in multi-person households vary between 56.51% (Vienna) and 68.12% (Burgenland), the share of single households covers the range from 27.70% (Burgenland) to 38.10% (Vienna) and the fraction of persons in institutions lies between 3.01% (Carinthia) and 5.80% (Salzburg). Only slight changes emerge until the year 2030 regarding a larger multi-person household share between 58.74% (Vienna) and 70.30% (Burgenland) simultaneously reducing single households ranging from 26.30% (Burgenland) and 36.71% (Vienna) and persons in institutions within 2.68% (Carinthia) and 5.46% (Salzburg).

4.1.2. Level of Dependency and Morbidity

As described in section 3.1, dependency is defined according to the seven levels of care needs as defined in the federal care allowance scheme. The share of the dependent elderly population in each of the seven levels of dependency was calculated for the years 1996 to 2007 to form seven dependency-level time series. These time series were forecast employing Double Exponential Smoothing (see Gardner 2006). Finally, the total prevalence of being dependent was then calculated by combining the seven dependency-level shares for each federal state and year. With the exception of Carinthia we find the share of dependent persons in the older population to increase from the base year 2008 to 2030. In the base year the total prevalence of being dependent ranges between 17.5% (Tyrol) and 23.56% (Carinthia). The projected prevalence rates for 2008 and 2030 are displayed in Diagram 1 below. The lowest prevalence of dependency in the age group 65 and older is projected for Tyrol (18.9%) the highest for Styria (27.4%) - a difference of more than 8 percent.

Diagram 1: Prevalence Rates of the Austrian Provinces 2008 and 2030



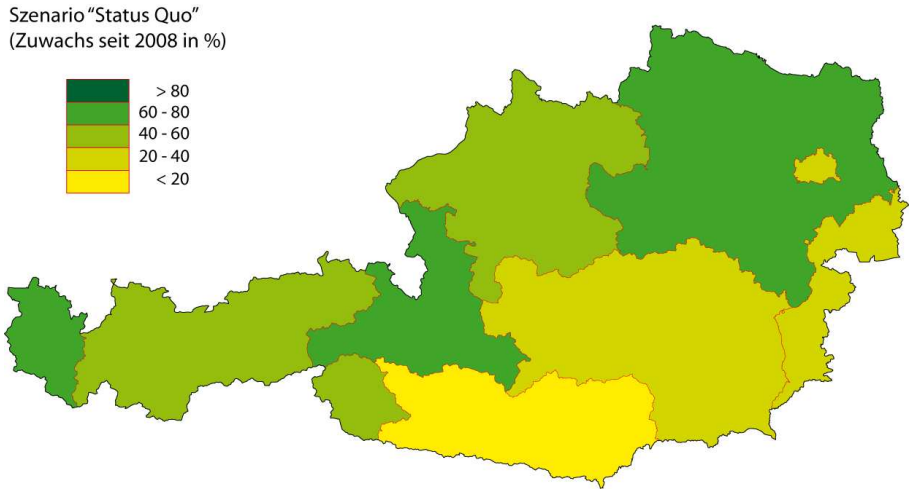
Source: own illustration

In more detail one can also see a decline in the share of dependent older person with a level two care need, which is the need category comprising most older dependent people in 2008 and an increase in the share of dependent older persons with a level-one or level-four degree of care need. Less surprisingly, the share of those with the highest level of dependency (*Pflegestufe 7*) is lowest over the entire period under consideration. .

4.1.3. Total number of Elderly Dependent Persons

The forecast of elderly dependent persons in Austria shows an increase of 43.3% from 297,330 persons in 2008 to 426.053 persons in 2030. Again a considerable variance can be observed on the regional level. The model estimates the highest growth rates in Vorarlberg (99.72%), Salzburg (91.77%) and Upper Austria (63.1%), while the lowest increase exists in Carinthia (15.51%), Vienna (37.96%) and Burgenland (44.52%). Diagram 2 summarizes the regional differences.

Diagram 2: Percentage Increase in the Number of Elderly Dependent Persons between 2008 and 2030 by Province

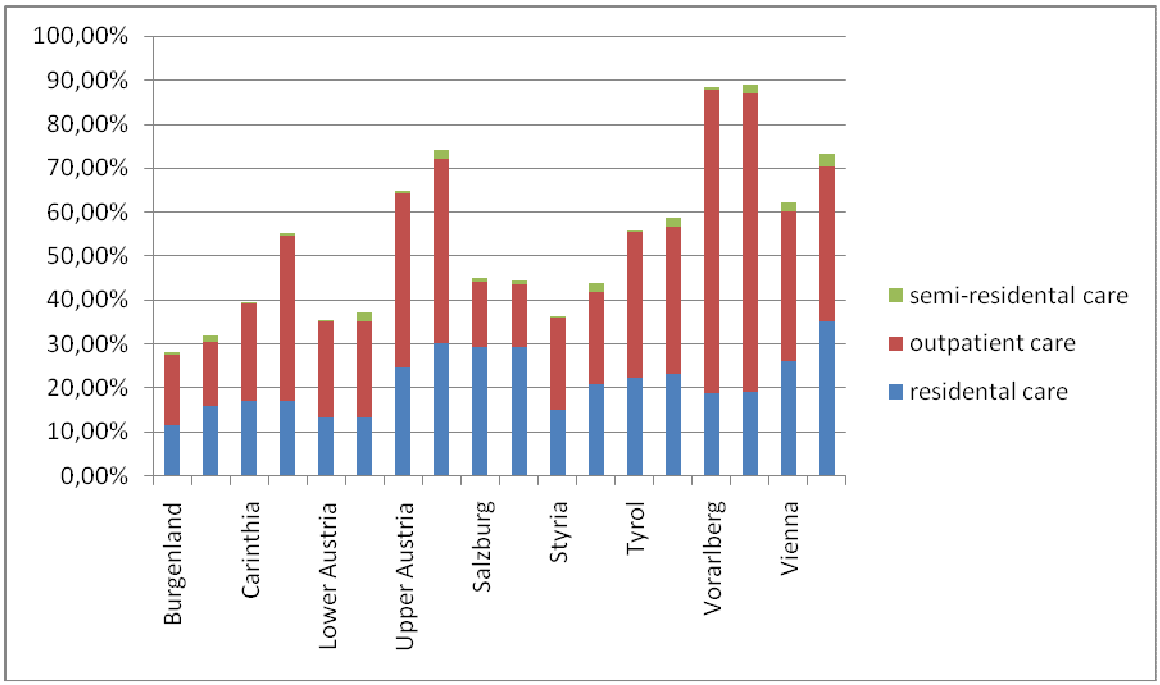


Source: own illustration

4.2. Regional Differences in the Provision of LTC Services and Projected Developments

In the 1990's, the Austrian government and the provinces agreed on common minimum standards and objectives in the provision of LTC services. Furthermore, the regional governments made a commitment to establishing an area-wide and decentralised network of residential, semi-residential and outpatient care. (see Trukeschitz/Buchinger 2007) Within the following 15 years, a wide range of different services emerged, which can be classified into residential care, semi-residential care and outpatient care. The following Diagram 3 displays the share of users of such services in the older dependent population for each of the Austrian provinces in 2008 (first bar) and 2030 (second bar).

Diagram 3: Share of users of LTC services in the older dependent population in 2008 and 2030 by type of service and province



Source: own illustration

In the base year 2008, service use was highest in Vorarlberg where 88.50% of the dependent older people were supported, followed by Upper Austria (64.87%) and Vienna (62.19%). In all three provinces, the majority of those elderly using formal care services opt for outpatient services. Burgenland (28.2%), Lower Austria (35.45%) and Styria (36.21%) display the smallest shares of LTC service users among their older dependent populations. In this context it seems important to stress that a smaller share of users does not point to a shortage in the supply of formal services. The supply of formal services is based on the provinces' social development plans, which are disaggregated to the district level and takes a lot of variables into account, including previous demand, vacant capacities and demographic change.

The projection for the year 2030 is based on development plans and appraisements from local authorities. Considering of the fact that most development plans only cover time periods up to the following five years, the percentage of the last year will be held constant until 2030. In the absence of precise plans in five federal states, it is assumed that semi-stationary services will grow to the extent of 2% per annum by 2030 – a value that comes close to what was reported as expected growth rate for this type of service by the remaining four Austrian provinces.

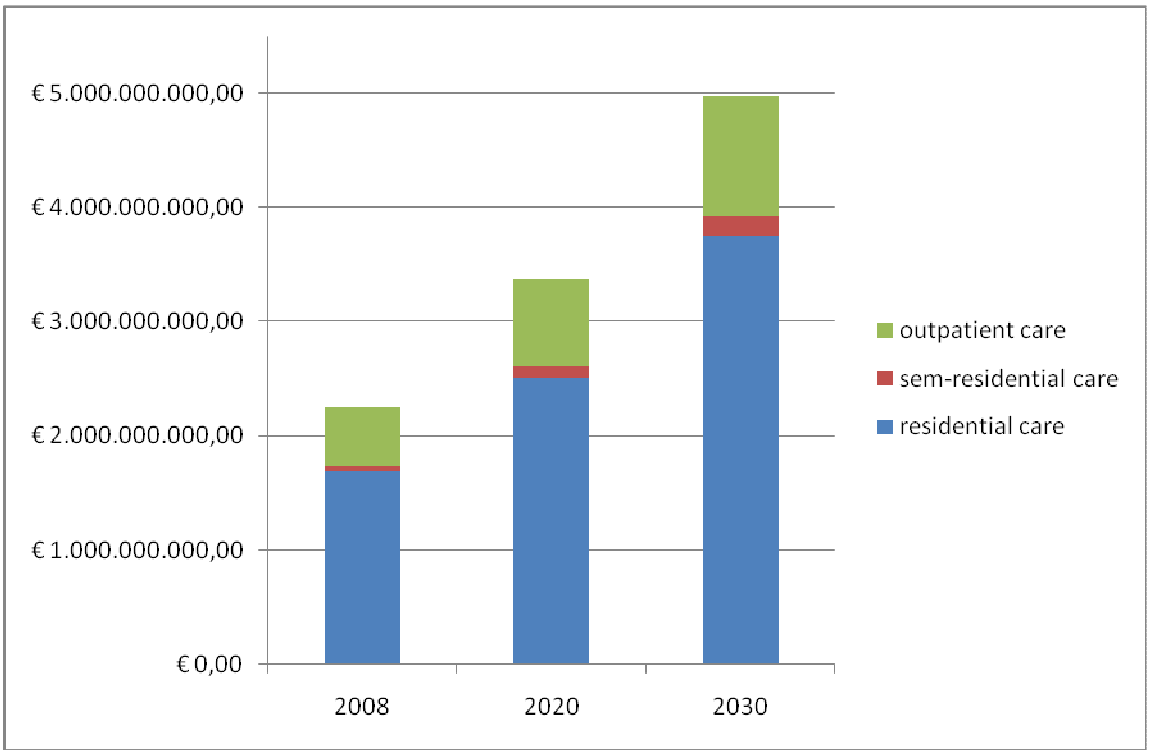
Supply and use of LTC services will be highest in Vorarlberg. A projected 89.05% of dependent persons in Vorarlberg are expected to use LTC services, compared to 74.11% in Upper Austria and 73.29% in Vienna, while the lowest proportions can be observed in Burgenland (31.95%), Lower Austria (37.30%) and Styria (43.80%). The highest increase of the supply and use of LTC services between 2008 and 2030 is projected for Carinthia (+15.47%), Vienna (+11.1%) and Upper Austria (+9.24%), whereas the share of service users will slightly decrease in Salzburg (-0.37%).

The unit costs of the services were obtained from official statistics and guidelines from federal states experts and separated into running costs and building costs. As an exception, outpatient services and semi-residential services of some provinces are only captured via running costs, owing to the circumstance that in these provinces the daily rates have to include building and administration cost. Regarding building costs it is assumed, that the present capacities are fully occupied and that each additional bed demanded in the future has to be build. As it is impossible to single out the federal building costs in the base year, we are unable to calculate annual growth rates. Therefore they are calculated as a total sum over the 23 years and as an average annual sum. Accounting for the fact that unit costs vary between service providers in most of the federal states, we use arithmetic means. In order to allow comparability it is assumed that the unit costs will increase only moderately by 2% per year in all provinces. This assumption will be varied in the course of a scenario analysis, which is work in progress.

4.3. Combining Supply and Demand: Future Costs of Long-Term Care in Austria

The model yields an increase in the Austrian full costs of LTC services of 126% from 2008 to 2030. In absolute values the costs will increase from € 2,254 million to € 5,100 million. Diagram 4 also displays the share of each type of service in the projected full cost of long-term care services. It shows that the largest part of the full costs can be attributed to residential care, which accounts for approximately 75%. The share of outpatient care varies around 20%, while semi-residential care accounts for the remaining approximate 5%. Furthermore the model suggests average annual building costs of € 108 million in residential care and € 1.2 million in semi-residential care.

Diagram 4: The Costs[2] of Austrian LTC Services 2008, 2020 and 2030



Source: own illustration

Once again the results of the federal states are varying considerably around the total growth rate. The highest rise will occur in Vorarlberg were the costs of LTC service increase by 178.38% closely followed by Salzburg with 171.88% and Styria, where the monetary value of LTC services expands by 154.97%. On the other hand the smallest effects will eventuate in Carinthia with an increment in full costs of 81.87%, Vienna with 96.29% and Lower Austria with 123.49%.

5. Conclusions

In this paper we discussed challenges and technical approaches concerning long-term care projections, provided a brief overview of cost projection for long-term care in the European context and presented findings for a regionally disaggregated projection for Austria.

Our macrosimulation model for Austria suggests that the number of dependent persons age 65 and older will rise by 43.3% from 297,330 to 426,053 between 2008 and 2030. This rise in the frail older population, in combination with the expansion of LTC services, will induce an

[2] Costs are defined as full costs comprising running and building costs.

increase in costs of LTC services by 126% to € 5,100 million. In the Austrian context these results fall between the projections of Streissler (2004) or the EU commission (+110% and +107% respectively) and the projection of Mühlberger et al. yielding 160%.

Furthermore, our results show remarkable regional differences on the level of demographics, prevalence rates, present and future provision of LTC services, unit and total costs. The disaggregation to the provincial level seems to improve the forecast accuracy due to the fact that the use of imprecise average values can be avoided. In addition regional disaggregation yields more detailed results, which is a clear benefit from a political point of view. Determining trends in variables endogenously on basis of qualitative and quantitative (especially time series) analysis of information and data overcomes the drawback of constant rates and lead to a more dynamic model.

On the other hand, the macrosimulation approach used in this paper is still subject to the potential risk of forecasting error and several steps could be taken to refine cost-projections in the field of long-term care: First, in addition (or as an alternative) to disaggregating the model to the provincial level a distinction between urban and rural regions could also be intriguing. Secondly, the trends in morbidity deserve closer inspection. Even though compression of morbidity has been proven by a number of studies less effort has been devoted to studying the link between morbidity and the demand of formal care services. Therefore further microlevel analysis would help to improve the specification of macrosimulation models in the field of LTC service costs.

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