

Actuarial Association of Europe

German long term care
experience and possible
applications to other markets

22.04.2016 / Dr. Ulrich Stellmann

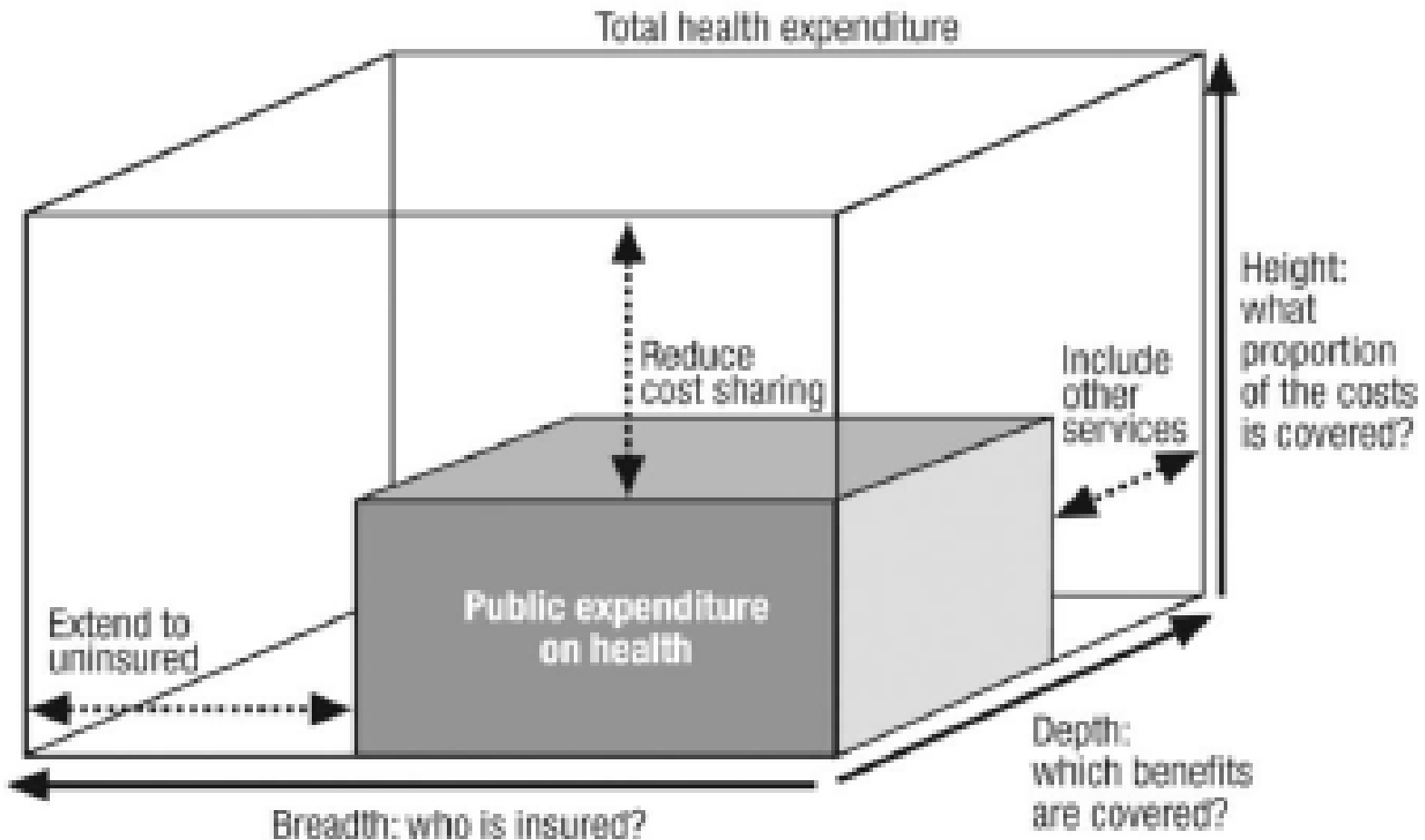
- **Motivation**
- **Some German basics**
- **Social elements in private coverage – this works?**

1. Background: a) Reasons for importance of issue

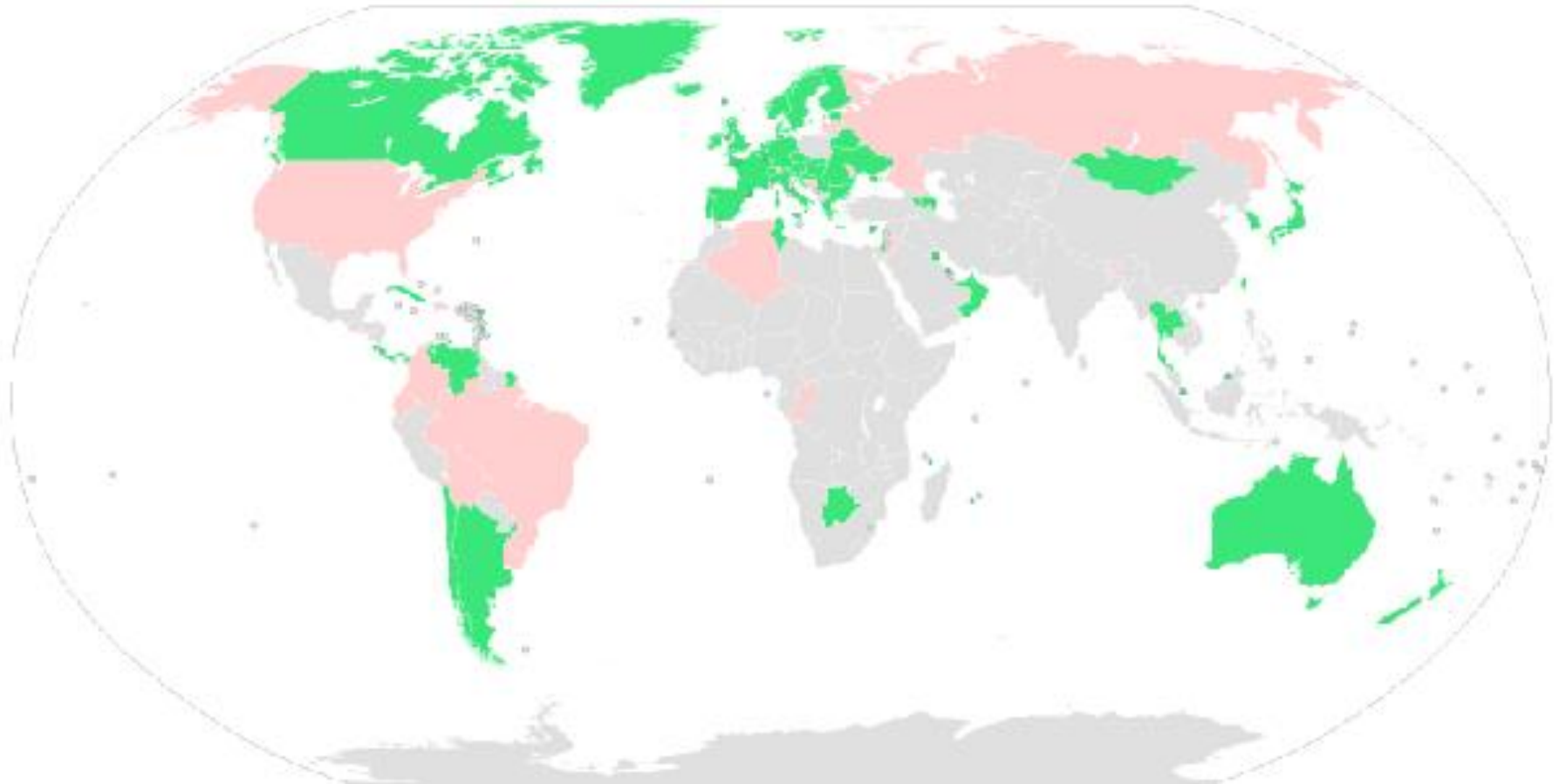
- Longer lifetimes mean more people living to advanced ages
- Medical advances enable chronic patients to live for many years
- Lower fertility rates leading to fewer family caregivers and sources of funding on a pay-as-you-go funding system
- Family - increased mobility, financial/time strain on family members
- Pressures on hospitals and short-stay facilities to reduce stays
- Costs will require an ever increasing share of GDP
- In many countries, inadequate preparation for long-term care


Dimensions of universal health care

Source: WHO 2008



who is covered, what services are covered, and how much of the cost is covered

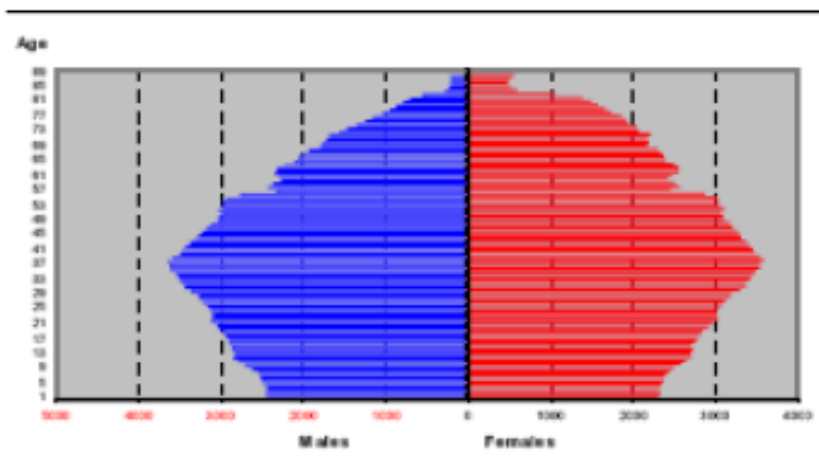


 Nations with universal health care (determined by proxy of ≥90% skilled birth attendance and ≥90% social insurance coverage)

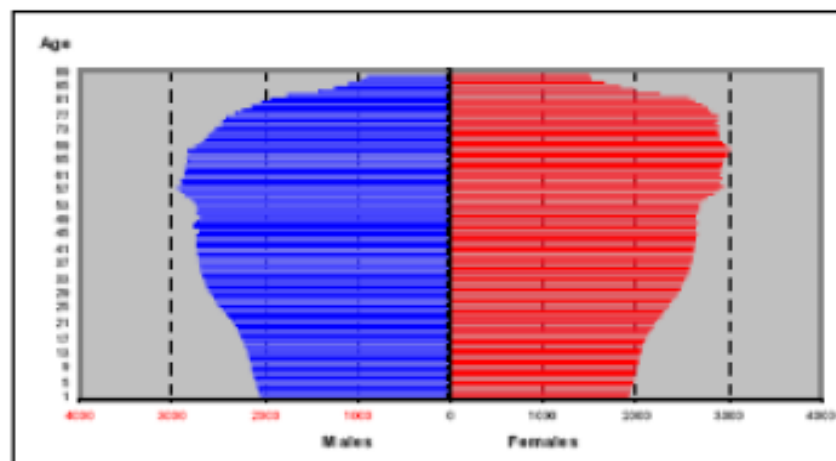
Nations with legislated mandate for Universal health coverage, but which have not yet reached thresholds above

Age pyramids for the EU25 population in 2004/2050 compared to China 2010/2050

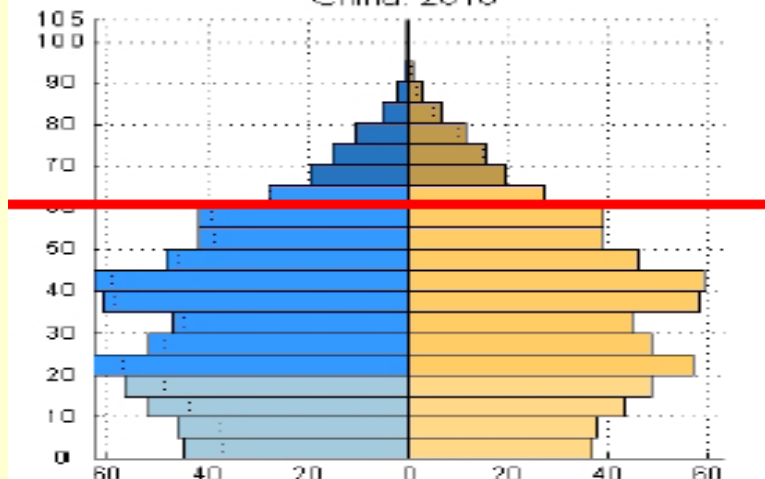
2004



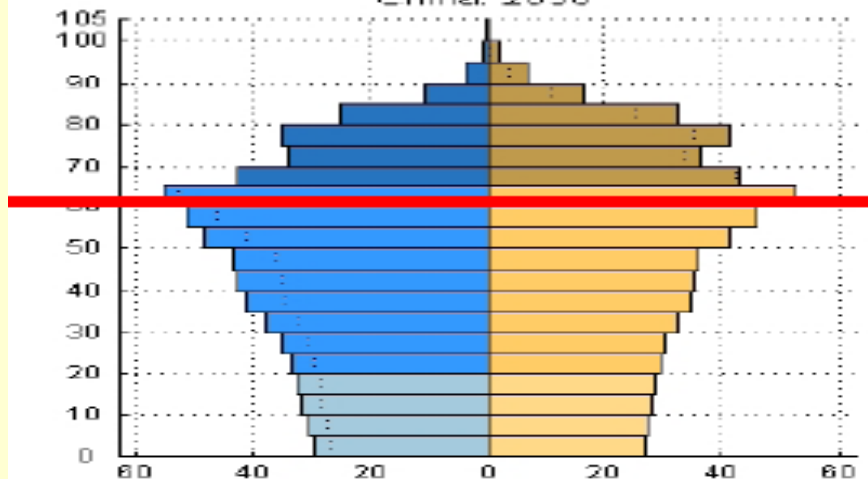
2050



China: 2010



China: 2050



Home alone...even more so for the 80+

Source: UNDESA/Population Division, Living arrangements of Older Persons Around The World (2005). *EU 27 minus Luxembourg, Malta and Slovakia.

Living alone for people aged 60-79 and those aged 80+, Eurostat 2001 Census data

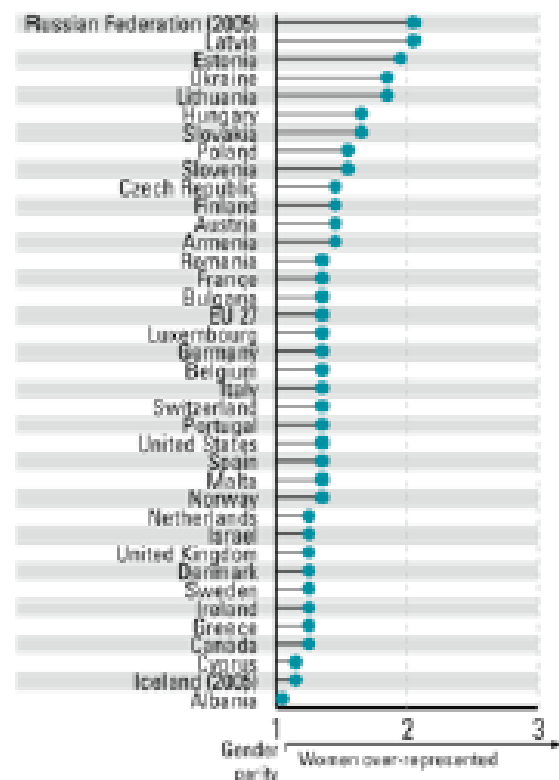


Who is the majority in care? Women!

Source: International Expert Meeting “Monitoring Long-Term Care for the Elderly”

More women survive to old-age than men

Gender ratio at the age of 65 (2006)

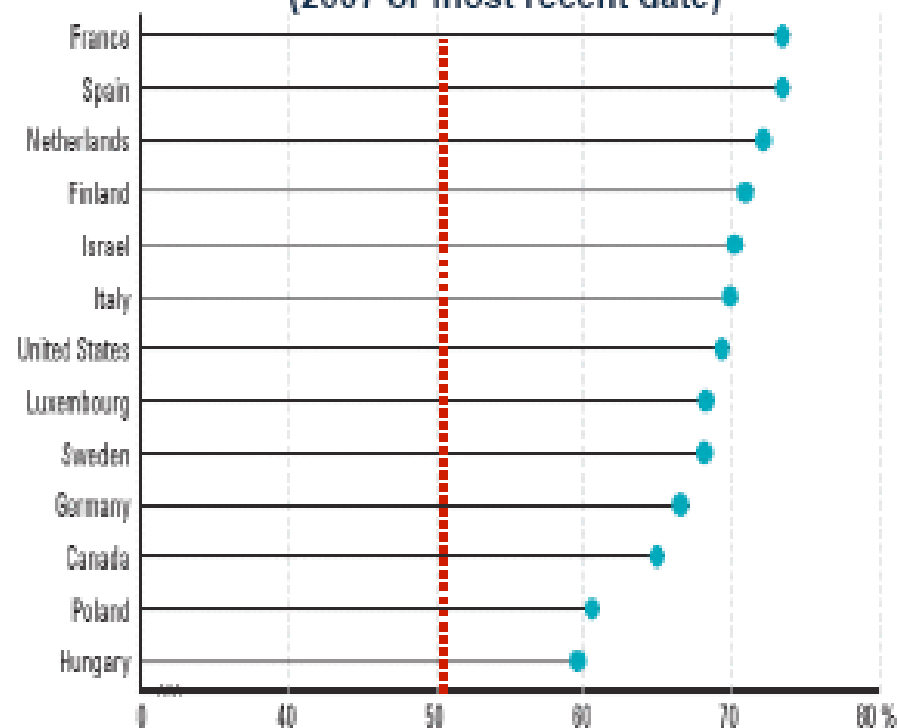


Gender ratio of the population aged 65+

Source: Eurostat, UNECE, UNPP.

More women than men receive care: the case of home care

Share of women among 65+ beneficiaries of home care (2007 or most recent date)



Share of women in 65+ beneficiaries receiving long-term care services at home

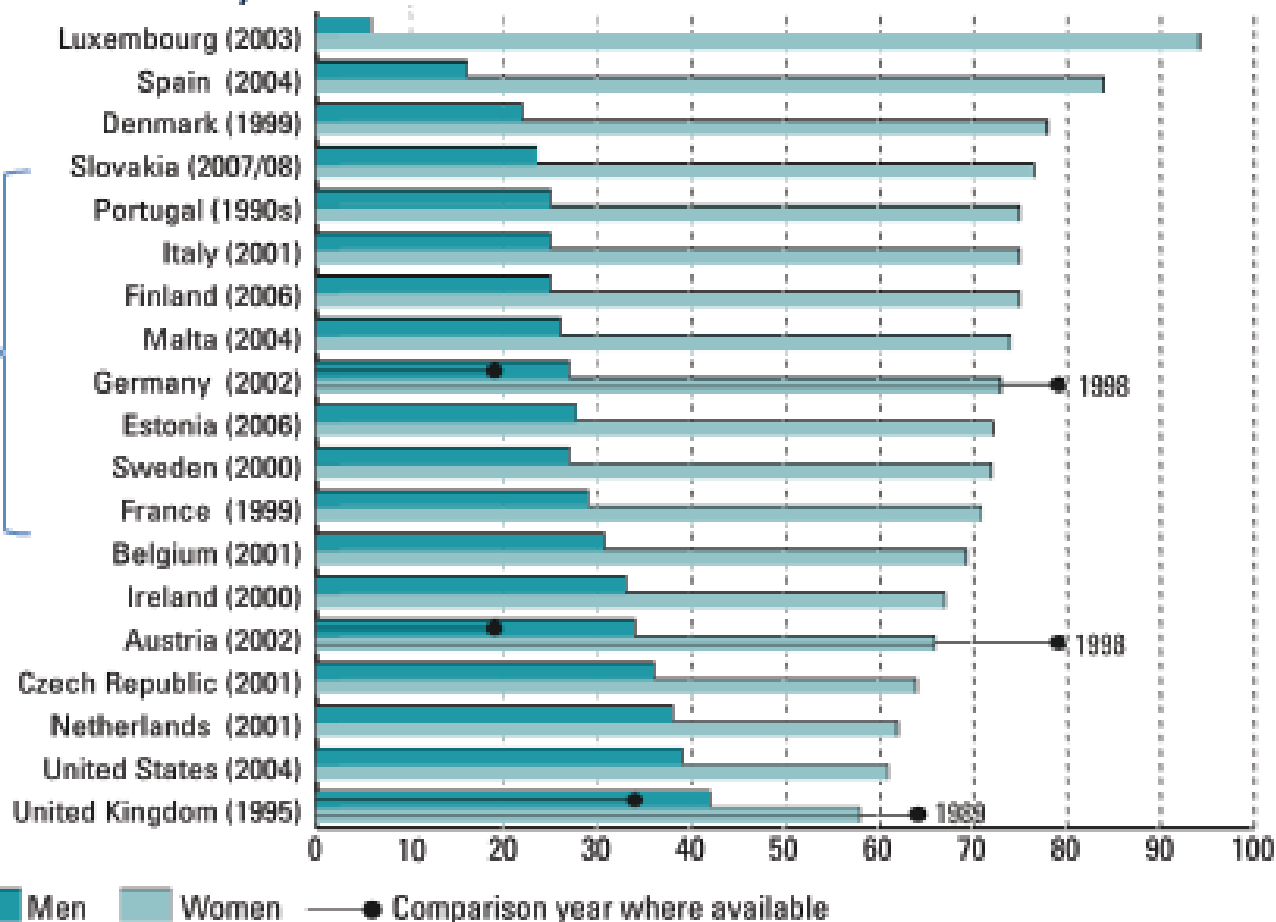
Source: Own calculations based on national sources, OECD and Eurostat demographic data, Huber et al. (2009, forthcoming).

Who cares? It's a women's world!

Source: National sources, OECD (2005) and EUROFAMCARE national reports.

Family carers by gender and country

Regardless of
„care regimes“



CARP Canada advises to investigate Germany's LTC Insurance System

October 21, 2011

Long wait lists, few homecare providers, and expensive co-payments characterize feelings toward long-term care (LTC) in Canada.....

The German Case

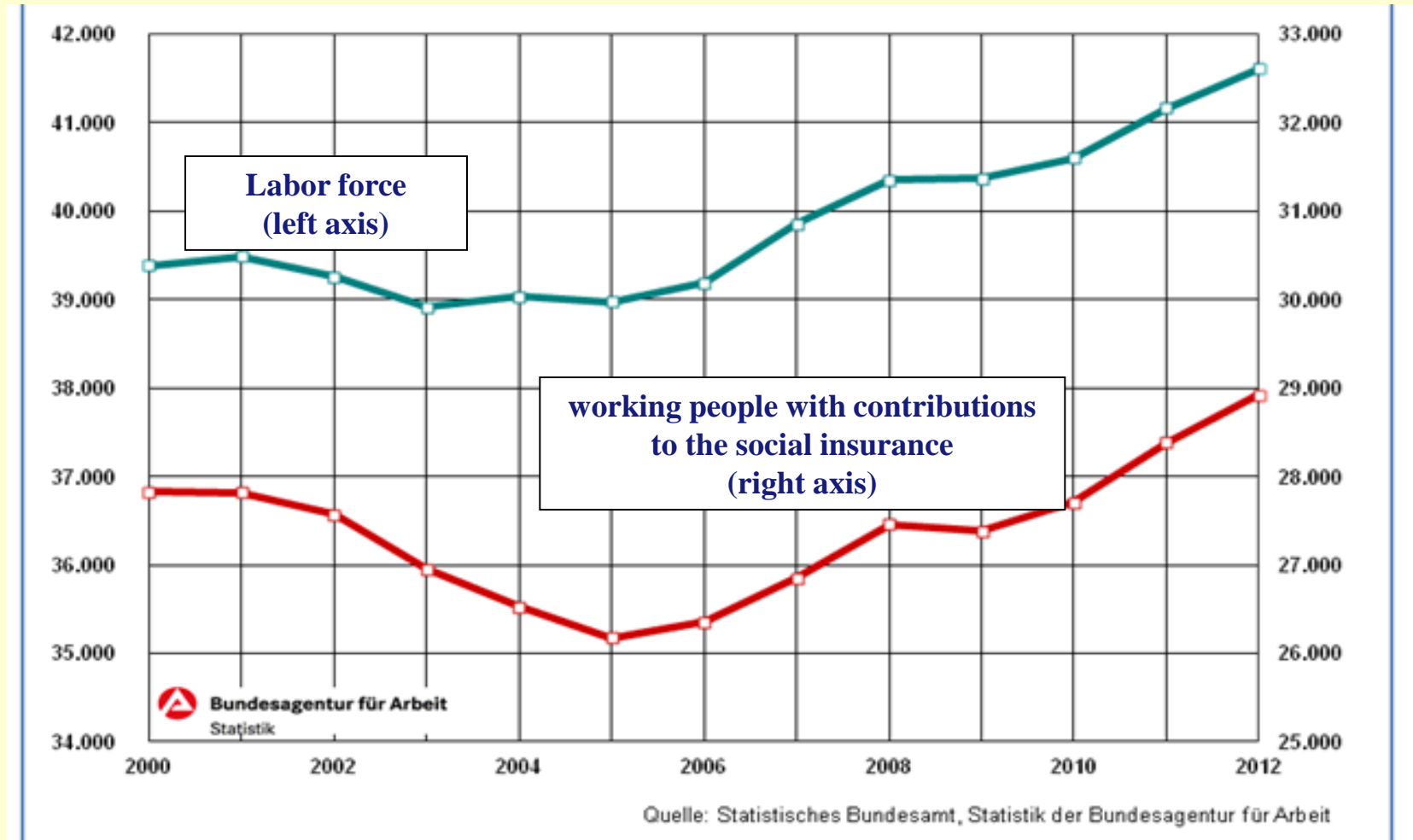
Germany provides a good test case for alternate ways of funding and providing LTC. Germany's population is aging even more rapidly than Canada's. More than 20 percent of the German population is over 65 and 5 percent of the population is over 80, compared to Canada, where the numbers are 15 percent and 4.5 percent respectively.
.....

The German model of separate insurance may or may not work in Canada, but as our own population ages and budget deficits increase, we too will have to think hard about creative solutions to healthcare challenges. If nothing else, Canada should take from the German model the understanding that LTC requires political and economic commitment and a common vision for aging.



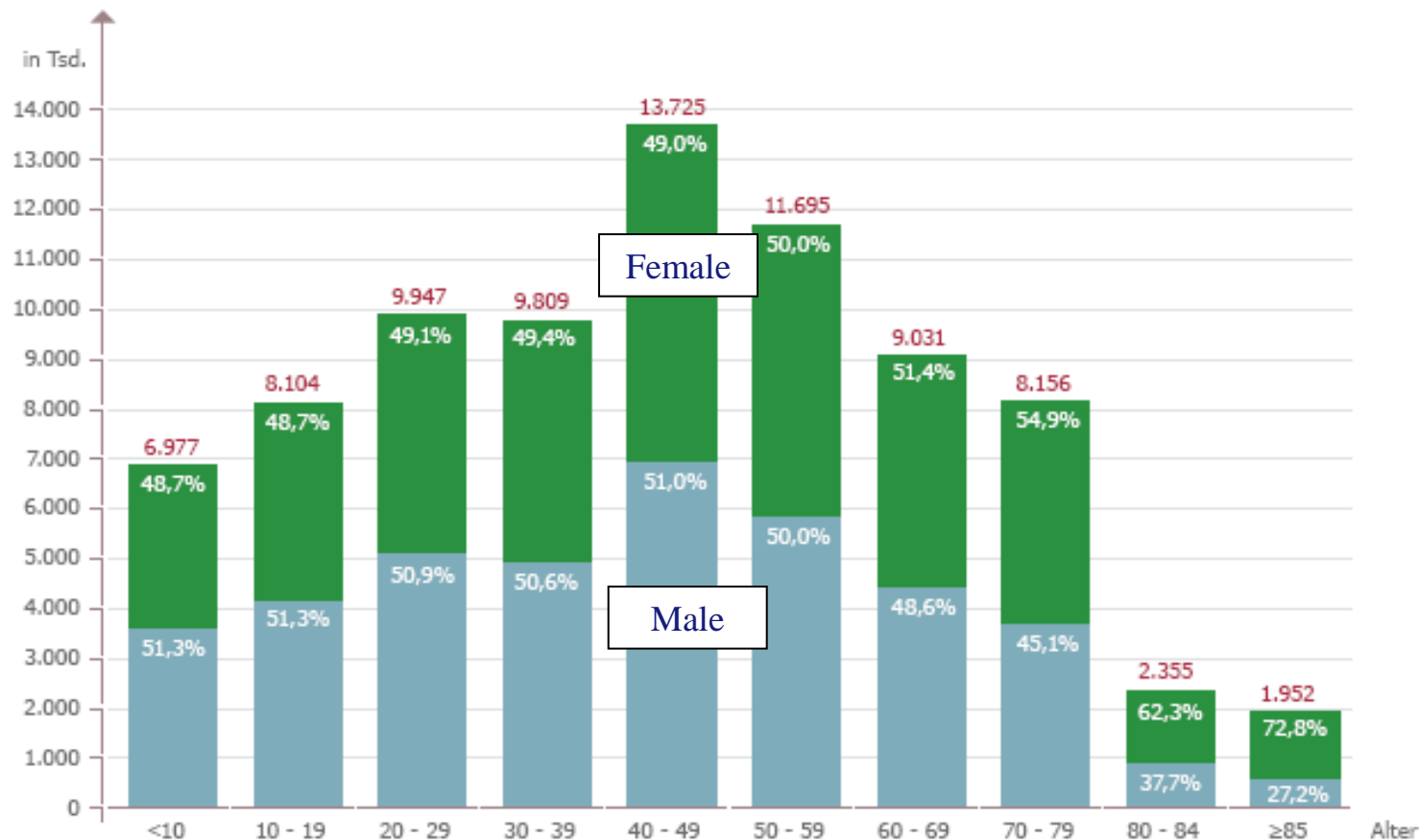
- **Motivation**
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Labor force and working people which contributes to the social insurance (in 1,000)



Total population in 2012 = 81.917 Tsd.

Gender dependent age distribution



Quelle: Statistisches Bundesamt: Online-Datenbank: Fortschreibung des Bevölkerungsstandes (Stand: 31.05.2012)

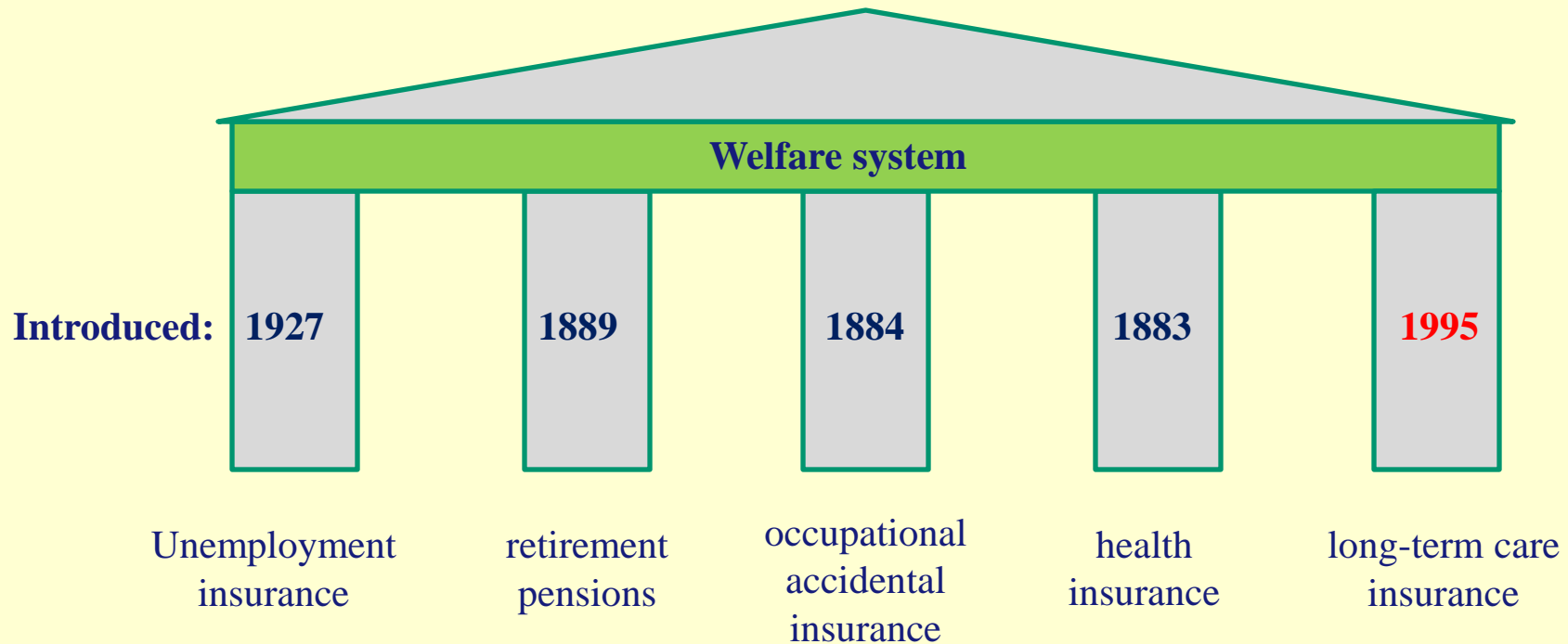
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Bundeszentrale für politische Bildung, 2012, www.bpb.de



The 5 pillar social insurance approach in Germany includes long term care

The Social Long-Term Care Insurance (SLTCI) was introduced in 1995 and is one of the main pillars of the German system of social insurances



Legal basis: The foundation of the German welfare system is laid out in the German Constitution (Grundgesetz) that guarantees living in dignity.

Development of contributions to the social system

Declining situation for the contributions for unemployment insurance, increasing payments for health and LTC- insurance

Table 1: Development of Contribution Rates for Social Insurances (in %)

	1995	2000	2005	2009
Unemployment Insurance	6.50	6.50	6.50	2.80
Health Insurance*	13.20 (12.80)	13.60 (13.80)	14.20 (14.00)	14.00
Long-term Care Insurance	1.00	1.70	1.70**	1.95**
Pension Insurance	18.60	19.30	19.50	19.90
Employees subject to social insurance contribution (in 1000)	28,118	27,826	26,178	27,560

* values in brackets apply to East Germany

** employees' contribution is 0.25%points higher for childless people

Source: Federal Ministry of Labor and Social Affairs (2009)

Caps for 2015 = 49,500 € p.a. for social health, & LTC (54,900 € p.a. threshold for private cover)
72,600 € (62,400 €) p.a. for pension & unemployment western (eastern) part

The majority of the population (90%) is covered in the SLTCI following the pay-as-you-go principle



Covered people:

SLTCI covers roughly 90% of the people. The rest (ca. 10%) are covered in the private long term care insurance.

Hint: Same benefits but a different contribution scheme

Contributions:

SLTCI: A fixed percentage of the salary / pension up to a certain income threshold, the so-called social insurance ceiling.

[pay-as-you-go principle]

Special regulations for unemployed people and other special groups of people (e.g. get payments from welfare etc.)

Private: Premiums calculated by age and level premium

– limited by the maximum premium of SLTCI

[deferred benefit coverage principle incl. premium adjustment]

Roughly 70% of the cared people are cared at home in Germany 2009 – 67% women

2.34 million total number of cared people in 2009

**Provided at home:
1.62 million (69%)**

**Provided inpatient:
717 000 (31%)
[75% women]**

**by relatives:
1.07 million**

**with the help of
professionals:
555 000**

**12 000 care provider
with
269 000 employees**

**11 600 institutions
with
621 000 employees**

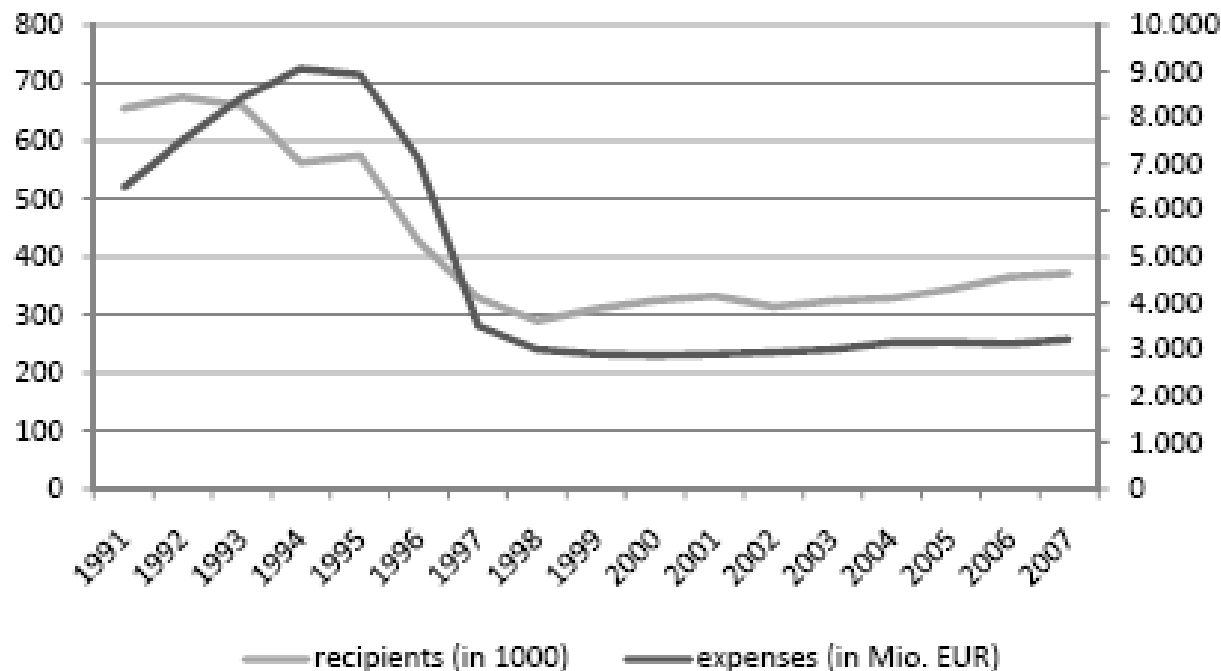
If we assume that one relative takes care of the cared person, than the rational of cared people and people providing the service is 1:1

Questions: Is this market relevant for the GDP?

Long-term care is a partially comprehensive insurance with the aim to cover the basic needs

Therefore, special public long-term care assistance as part of social welfare was not abolished but its relevance decreased significantly

Figure 1: Special Public Long-term Care Assistance: Recipients and Expenses (1991 to 2007)



Source: Federal Bureau of Statistics (2009a), p. 37, own representation

- **Motivation**
- **Some German basics**
- **Social elements in private coverage – this works?**

1. Gender independent premiums
2. No payments for child
3. Special regulations for other groups:
 - Students
 - Unemployed
 - Civil servants
 -
4. Payment for married couples = 2x or 1x contributions*
5. Contributions of the salary (~2% **with cap****)
are shared with the employer (50|50)***

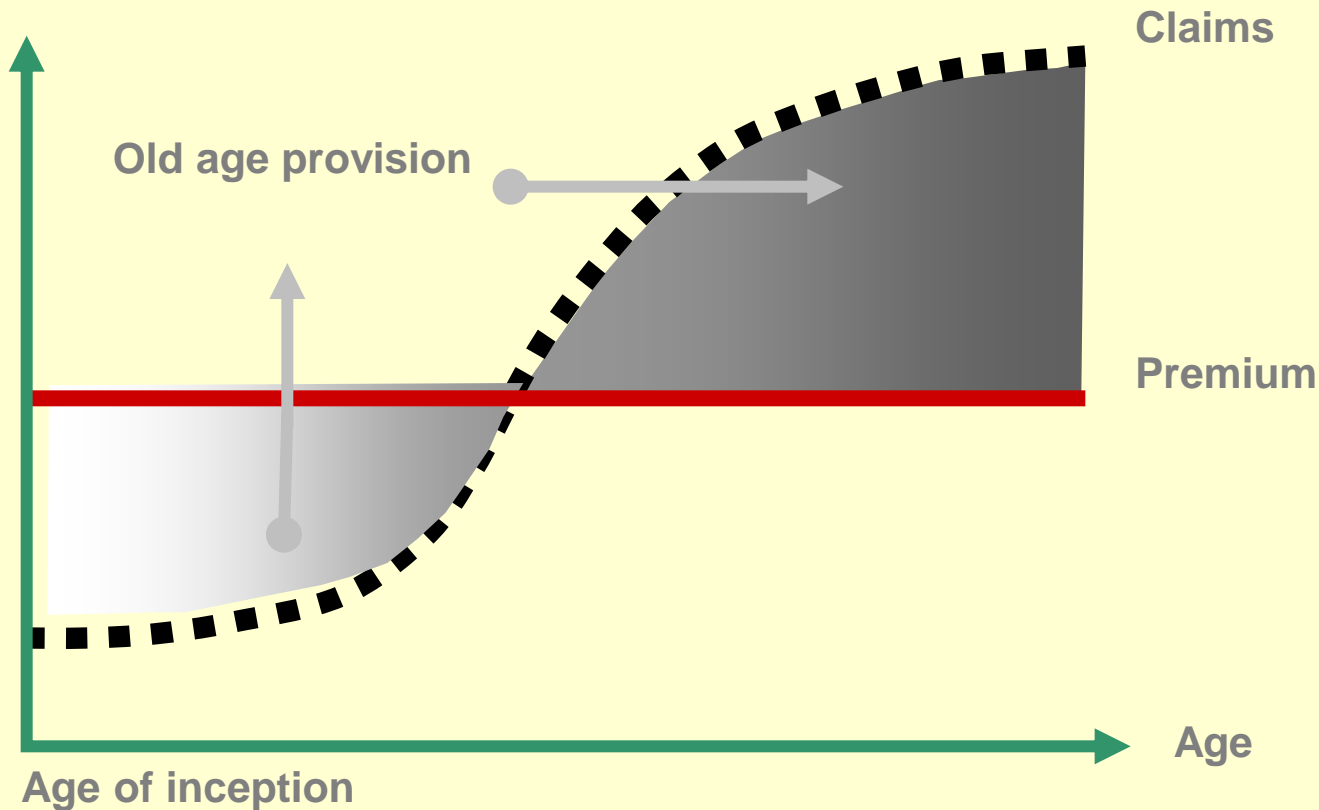
* The none working part is free of charge

** Cap for 2015 = 69,600 € p.a. [x 2% / 12 ~ 116 € → **58 € p.m.** (= 50|50)]

*** For retirees instead of the salary their pensions are used

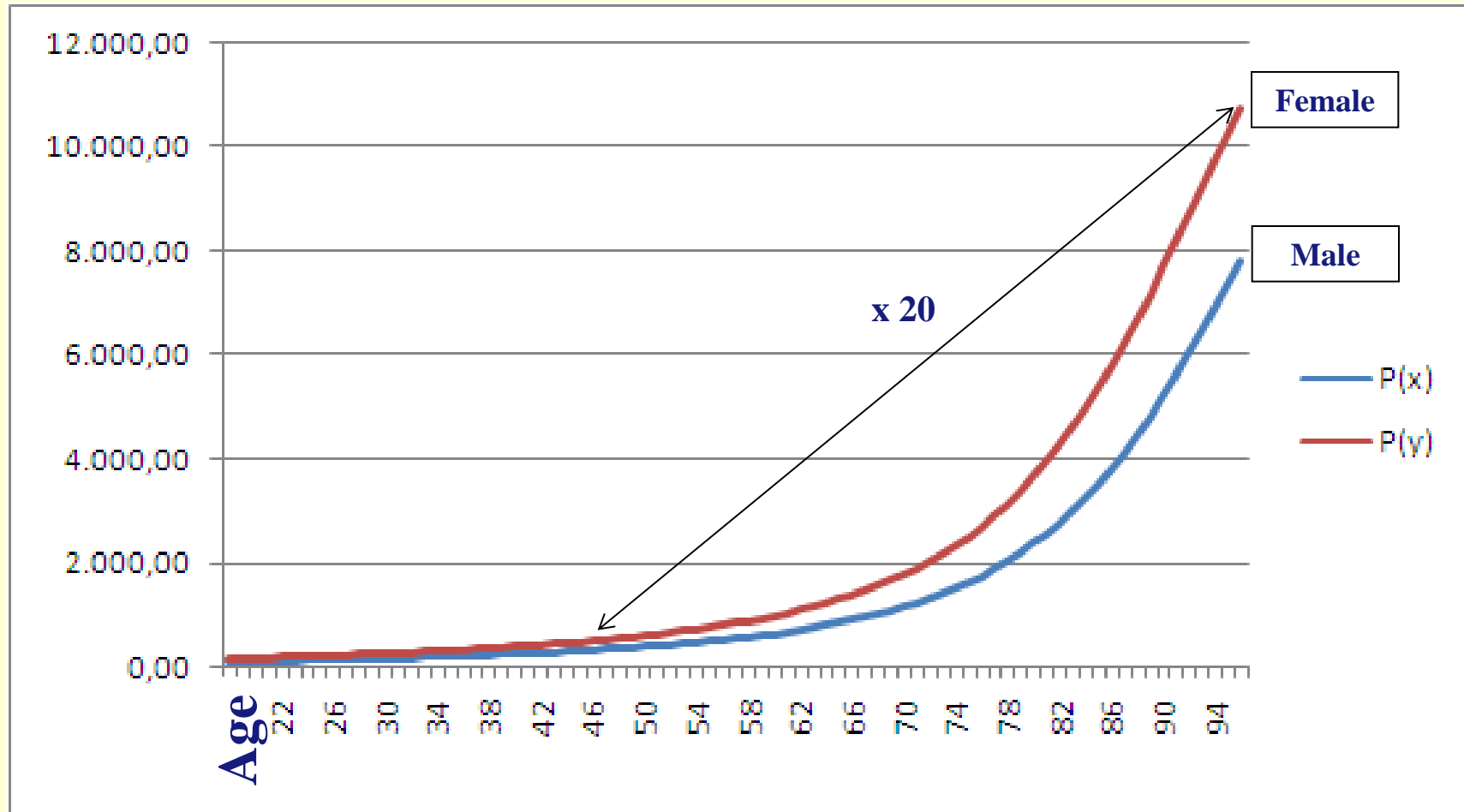
Traditional private calculus for long term insurance individual based

Whole life level premiums - Building of age provisions



Special characteristics in private LTC calculation – very steep profiles

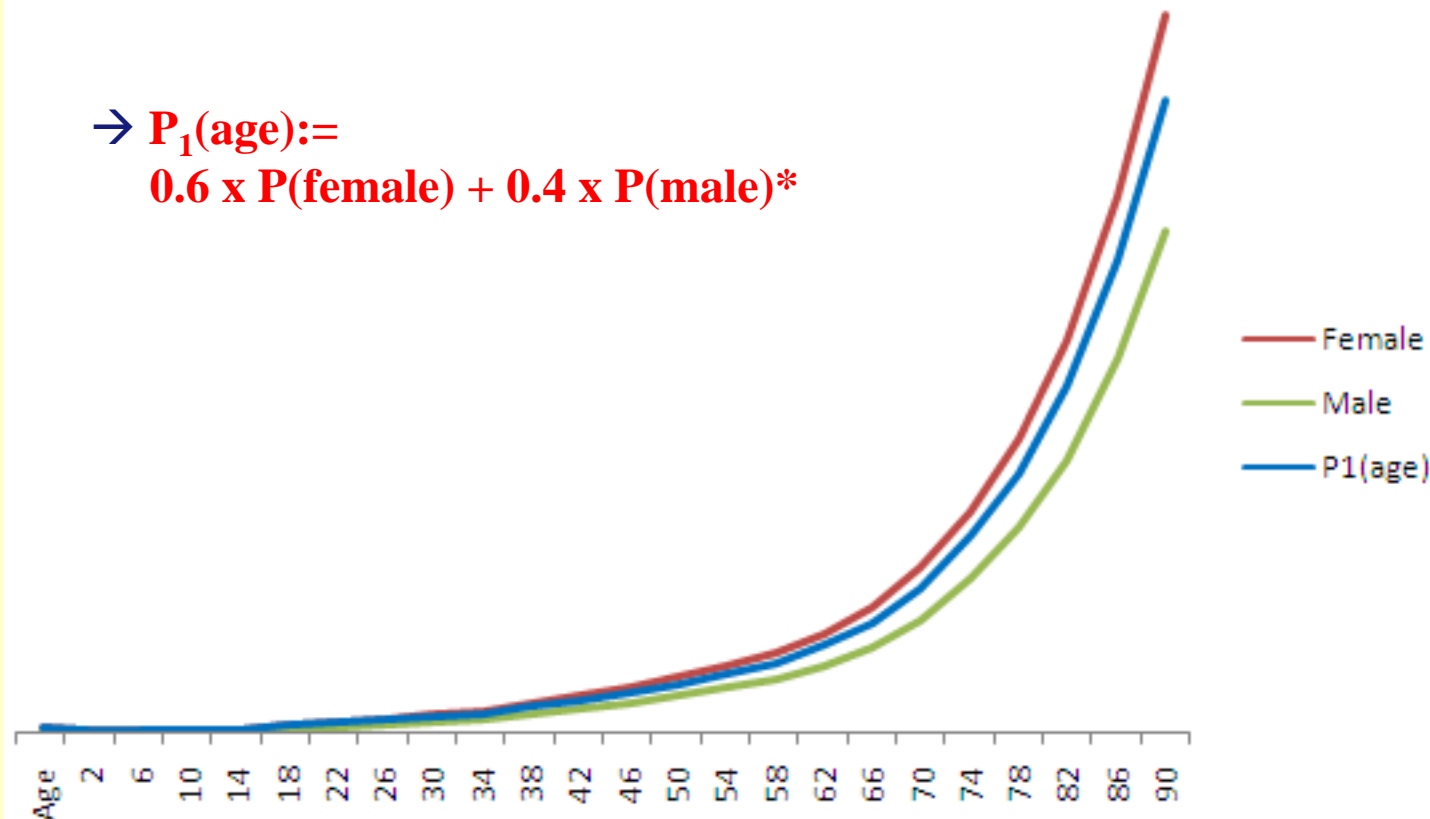
Gender dependent net premium P_x resp. P_y



Gender independency: → Not so complicated, use “interpolation”

Shift the male premium a little bit upwards (multiply with the factor C_{gender}) and add for all ages the mistake (equalization)

→ $P_1(\text{age}) :=$
 $0.6 \times P(\text{female}) + 0.4 \times P(\text{male})^*$

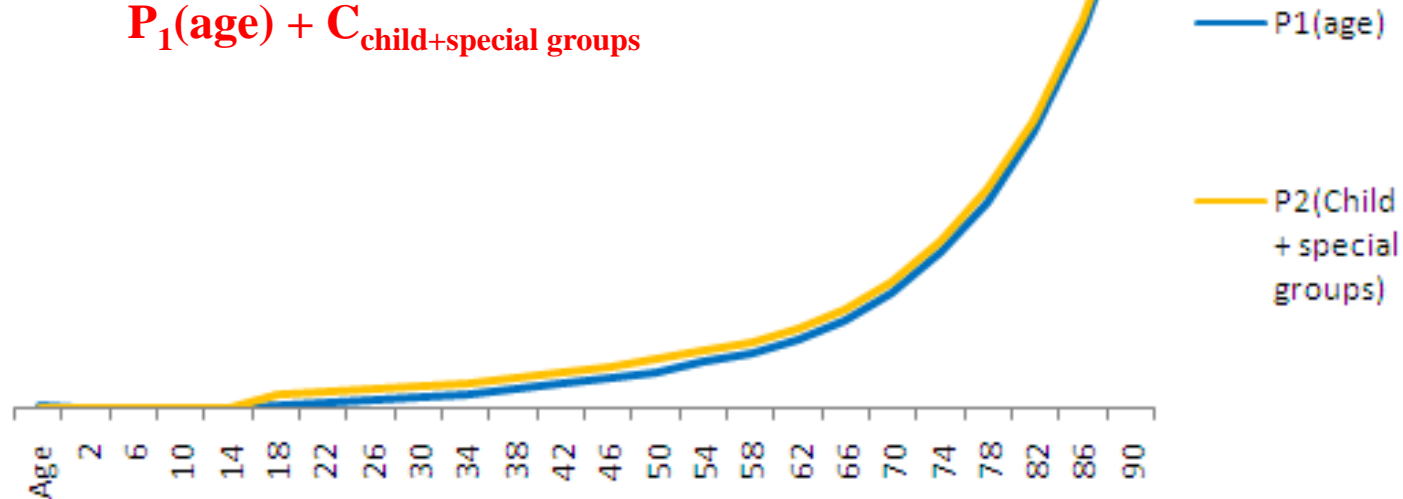


* For private German LTC a slightly different algorithm is used

Childs for free and special groups: → Not a big issue

Shift the age independent premium a little bit upwards (add amount for child)

$$\rightarrow P_2(\text{child+special groups}):= \\ P_1(\text{age}) + C_{\text{child+special groups}}$$



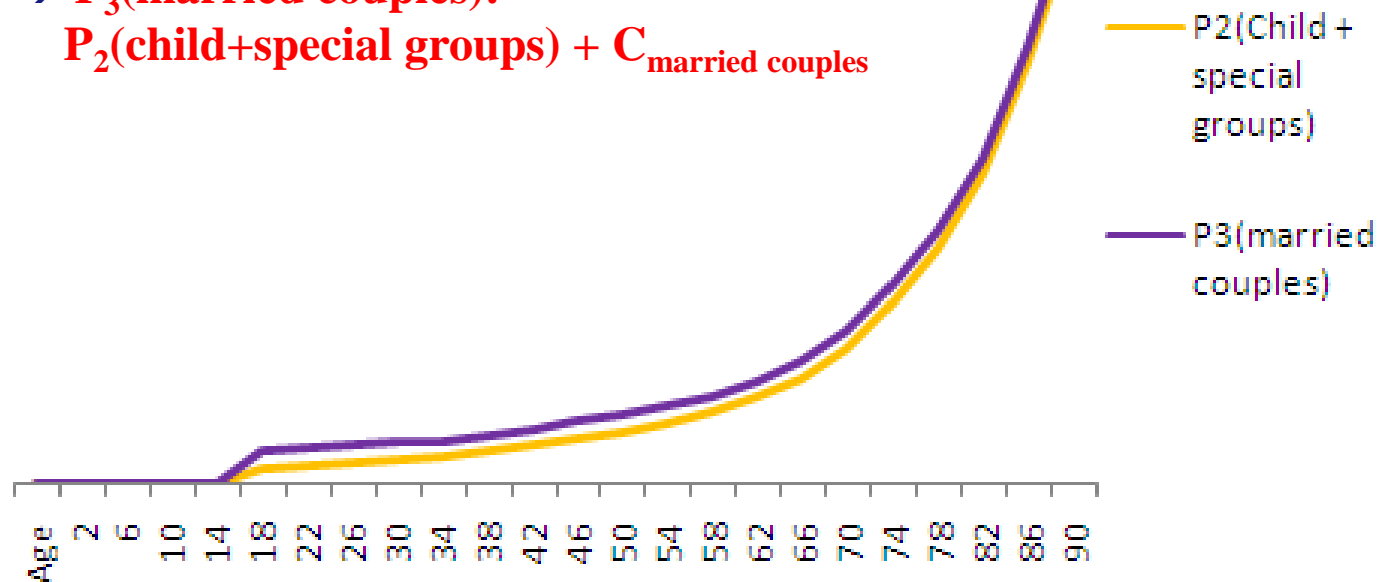
Children are for free and special groups e.g. students has reduced contributions.

Married couples – one for free?

→ Use a compromise

For married couples the maximum is set to 1.5 x maximum amount of SLTCI

→ $P_3(\text{married couples}) :=$
 $P_2(\text{child+special groups}) + C_{\text{married couples}}$

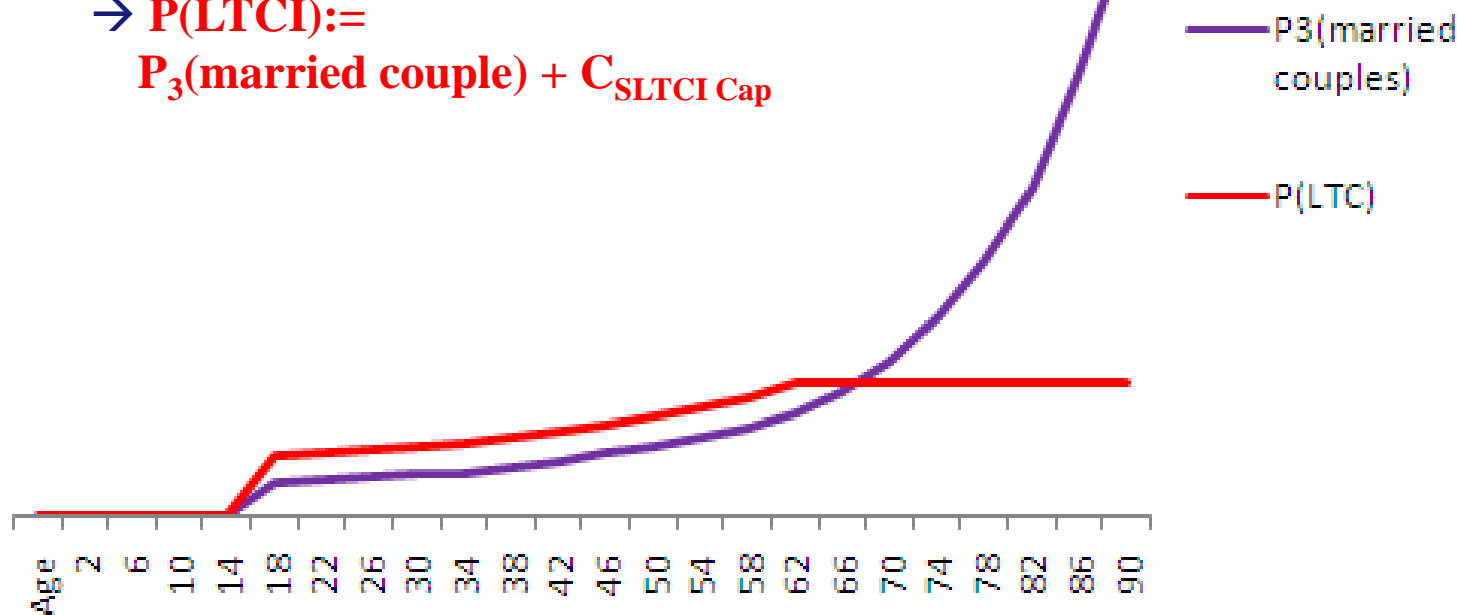


SLTCI married couples: Payment for married couples = 2x or 1x contributions.
The none working part is free of charge.

Capped premium via SLTCI: → Challenging job (iteration used)

For including the cap from SLTCI iteration algorithm is necessary, to find the right age

→ $P(\text{LTCI}) :=$
 $P_3(\text{married couple}) + C_{\text{SLTCI Cap}}$



Cap for 2015 = 69,600 € p.a. [$\times 2\% / 12 \sim 116 \text{ €} \rightarrow 58 \text{ € p.m. (= 50|50)}$]

Hint: For the above cap costs must be taken into account.

How to handle portfolio differences?

→ Various pooling mechanism

Why there is a need for a pooling mechanism ?

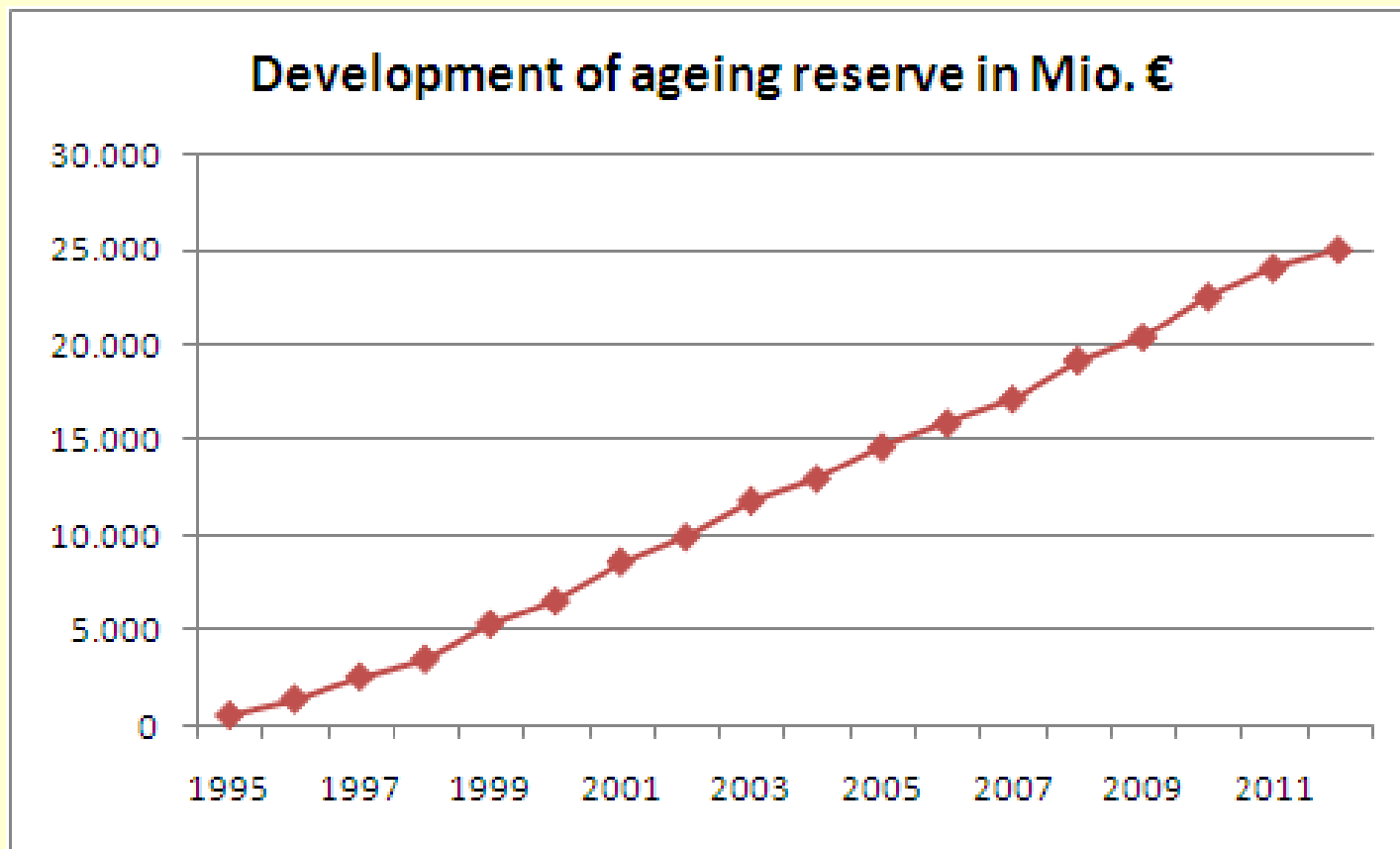
Insurance companies may have:

- different age structure of the insured portfolio,
- different financial burden because
 - premium-free children,
 - premium limitations for married couples,
 - premium limitation for single persons,
- different portfolio mix of males and females,
- different mix of the risk structure

Hint: Roughly 40 private health insurer are within the pool

A quite successful story

Strong development of the aging reserve in private LTC.
Starting at 500 Mio. raising up to approximately 25 bn € in 2013



After evaluating the last 20 years, following improvements are identified:

- Include a care level for dementia
- Adjust the care levels and payments
- Improve the categorization mechanism

→ SLTCI-Reform 2016

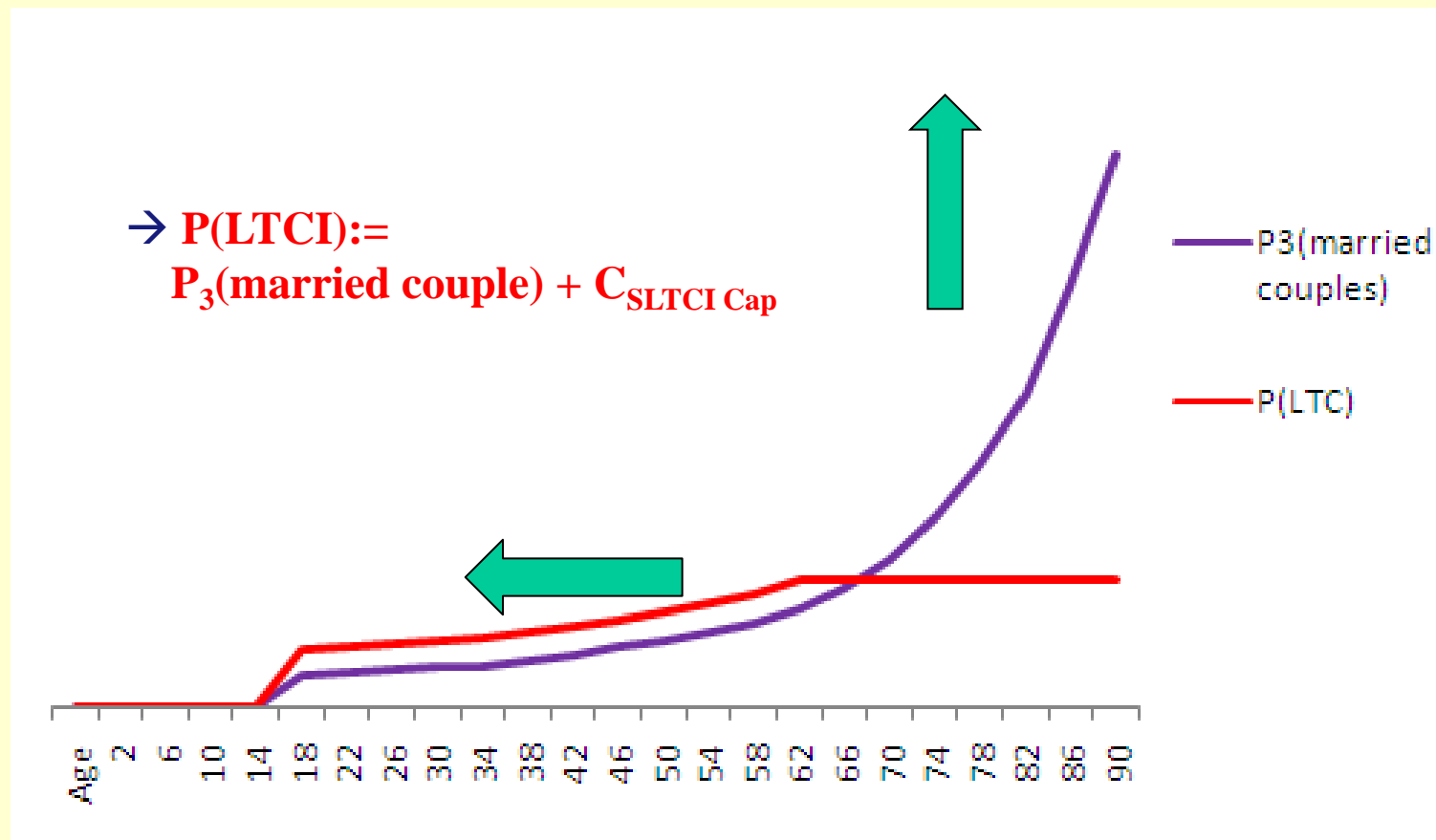
→ The private LTCI has to follow. Again a challenging job, but today a strong data base is available

→ Some consequences for the calculus in case of an adverse scenario (increased length of stay in each care level)

Capped premium via SLTCI:

- First non cap age moves to the left (ok)
- No solution because all ages are capped (?)

For including the cap from SLTCI iteration algorithm is necessary, to find the right age



Cap for 2015 = 69,600 € p.a. [$\times 2\% / 12 \sim 116 \text{ €} \rightarrow 58 \text{ € p.m. (= 50|50)}$]

Hint: For the above cap costs must be taken into account.

Current situation in other markets:

- Rapidly aging population (\approx GER 1995)
- No social scheme for LTC coverage (\approx GER 1995)
- Private LTC (sum insured) insurance products available (\neq GER 1995)
- Low infrastructure to provide professional care (\approx GER 1995)
- Care giving activities are provided mostly by relatives (\approx GER 1995)
- Weak statistical information available (\approx GER 1995)
- **→ Similar to GER 1995 ?**

Application possible? Yes! How?

- SLTCI for people with a salary lower some threshold X on a “pay as you go principle” similar to the German SLTCI
- Private LTCI (same benefit = SLTCI) for people with a salary $> X$ level premium based
- All people should be insured (e.g. child, civil servants, self employed etc.)
-

Some advantages

- Move forward to an universal health system
- Managing active on of the aging problems
- Improve the situation of the elderly and the care givers
- Creates a quite huge industry (professional care provider, care giver, impatient care, care article supplier etc.)
- Private / social partnership to balance the payments
- Relax the situation of the relatives

....

Some necessary pre-requisites and conditions

- Right on SLTCI must be fixed in the social scheme - legal aspects must be solved (→ contributions for LTC insurance are tax deducting)
- Private LTCI must include the right to adjust the premium under some predefined given conditions (regulatory aspects needs to be solved)
-



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Back up

Application of K-means clustering

Comparing LTC Systems in Europe

Which methodology was used?



1. In a first step we used ordinal scaled/pseudo-metric variables to obtain an index for the organizational depth (X_i) and the financial generosity (Y_i) of LTC systems. The indices were derived as follows:

$$\text{Organization dept } /k: X_i = \sum_{j=1}^n O_{ji}, \quad i = 1, \dots, 22, \quad (1.1)$$

$$\text{Financial generosity: } Y_i = \sum_{k=1}^m F_{ki}, \quad i = 1, \dots, 22, \quad (1.2)$$

Where i indexes the 22 countries of our dataset, O_j , are the organizational variables and F_k are the financial variables using the following variables.

2. In the second step, the results was clustered using usual cluster algorithms (for example: K-means clustering)

Comparing LTC Systems in Europe

Selection of used variables



The selection of variables is crucial when designing a typology. To identify and select the variables for deriving the indices of organizational depth (X_i) and financial generosity (Y_i), we applied a four-step process:

- 1) identification of relevant topics from the literature plus some additions we deemed necessary;
 - 2) definition of variables that a) describe those topics and b) can be used in the typology;
 - 3) checks on the availability, quality and comparability of the corresponding information; and
 - 4) attempts to find close substitutes for desirable variables with insufficient availability or quality of information
- This procedure resulted in six variables describing the organization of LTC systems
- means-tested access, entitlement, the availability of cash benefits, the choice of provider, quality assurance and integration
- and two variables characterizing the financing of LTC systems
- public expenditures for LTC as a share of GDP and cost sharing

Comparing LTC Systems in Europe

Some of the used organization variables



Availability of cash benefits:

Overall, 16 out of the 21 countries have some form of cash benefit. Only in Bulgaria, Denmark, Hungary, Romania and Sweden do cash benefits not exist.

Choice of provider (depends on national definition):

Generally, free choice of provider is widespread in European LTC systems. The majority of the systems offer free choice of provider in both institutional and home-based care. In Denmark, Italy and Spain free choice of provider is limited to home-based care. It is only in Finland that care recipients cannot freely choose a provider.

Quality assurance:

In general, the vast majority of the European LTC systems have introduced mandatory quality assurance in institutional care and home-based care. The Czech Republic and Hungary have mandatory quality assurance only in home-based care, while Latvia has it only in institutional care. In Austria, Finland and Slovenia, mandatory quality assurance does not exist in any setting of care.

Comparing LTC Systems in Europe

The financial variables



Cost sharing:

This variable describes the financial burden of private households/care recipients for LTC services. Private households not only provide informal care but also substantial financial means for care provided in institutions and at home. LTC services provided in institutions are usually covered partly by the public system and partly by private households. Cost sharing by the care recipients may be linked to the retirement income or the care recipients may pay an accommodation charge.

Public expenditures as a share of GDP:

This variable can be seen as a measure of the generosity of an LTC system. The more a country spends on LTC the more services/service capacity are supposedly available. Public expenditures are the most important source of financing for LTC services in almost all countries. Nevertheless, public spending on long-term care is still relatively low as a proportion of GDP, when compared with public spending on health care (OECD, 2005).

Comparing LTC Systems in Europe

Transfer qualitative data into quantitative system

Table 3. Description and coding of variables

Variable	Value				
	3	2	1		
Means-tested access to publicly financed FIC/HBC	No means-tested access to either FIC or HBC	No means-tested access to FIC; means-tested access to HBC	Means-tested access to both FIC and HBC		
Is there an entitlement that applies to FIC/HC/HNC?	Entitlements apply to both FIC and HBC	No entitlement applies to FIC; entitlement applies to HBC	No entitlement applies to either FIC or HBC		
Availability of cash benefits	Cash benefits in both FIC and HBC	Cash benefits in either FIC or HBC	No cash benefits		
Can recipients choose the provider freely in FIC/HBC?	Free choice of provider in both FIC and HBC	No provider choice in FIC; free choice of provider in HBC	No provider choice in either FIC or HBC		
Quality assurance in FIC/HC/HNC is mandatory	Mandatory quality assurance in both FIC and HBC	Mandatory quality assurance in FIC or HBC	No mandatory quality assurance in either FIC or HBC		
Quality of coordination between LTC and other services is...	Rather good – there might be some organizational challenges for the individual but they are usually not too severe	Rather poor – provision of care is fragmented and often can pose a challenge for (prospective) care recipients	Very poor – provision of care is very fragmented and poses regular or severe challenges for (prospective) care recipients		
Formal care recipients have to share costs for FIC/HC/HNC	Cost sharing in FIC; no cost sharing in HC or HNC	Cost sharing in FIC and HC; no cost sharing in HNC	Cost sharing in FIC, HC and HNC		
	5	4	3	2	1
Public expenditure on LTC as a share of GDP	2% or more	1.5–2%	1–1.5%	0.5–1%	Less than 0.5%

Note: FIC refers to formal institutional care, HC to home care, HBC to home-based care (home care + home nursing care) and HNC to home nursing care.

Comparing LTC Systems in Europe

Results in detail for the two indices

Table 4. LTC system characteristics by country

Countries	Organisational depth						X _i Total	Financing generosity		Y _i Total
	Means-tested	Entitlement	Cash benefits	Choice	Quality assurance	Integration		Cost sharing	Public expenditures	
Austria	3	1	3	3	1	3	14	1	3	4
Belgium	3	3	3	3	3	3	18	2	4	6
Bulgaria	3	3	1	3	3	2	15	1	1	2
Czech Republic	3	3	2	3	2	2	15	1	1	2
Denmark	3	3	1	2	3	3	15	3	4	7
England	1	2	3	3	3	2	14	2	2	4
Estonia	3	3	3	3	3	2	17	1	1	2
Finland	3	3	3	1	1	3	14	1	4	5
France	3	3	2	3	3	2	16	2	3	5
Germany	3	3	2	3	3	2	16	3	2	5
Hungary	3	3	1	3	2	1	13	2	1	3
Italy	1	3	3	2	3	2	14	2	4	6
Latvia	1	3	2	3	2	3	14	3	1	4
Lithuania	1	3	2	3	1	2	12	1	2	3
The	3	3	2	3	3	2	16	1	5	6
Poland	1	3	2	3	1	2	12	1	1	2
Portugal	na	na	na	na	na	na	na	na	na	na
Romania	2	1	1	3	3	1	11	2	1	3
Slovakia	3	3	2	3	3	2	16	2	1	3
Slovenia	3	3	3	3	1	2	15	2	3	5
Spain	1	3	3	2	3	2	14	2	2	4
Sweden	3	3	1	3	3	3	16	1	5	6

Comparing LTC Systems in Europe

K-means clustering - The Algorithm (MacQueen,1967)



K-means is a simple unsupervised learning algorithm that solves the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. The main idea is to define k centroids, one for each cluster. These centroids should be placed in a cunning way because of different locations cause different results. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest centroid. When no point is pending, the first step is completed and an early grouping is done. At this point we need to re-calculate k new centroids as barycenters of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new centroid. A loop has been generated. As a result of this loop we may notice that the k centroids change their location step by step until no more changes are done. In other words, centroids do not move any more. Finally, this algorithm aims at minimizing an *objective function*, in this case a squared error function. The objective function

Comparing LTC Systems in Europe

K-means clustering - The Algorithm (MacQueen,1967)



The algorithm is composed of the following steps:

1. *Place K points into the space represented by the objects that are being clustered. These points represent initial group centroids.*
2. *Assign each object to the group that has the closest centroid.*
3. *When all objects have been assigned, recalculate the positions of the K centroids.*
4. *Repeat Steps 2 and 3 until the centroids no longer move. This produces a separation of the objects into groups from which the metric to be minimized can be calculated.*

Finally, this algorithm aims at minimizing an *objective function*, in this case a squared error function. The objective function

$$J = \sum_{j=1}^k \sum_{i=1}^n \|x_i^{(j)} - c_j\|^2 ,$$

where $\|x_i^{(j)} - c_j\|^2$ is a chosen distance measure between a data point $x_i^{(j)}$ and the cluster centre c_j , is an indicator of the distance of the n data points from their respective cluster centres.

Comparing LTC Systems in Europe

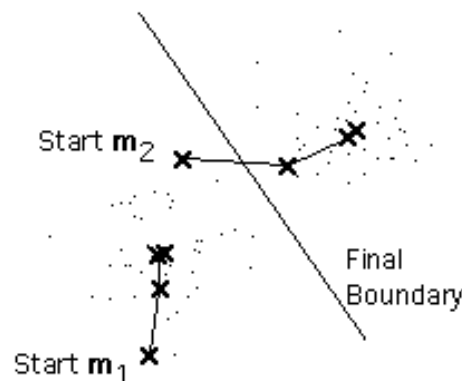
K-means clustering - The Algorithm (MacQueen,1967)

An example

Suppose that we have n sample feature vectors x_1, x_2, \dots, x_n all from the same class, and we know that they fall into k compact clusters, $k < n$. Let m_i be the mean of the vectors in cluster i . If the clusters are well separated, we can use a minimum-distance classifier to separate them. That is, we can say that x is in cluster i if $\|x - m_i\|$ is the minimum of all the k distances. This suggests the following procedure for finding the k means:

- Make initial guesses for the means m_1, m_2, \dots, m_k
- Until there are no changes in any mean
 - Use the estimated means to classify the samples into clusters
 - For i from 1 to k
 - Replace m_i with the mean of all of the samples for cluster i
 - end_for
- end_until

Here is an example showing how the means m_1 and m_2 move into the centers of two clusters.



Comparing LTC Systems in Europe

Results after cluster analysis

