Reallocation of Purchasing Power due to Demographic Change - The Case of North Rhine-Westphalia

Britta Stöver

gws

Gesellschaft für Wirtschaftliche Strukturforschung mbH
Heinrichstr. 30

D - 49080 Osnabrück

Britta Stöver (stoever @ gws-os.com)

Tel.: +49 (541) 40933-250

Fax: +49 (541) 40933-110

Internet: www.gws-os.com

March 2012

CONTENTS

ABSTRACT

The ageing process of populations due to demographic change affects the economy in various ways. The study at hand focuses on the reallocation of income and changes in consumption expenses caused by demographic change. Local disparities on NUTS 3 level are of special interest as the demographic effects can vary considerably between regions depending on their initial position such as population density, age structure, and economic condition. By means of data for the regions of North-Rhine-Westphalia (Germany) a dynamic purchasing power indicator is built that takes the development of different age groups into account and gives a first impression of the effects of ageing on the development of income and consumption behaviour. Regional discrepancies can be identified. While some regions are characterised by a static income situation, i.e. a more or less age independent development, others show distinct increases/decreases in their income caused by their specific structure of demographic change.

1 INTRODUCTION

Demographic change in the sense of an ageing population proceeds in many industrialised countries. The consequences and challenges resulting from ageing are hence of increasing interest to national governments and international organisations. Several large scale studies (see e.g. IMF 2004, European Commission 2011, OECD 2011) assess the impact of demographic change and possible ways to soften or circumvent negative influences on country or international level. But the extent of the demographic effects not only varies between countries but also between regions within one country. The regional differences depend on the initial position such as population density, age structure, and economic condition. As the regional disparities can be considerable (Neu 2012), they should be included in the analysis of ageing to provide a complete picture and to give hints on the weaknesses in a country.

The aim of the study is twofold. First, it wants to give an impression on the impact of demographic change on income and consumption on regional level. Second, the method of region specific purchasing power indicators is enhanced by projecting an age dependant purchasing power indicator into the future.

As it is often the case in empirical studies the data constitutes the major obstacle. Especially information on regional level is quite rare. For the study at hand information on the consumption expenditures and the income composition by age groups on NUTS 1 level is available for the year 2008. The limited data availability restricts the application of complex econometric methods and modelling methodologies. The construction of an indicator is one way to overcome the data problem. It offers the opportunity to get an idea of the consequences of demographic change on regional level. In order to provide a vivid picture regional is meant to be NUTS 3 level. There are 413 NUTS 3 level regions within Germany. [1] For the sake of clearness, time and effort the indicator is modelled using the 54 regions of the German federal state North Rhine-Westphalia (NRW) as an example. This federal state has been chosen because it represents the average structure in Germany quite well. [2] The purchasing power indicator differentiates between regions on NUTS 3 level and takes the income situation and consumption behaviour of different age groups into account. More precisely, the author used the data to determine age group dependant disposable incomes and consumption shares on that income on NUTS 3 level. The resulting region and age group specific information was projected until 2025 using growth factors from estimated time series for income from the multidimensional, macro-econometric model PANTA RHEI REGIO II. The development of the age groups was taken from the coordinated population projection of BBSR (2010)[3]. The so derived dynamic purchasing

---

[1] Germany is composed of 16 federal states (NUTS 1 level) that are again administratively structured in 413 districts called "Kreise" (NUTS 3 level).

[2] The regions within NRW combine densely populated as well as rural areas, show very high and very low income levels, are confronted with different age compositions and demographic prospects and their production focuses on different sectors (industries, services, tourism, trade etc.).

[3] „Raumordnungsprognose 2025" of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

power indicator shows the effects of ageing on the development of income and consumption behaviour.

Compared to already existing purchasing power indicators on regional level[4], the projection of the indicator developed in this study is one of the major advantages. The shortfall of the other indicators is that they focus only on one point in time. This means that they are static and thus fail to show the prospective positive or negative factors due to changes in income or population. Moreover, they mainly indicate the purchasing power of an average representative consumer in the relevant region though it is shown in the data (Household budget survey) that the expenses and consumption structure differ considerably between different socio-economic groups. The information developed in this study is valuable for retail trade to assess market opportunities, future demand and purchasing power. It also supports the identification of regions with growing structural problems.

The results show that the initial income situation on absolute level will basically not change in the future. The households will be confronted with the region-specific income possibilities regardless their age. However, regarding growth rates in disposable income there can be found differences relating to age. Especially regions that started with a comparatively young population in 2008 show the highest increases in disposable income until 2020.

The paper is structured as follows. The next section discusses the impact of ageing societies. The first part (section 2.1) gives an overview over various effects evoked by demographic change. Section 2.2 goes in more detail and analyses consumption patterns of private households depending on age stating the importance to implement demographic components in purchasing power indicators. Section 3 contains the technical part. The data and model used to calculate the purchasing power is introduced in section 3.1. A detailed description of the structure and calculation procedure is given in section 3.2. Section 4 gives the results on NUTS 1 (section 4.1) as well as NUTS 3 level (section 4.2). Section 5 concludes the study.

2 THE IMPACT OF DEMOGRAPHIC CHANGE

2.1 OVERVIEW OVER THE CHALLENGES EVOKED BY AGEING SOCIETIES

Demographic change has manifold influence on the economy. At first glance it mainly affects the social security system. This has been already intensely discussed as for example in Blake and Mayhew (2006), Kerschbaumer and Schroeder (2005), Feldstein and Siebert (2002), Bohn (2001), and others. Infrastructure, educational systems, housing etc. have to be adapted to a changing composition of the population as well. Low birth rates for example result in fewer pupils followed by higher educational costs per students on the one hand and close-downs of schools and a smaller requirement of teachers on the other hand

---

[4] See e.g. the purchasing power index of GfK Geomarketing (http://www.gfk-geomarketing.com) or of MB-Research (http://www.mb-research.de/).

(Kempkes 2010). Especially rural areas must find a way to face these challenges. Declining water consumption calls for a restructured water management and a reorganised sewerage system (Lux 2009). Other infrastructure that is affected by the ageing society is that of transport, information and communication. In order to meet the needed possibilities to participate and the growing claim for mobility a well-structured net of public transport and a stable and fast telecommunication infrastructure should be guaranteed. While the number of persons declines the number of households still grows as large family households are replaced by 1 and 2-person households. This implies a huge challenge for the housing market. When children move out, parents often continue to stay in the now overly large dwelling. Consequently the demand for net dwelling area per person will increase, e.g. in Germany about 6% until 2025 (Sachverständigenrat 2011). Later on – as is stated in the Generation and Gender Survey – "in widowhood, a new situation also arises with respect to living arrangements. An individual could either continue living alone, find a new partner, move to one of the children, or move to an institution (p.398)." This will enhance the need for small apartments preferably in the cities considering centrality and short distances. Furthermore, as was first established by the life cycle theory (Fisher 1907[5], 1930, Ramsey 1928, Modigliani and Brumberg 1954), the financial situation of each household changes with age and the corresponding personal circumstances. It has been shown by several studies that the saving rate and hence the consumption vary with the age group of the consumer (Masson et al. 1998, Horioka 1997). The age composition of a population thus influences the amount consumed and saved. Fair and Dominguez 1991, Attfield and Cannon 2003 even explored the direct relationship of consumption, income and demographic effects. They also conclude that age structure strongly influences aggregate consumption. Fair and Dominguez (1991) show that the consumption to income ratio is lower for the prime-age people than for the young and old (p.1283). The results of Attfield and Cannon (2003) indicate that an ageing population, i.e. a growing proportion of old to all inhabitants, induce a reduction of overall per capita consumption for equivalent income levels (p.8). Thus, the future demographic development will alter the allocation of disposable income and the accumulation of saving/assets. The changed income situation induces changes in consumption behaviour and structure depending on the local demographic structure, birth rates and migration. The concentration of wealth on some age groups gives rise to inequality and can possibly trigger dissatisfaction of the other groups. Relating to that the reallocation of saved asset values and changing income distribution raise subjects like welfare and social equity. It also brings up the discussion of the right calculation of GDP and the measurement of happiness. But it also confronts the regular suppliers of consumption goods and services with a slowly changing demand. The influence of age on the consumer behaviour and the resulting impact of demographic change are discussed in more detail in the following section.

## 2.2   THE RELEVANCE OF AGE FOR INCOME AND CONSUMER BEHAVIOUR

It has been acknowledged by several studies that changing demographic factors influence consumption behaviour and the level of overall as well as specific consumption expenditures (see e.g. Liddle 2011, Buslei et al. 2007, Dowd et al. 1998, Pollak and Wales

---

[5]   Regarding the changing financial situation during lifetime chapter VI is of special interest.

1981). Direct effects are given by the number of consumers, i.e. with low birth rates that are not levelled by migration the demand for goods and services will decline in the long run. Prices can partly compensate the reduced amounts. Indirect effects occur by changes in demand patterns due to age, household size, profession, and habits. The age of the consumer gives already valuable information about the goods and services that are preferably purchased and the amount that will be spent.

However, the descriptive analysis of the data alone does not reveal a clear-cut development of the prospective regional consumption. Looking at Figure 1 it shows for NRW that the young and old spend more parts of their net income for consumption than the middle aged persons. At the same time the latter purchase most on an absolute level. In 2008 people aged 24 or less spent most of their net income for consumption purposes. The age groups 65 to 70 years and 70 to 80 years used more than 80% of their disposable income for consumption as well. The smallest part was used by the households from 35 to 45 years and 45 to 55 years. But in absolute terms this means about 2,500 Euro per household and month for consumption. Compared to that, the aforementioned very young and very old age groups loose some significance. This behaviour goes along with the life cycle model first theoretically established by Fisher (1907, 1930) and Ramsey (1928) and later on expanded and empirically applied by Modigliani and Brumberg (e.g. 1954). With that it is said that an individual borrows as young, saves as middle-aged and dissaves when old. Consequently, the part of net income spent for consumption is smallest when the private household is aged 35 to 65 years.

Figure 1:   **Share of consumption purposes on net income (blue bars, %) and absolute consumption expenditures (black dots, €) by age groups in 2008 for NRW**
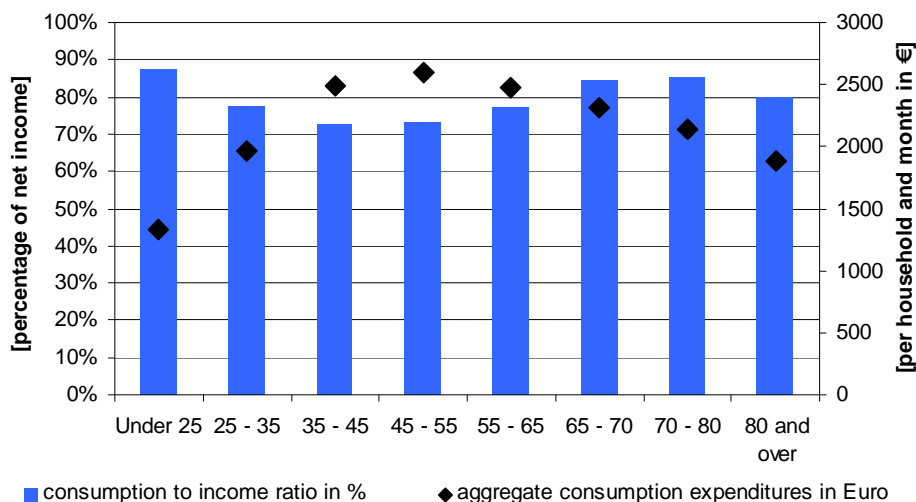
Source: Statistical Office NRW (2010), own calculations

The distribution of income and the ability to consume depends on the age of the consumer as well. Erlandsen and Nymoen (2008) tested for changes in the age structure to be an omitted variable in the consumption function. They prove evidence of the significance of age structure effects for the Norwegian aggregate consumption function. Put differently, the lower the disposable income, the more of it has to be spend for the basic living. So, when the principal earner is younger than 25 years the corresponding household has only half of the average net income available (see Table 1). Together, those

households contribute a minor part to the overall net income in NRW. Similar facts can be found for the age groups 25 to 35 years and from 65 years on. The most important households by contributing large parts of the overall income are the age groups 35 to 45, 45 to 55 and 55 to 65. They also have more than the average net income at their disposal.

Table 1:   Level and allocation of net income on average for age groups

Age groups	net income per household and month	proportion to average net income	share on aggregate net income
Under 25	1,505	49.9%	1.1%
25 - 35	2,478	82.1%	9.0%
35 - 45	3,366	111.5%	23.0%
45 - 55	3,495	115.8%	27.6%
55 - 65	3,154	104.5%	18.6%
65 - 70	2,708	89.7%	8.1%
70 - 80	2,481	82.2%	9.9%
Over 80	2,325	77.0%	2.7%
All	3,019	100.0%	100.0%

Source: Statistical Office NRW (2011), own calculations

Changes in the composition of the age distribution of the North-Rhine Westphalian society thus have an impact on income, saving and consumption. Looking at the demographic change displayed in Figure 2 the overall effect for aggregate consumption expenses remains unclear though. The households increasing in number show opposed financial means for consumption. Plus, most of the wealthiest age groups belong to the decreasing part of the population. So the part of medium aged households of the age groups 35 to 45 years and 45 to 55 years become less until 2020. In contrast, the households with members aged 55 up to 65 that also have high income levels grow in numbers. In 2020 they will represent the second biggest part of the society. Negative impact on consumption will have the growing population group of 80 years and older as their net income makes them to the second least important consumer group. Though gaining 3.0% of persons p.a. these households still continue to represent the second smallest group in 2020 keeping the negative consumption effect low. The third kind of consumers which is also growing but at a smaller rate is that from 25 years up to 35 years. In contrast to the oldest consumers they have 82% of the medium net income available and therefore purchase somewhat more goods and services but still only 84% of the average household.

To be finally able to assess the demographic effects on aggregate consumption the projection of the net income and the consumer behaviour into the future becomes important. Considering regional discrepancies a look at a more detailed level (NUTS 3) will also be important.

Figure 2:   Age structure in NRW in 2008 and 2020
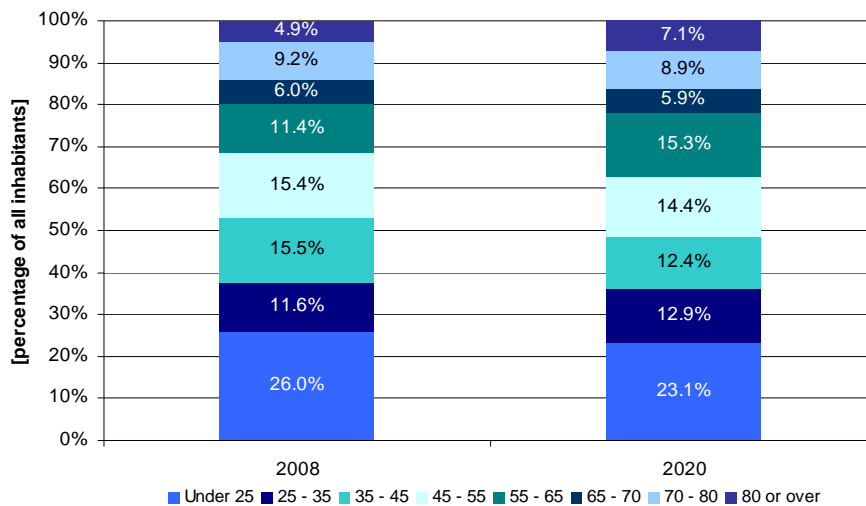
Source: BBSR (2009), own calculations

3   MODELLING THE PURCHASING POWER INDEX ON NUTS 3 LEVEL

In the following section a description of the data, the modelling environment and the calculation procedure is given. Special events like the economic crises in 2009 are not explicitly addressed, but implicitly considered in the projection.

3.1   THE BASIS – DATA AND MODEL

The calculation procedure of the purchasing power indicator bases on data from the Household Budget Survey (HBS) 2008 for NRW.[6] The sample gives information about the income and expenditure of private households differentiated by socio-economic attributes and is conducted on a five-year-basis. The participation is voluntarily and comprises 60,000 households. Accurate and reliable results are granted by plausibility checks. The Federal Statistical Office (2011) also states, that "representative data are obtained for almost all households since all social groups are covered by a quota plan and the results obtained are expanded on the basis of the relevant microcensus figures." Though, some parts of the population are neglected as "the EVS does not provide data on persons living in communal establishments and institutions […]. The EVS neither provides data on households with a monthly net income of Euro 18,000 or more as the number of these households participating in the survey is usually not sufficient to provide reliable information on their standards of living."

Comparing overall consumption expenditures and total disposable income with that provided by the System of National Accounts (SNA), the values deviate. Next to the restrictions indicated above, HBS also shows differences to SNA in so far as non-profit institutions serving households (NGOs, unions etc.) and payments in kind are neglected. Furthermore, in SNA the full price at the point of purchase is included irrespective of the

---

6   Einkommens- und Verbrauchsstichprobe (EVS), Statistical Office NRW (2010)

way of financing (e.g. by taking a loan) and imputed rents are calculated. Expenditures abroad and sales between households are integrated in HBS but not so in SNA. The highest impact on the discrepancy between HBS and SNA has most probably the missing information of rich households and imputed rents as well as the low coverage of expenses for "miscellaneous goods and services".

In this study, the data was not adjusted to the absolute level of National Accounts data so that the resulting time series based on HBS differ in aggregate values from SNA's consumption expenditures. The adjustment was not necessary as both time series are not directly compared with each other. Furthermore, the results aimed at (purchasing power on NUTS 3 level for different age groups) can be solely derived from HBS and have no corresponding values in SNA. Both time series show the same development. This is due to the fact that the consumption and income structure extracted from HBA is projected by growth rates from the model PANTA RHEI REGIO II which bases on the SNA. So PANTA RHEI REGIO II serves as a trigger for the sub-module NRW.

PANTA RHEI REGIO II projects the economic development of 413 regions on NUTS 3 level until the year 2025 and was applied in several studies (see e.g. Distelkamp et al. 2011, Stöver et al 2010, Distelkamp and Ulrich 2009). It is an extended version of the macro-econometric simulation and forecasting model INFORGE and its module LÄNDER.[7] INFORGE is based on a bottom-up principle i.e. each sector of the economy is modelled in great detail and the macro-economic aggregates have to be calculated by explicit aggregation within the model. This bottom-up principle and the ideas of full integration and bounded rationality are maintained in the regional model. The data sets consist of national statistics, mainly (regional) National Accounts and harmonise with the System of National Accounts. The regionalisation combines both top-down and bottom-up approaches. Thus, the model incorporates demographic and economic developments as well as disaggregated economic structures by sectors. The population development is given exogenously by the regional forecast study "Raumordnungsprognose 2025" of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2010). A schematic overview of the construction design of PANTA RHEI REGIO II is given in Figure 3.

---

[7] An overview of the model INFORGE can be found in the annex. For more detailed information see e.g. Schnur and Zika, G. (2009).

Figure 3: **Design of the model PANTA RHEI REGIO II**
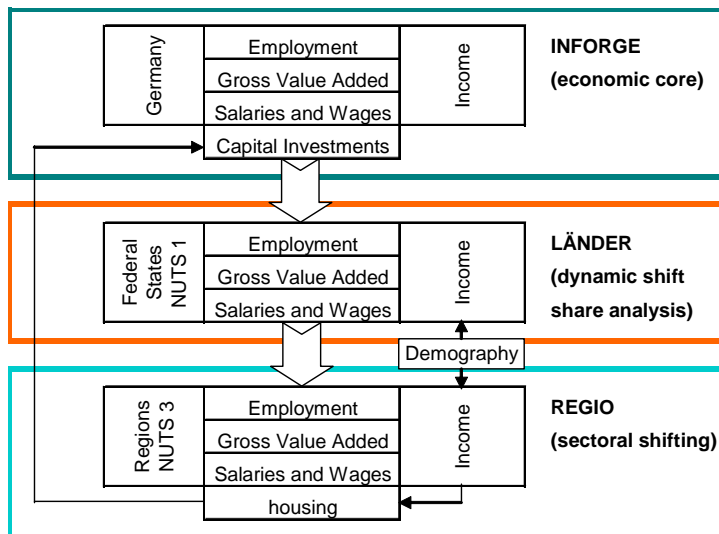
Source: GWSmbH

Based on the economic structure and the interdependences between twelve economic sectors, gross value added on NUTS 1 level (16 federal states) is calculated. Connections and interrelations between the different states as well as shifts in economic structures are considered.

The projection of the development on NUTS 3 level in the module REGIO is carried out in a similar way. Due to the restricted availability of data on the smaller regional scale only seven economic sectors are distinguished. The resulting regional projections of basic economic indicators are linked to the nation-wide developments (structural and technological change). An econometric shift-share approach is applied to the most detailed structural data available. Furthermore, employment and productivity were linked to the regional development of disposable income (via compensation of employees and distributional income effects). Moreover, a bottom-up approach was used for the modelling of housing and construction. The changes in population and the total number of private households were implemented and linked to economic variables.

For the problem at hand the projection of disposable income and the demographic development are needed. They were used for the calculation of the purchasing power described below.

3.2 MODELLING PURCHASING POWER IN NRW

Age significantly influences the willingness and the possibilities to consume and thus should be considered when looking at purchasing power. The descriptive analysis is insufficient to reveal the future distribution of income and can only fail to predict the prospective regional consumption expenditures.

The methods as applied by Masson et al. (1998), Horioka (1997), Fair and Dominguez (1991) or Attfield and Cannon (2003) for example can be used to show the effects of ageing societies. The disadvantage of those procedures is that they are also implemented to justify the life cycle theory and thus base on long time series. In this study the relevant data only consists of one point in time. Furthermore, the focus is on the implications of the thus

far shown importance of the age group composition on regional level. Neu (2012) stress the importance to analyse on regional level as the regional disparities concerning ageing, socio-demographic factors, wealth, living condition etc. are considerable. So the main point in this study is to identify regions that will be faced with a favourable age structure of their inhabitants regarding consumption.

Starting by the assumption that income is different for each age group as well that each age group represents a specific share of consumption on income a purchasing power index is constructed that permit to compare the prospective consumption expenditures in the NUTS 3-regions. Whereas normally purchasing power regards the value of money[8] in this analysis it rather indicates the value of income and consumer behaviour depending on age.

The possibility of cohort effects i.e. generation specific behaviour that transverses the age groups with the generation, is neglected. This can be legitimate by the data set and missing information on regional level. Though it would be possible to extract cohort effects with only three data point as was done by Buslei et al. (2007) for Germany, this cannot be done for NUTS 3 level as there is no data. Thus, assumptions regarding the relation of the cohorts' behaviour on NUTS 1 to NUTS 3 level would have to be made that cannot empirically be tested. Therefore, to keep this analysis simple it was refrained from caring about cohort effects.

The regional purchasing power is considered to depend on the disposable income of the different age groups and their weight on the local population. Based on that, the calculation procedure is as follows. Population data consisting of eight age groups j and a bulk sum on NUTS 1 and NUTS 3 level for North Rhine Westphalia (NRW) from the coordinated population projection of BBSR has been integrated into the model PANTA RHEI REGIO II.

In a next step, the disposable income (ni) of the eight different age groups is generated on NUTS 1 level subject to the development (gp) of number of people ($pers$) in each group j as displayed in Formula (1). More precisely, the i components of net income (nic) - gross income, income from assets and rent and lease, income from public and non-public transfer payments less taxes and social security contribution - grow with the same factor (gic) as the projected equivalent quantities of the SNA (nic^{SNA}). Variation is induced by the changing composition of the age groups and their specific income structure. The result is a time series for disposable income by age groups (ni_j) in NRW from 2008 to 2025.

(1) $ni_{jt} = gp_{jt} * \sum_{i=1}^{6} gic_{it} * nic_{ij,t-1}$, with

$$gp_{jt} = \frac{pers_{jt}}{pers_{jt-1}}$$

$$gic_{it} = \frac{nic_{it}^{SNA}}{nic_{it-1}^{SNA}}$$

i: income component $\quad$ $i = 1...6$
j: age group $\quad\quad\quad$ $j = 1...8$

Furthermore, the share of consumption on disposable income by age groups (cs_j) was calculated for the year 2008. This share is assumed to be constant for the remaining years

---

[8] Purchasing power is defined by Fisher (1922) as follows: "The purchasing power of money is indicated by the quantities of other goods which a given quantity of money will buy." (§1 II.12)

until 2025. The size of consumption expenditures (c_j) changes according to the change in disposable income (ni_j):

$$(2) \; c_{jt} = \overline{cs}_j * ni_{jt}$$

One now could analyse the impact of demographic change on consumption and the purchasing power for NRW. To get a more detailed look, the age dependant consumers' behaviour and purchasing power has to be further disaggregated on NUTS 3 level. Difficulties arise as the number of available information and data reduces enormously with higher levels of disaggregation. Thus, in order to receive the necessary information, more simplifications have to be accepted.

Starting with the income side, disposable income (ni) according to different age groups j in region k is calculated by using the ratio of an average household's disposable income ($niph$) on NUTS 3 to NUTS 1 level (niq). In combination with the per capita age dependant disposable income on NUTS 1 level ($nipc_j$) and the number of persons ($pers$) in each age group j on NUTS 3 level k one gets the relevant income quantities:

$$(3) \; ni_{jkt} = pers_{jkt} * niq_{kt} * nipc_{jt} \text{, with}$$

$$niq_{kt} = \frac{niph_{kt}}{niph_t^{NRW}}$$

$$nipc_{jt} = \frac{ni_{jt}^{NRW}}{pers_{jt}^{NRW}}$$

j: age group $j=1...8$
k: region $k=1...54$

Again, taking the share of consumption calculated before on NUTS-1-level-net income (cs_j), information on consumption expenses (c) for different age groups j in region k results:

$$(4) \; c_{jkt} = \overline{cs}_j * ni_{jkt}$$

Purchasing power (PP) in the region k is finally given by the sum of consumption expenses of all age groups j:

$$(5) \; PP_{kt} = \sum_{j=1}^{8} c_{jkt}$$

4   THE PURCHASING POWER IN 2020

In the next sections the results calculated for NRW and its regions are presented. The main focus is the outcome in 2020 which is compared with the year 2008. The results are given in current prices. As discussed above the consumption patterns of each age group remain unchanged during the observation period leaving cohort effects unconsidered.

4.1   THE CASE FOR NORTH RHINE-WESTPHALIA

Having in mind the opposing positive and negative demographic developments described in chapter 2 a first result is that the positive effects prevail. As can be seen in Table 2 consumption expenditures in NRW will be 15% higher in 2020 than in 2008 and

sum up to 277 billion Euros. From 2008 to 2020 the expenses grow by 1.2% p.a. on average. One has to bear in mind that the results are expressed in current prices.

The households that foster the current growth are those aged 80 years and more, aged between 55 and 65 years and between 25 and 35 years. They increase their consumption spending significantly more than the others. In sum this is sufficient for the overall positive increase in consumption expenditures. The group from 35 to 45 years is the one with the opposite effect on demand by diminishing their consumption expenses. The consumers younger than 25 years have nearly no impact as they do not change their amount spent for consumption purposes over the years.

Per capita expenses increase independent of the age of the household members. This is due to a growing disposable income level for all types of income components. Thus, the influence and impact of the diminishing number of persons with their consumption specific behaviour due to demographic changes is much higher.

Table 2:   **Development of consumption in NRW**

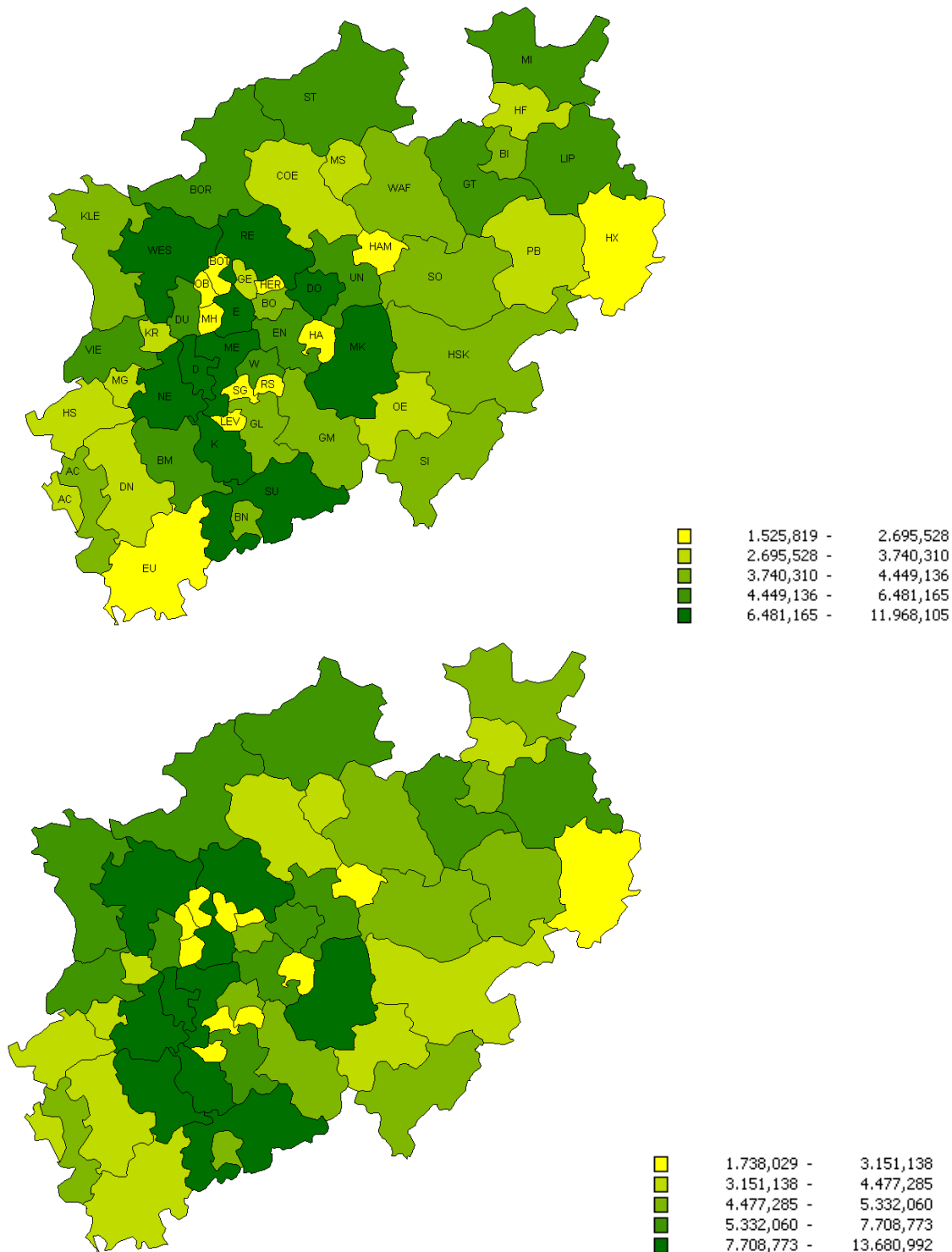| Age groups	consumption expenditures in million EUR		Absolut change	Average annual change
	2008	2020		
Under 25	2.987	2.984	-0,1%	0,0%
25 - 35	21.836	27.228	24,7%	1,9%
35 - 45	52.185	47.132	-9,7%	-0,8%
45 - 55	63.392	67.164	6,0%	0,5%
55 - 65	44.886	68.289	52,1%	3,6%
65 - 70	21.492	24.415	13,6%	1,1%
70 - 80	26.514	29.457	11,1%	0,9%
Over 80	6.623	10.746	62,3%	4,1%
All	**239.915**	**277.415**	**15,6%**	**1,2%**

Source: GWSmbH

4.2   THE DEVELOPMENT ON REGIONAL LEVEL

With regard to the different consumption behaviour depending on age the situation in the individual regions within NRW might be quite diverse. The regions on NUTS 3 level having the highest consumption expenditures in 2008 as well as 2020 are Cologne (K), Rhein-Sieg-Kreis (SU), Mettmann (ME), Recklinghausen (RE) and Düsseldorf (D) (see Figure 3). Here, the population in each region spent over 7.8 billion Euro in 2008 and will rise the amount over 8.7 billion Euro till 2020. In comparison the population of the regions Bottrop (BOT), Remscheid (RS), Herne (HER), Höxter (HX) and Leverkusen (LEV) spent less than 2.0 billion Euro in 2008. This amount will not increase much till 2020 so that these regions remain the ones with the lowest purchasing power.

The contrast between the regions results from differences in income levels and numbers of inhabitants. The development of net income, population size and purchased goods and services is much more similar than the absolute levels show. The number of persons more or less stagnates in all indicated regions (see **Table 3**). While population in Rhein-Sieg-Kreis (SU) and Düsseldorf (D) still grows very slowly by 0.4% and 0.1 % p.a. the other regions lose inhabitants by rates between -0.1% and -0.6% per year. In Cologne (K)

population stays constant. The groups that are strongly growing in all regions are those between 55 years and 64 years and 80 years and older.

Figure 4:   Consumption expenditures on NUTS 3 level in 2008 and 2020 [Mill. EUR][9]

1.525,819 -	2.695,528
2.695,528 -	3.740,310
3.740,310 -	4.449,136
4.449,136 -	6.481,165
6.481,165 -	11.968,105

1.738,029 -	3.151,138
3.151,138 -	4.477,285
4.477,285 -	5.332,060
5.332,060 -	7.708,773
7.708,773 -	13.680,992

Source: GWSmbH

---

[9]   The figure's legend displays numbers in German notation with decimal comma instead of point. The groups are equally distributed. This applies to all maps in this paper.

Table 3: **Average annual demographic change [% p.a.] between 2008 and 2020**

	All	Under 25	25 - 35	35 - 45	45 - 55	55 - 65	65 - 70	70 - 80	Over 80
					Age groups				
Top 5 - highest level of consumption expenditures									
Cologne, K	0.0	-0.1	-0.3	-1.2	0.1	1.8	-1.4	-0.2	2.7
Rhein-Sieg-Kreis, SU	0.4	-0.9	1.3	-1.4	-0.1	2.8	-0.1	0.9	3.9
Mettmann, ME	-0.3	-1.5	1.0	-2.4	-0.6	1.8	-1.6	0.0	4.1
Recklinghausen, RE	-0.5	-1.8	0.5	-2.5	-1.1	1.7	0.5	-0.4	2.6
Düsseldorf, D	0.1	0.0	0.0	-1.3	0.5	1.6	-1.5	-0.5	2.5
Top 5 - lowest level of consumption expenditures									
Bottrop, BOT	-0.4	-1.5	0.8	-2.2	-1.2	1.7	0.6	-0.6	2.5
Remscheid, RS	-0.6	-1.3	0.7	-2.4	-1.5	1.3	-1.8	-0.7	2.5
Herne, HER	-0.5	-1.5	0.5	-2.6	-1.0	1.6	0.0	-0.8	1.7
Höxter, HX	-0.5	-1.8	0.2	-2.9	-1.3	2.8	0.6	-0.9	2.6
Leverkusen, LEV	-0.1	-0.8	1.1	-1.9	-0.6	2.2	-1.5	-1.5	4.1

Source: BBSR (2009), own calculations

Regarding the changes in income shown in Table 4 the households of the indicated regions can expect an average rise of around 1% p.a. between 2008 and 2020. Exceptions are those living in Remscheid (RS) and Rhein-Sieg-Kreis (SU) showing growth rates of 0.5% p.a. and 1.8% p.a. Again, the age groups with the highest increasing net incomes are those indicated before namely when aged 80 years and more, 55 to 65 years and 25 to 35 years.

Table 4: **Average annual change in net income [% p.a.] between 2008 and 2020**

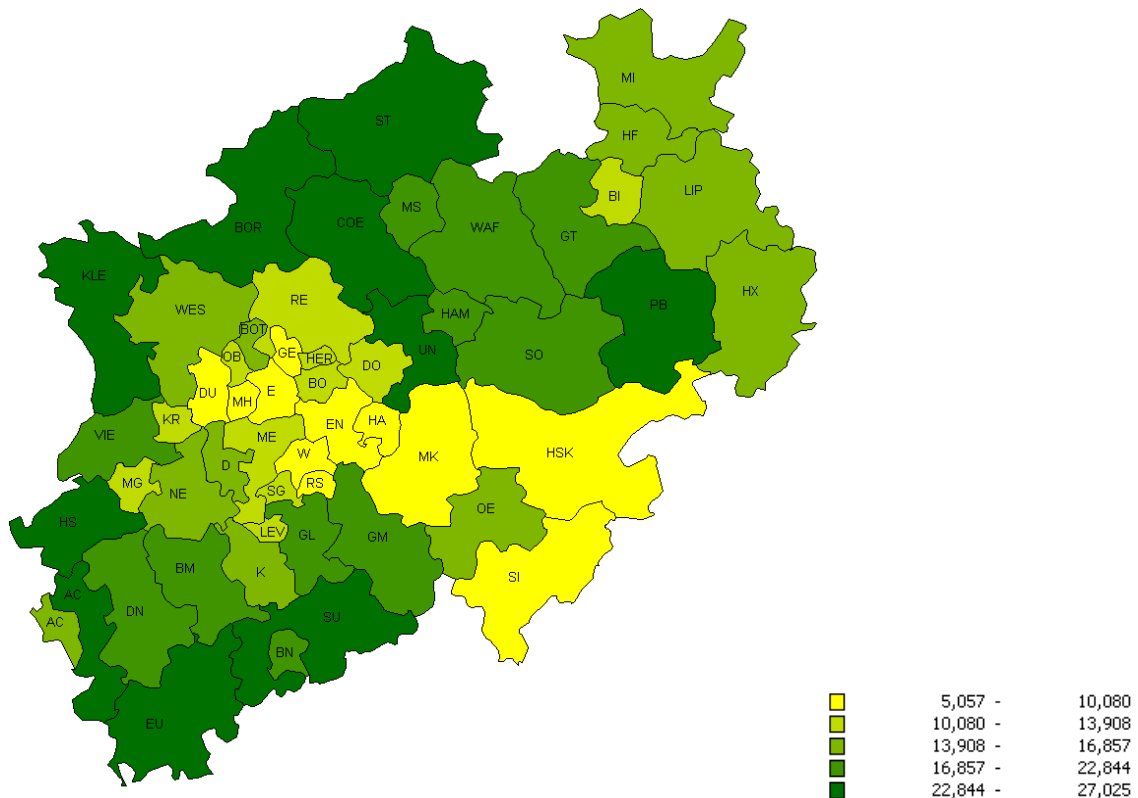|	All	Under 25	25 - 35	35 - 45	45 - 55	55 - 65	65 - 70	70 - 80	Over 80
					Age groups				
Top 5 - highest level of consumption expenditures									
Cologne, K	1.1	0.9	0.7	-0.1	1.2	3.0	-0.2	1.0	3.7
Rhein-Sieg-Kreis, SU	1.8	0.3	2.5	-0.2	1.1	4.1	1.2	2.2	5.1
Mettmann, ME	1.0	-0.4	2.1	-1.2	0.5	2.9	-0.4	1.2	5.2
Recklinghausen, RE	0.8	-0.7	1.5	-1.4	0.0	2.9	1.7	0.7	3.7
Düsseldorf, D	1.1	0.9	1.0	-0.2	1.6	2.7	-0.4	0.6	3.4
Top 5 - lowest level of consumption expenditures									
Bottrop, BOT	1.0	-0.3	2.1	-0.9	0.1	3.0	2.0	0.7	3.8
Remscheid, RS	0.5	-0.3	1.7	-1.3	-0.4	2.5	-0.6	0.5	3.6
Herne, HER	0.9	-0.2	1.8	-1.3	0.4	3.0	1.4	0.6	2.9
Höxter, HX	1.1	-0.6	1.5	-1.5	0.1	4.2	2.0	0.5	3.9
Leverkusen, LEV	0.9	0.1	2.1	-0.9	0.4	3.3	-0.5	-0.5	5.0

Source: GWSmbH

Summarising, the aforementioned regions keep their position regarding very high/low income levels. The inhabitants do not need to adapt their consumption behaviour to a completely new income situation and generally can afford more/less than in other regions independently of the age structure within the region. The reason lies in a quite identical development of demography and income.

But there are also regions that change their initial situation by showing higher/lower growth rates. The most prospective regions regarding high increases in demand for consumer goods and services are those where the people in the prosperous age groups are living in the future. Regions that show a declining number of people in those age groups are less promising. The highest rise in consumption expenditures can be expected in Paderborn (PB), Coesfeld (COE), Rhein-Sieg-Kreis (SU), Borken (BOR) and Kleve

(KLE). Figure 5 shows that the growth rates range from 22.8% in Kleve (KLE) to 26.5% in Paderborn (PB). The high growth rates can be mainly explained by the fact that the number of persons living there augment more strongly in the next decade than in other regions (see Table 5). Especially the group between 55 and 65 years becomes larger having on average 4% to 5% more net income per year (see Table 6). The development of the consumers aged 80 years and older is quite similar. On a somewhat smaller pace the increase of the age group from 25 to 35 years contributes demand and purchasing power as well. Its income will grow by around 2.5% p.a. In contrast to the other regions, Paderborn (PB), Coesfeld (COE) and Kleve (KLE) also have a growing number of inhabitants aged from 65 to 80 who support demand.

The opposite development show Hagen (HA), Remscheid (RS), Gelsenkirchen (GE), Duisburg (DU) and Mülheim a.d.R (MH) staying behind with the lowest growth rates for consumption (see Figure 5). This is due to an overall reduction in population between 2008 and 2020 that ranges from -0.5% p.a. to -0.8% p.a. (Table 5). The only comparably small rise in number of people of the age groups 55-56, over 80 and 25-35 years cannot compensate the high decrease in the other age groups. So, the average annual increases in income over all households lie only between 0.4% and 0.6% even suggesting a reduction in real terms (Table 6). Looking at the age groups worse off, consumers under 25 years, between 35 and 45 years and between 45 and 55 years have annually lower available net income. It shrinks in average about 0.3% p.a., 1.3% p.a. and 0.3% p.a. respectively. The contribution by the consumers' income aged from 55 to 65, 80 and more as well as from 25 to 35 is lower than in other regions and therefore not relieving the demand situation.

Figure 5: **Growth of retail trade relevant expenditures between 2008 and 2020 [in %]**

Source: GWSmbH

Table 5: **Average annual demographic change [% p.a.] between 2008 and 2020**

	All	Under 25	25 - 35	35 - 45	45 - 55	55 - 65	65 - 70	70 - 80	Over 80
					Age groups				
Top 5 - highest growth rates of consumption expenditures									
Paderborn, PB	0.3	-0.9	0.7	-1.2	-0.6	3.6	1.4	0.1	3.2
Coesfeld, COE	0.2	-1.4	1.0	-2.2	-0.4	3.5	1.5	1.0	3.7
Rhein-Sieg-Kreis, SU	0.4	-0.9	1.3	-1.4	-0.1	2.8	-0.1	0.9	3.9
Borken, BOR	0.2	-1.2	1.0	-2.2	0.0	3.7	1.0	-0.2	4.2
Kleve, KLE	0.2	-1.2	1.3	-2.1	-0.2	3.0	1.2	0.6	3.3
Top 5 - lowest growth rates of consumption expenditures									
Hagen, HA	-0.8	-1.5	0.7	-2.7	-1.7	1.3	-1.2	-1.5	2.3
Remscheid, RS	-0.6	-1.3	0.7	-2.4	-1.5	1.3	-1.8	-0.7	2.5
Gelsenkirchen, GE	-0.8	-1.6	0.5	-2.6	-1.6	1.4	0.0	-1.3	1.3
Duisburg, DU	-0.5	-1.3	0.8	-2.1	-1.3	1.6	-0.5	-1.8	2.4
Mülheim a.d.R., MH	-0.5	-1.5	1.0	-2.5	-1.2	1.4	-0.9	-0.9	2.6

Source: BBSR (2009), own calculations

Table 6: **Average annual change in net income [% p.a.] between 2008 and 2020**

	All	Under 25	25 - 35	35 - 45	45 - 55	55 - 65	65 - 70	70 - 80	Over 80
					Age groups				
Top 5 - highest growth rates of consumption expenditures									
Paderborn, PB	2.0	0.5	2.1	0.2	0.8	5.1	2.9	1.5	4.5
Coesfeld, COE	1.9	-0.2	2.2	-0.9	0.8	4.9	2.9	2.3	4.9
Rhein-Sieg-Kreis, SU	1.8	0.3	2.5	-0.2	1.1	4.1	1.2	2.2	5.1
Borken, BOR	1.8	-0.1	2.2	-1.0	1.2	5.0	2.3	1.1	5.3
Kleve, KLE	1.7	-0.1	2.5	-0.9	1.0	4.2	2.5	1.8	4.4
Top 5 - lowest growth rates of consumption expenditures									
Hagen, HA	0.4	-0.3	1.8	-1.5	-0.5	2.5	0.1	-0.3	3.4
Remscheid, RS	0.5	-0.3	1.7	-1.3	-0.4	2.5	-0.6	0.5	3.6
Gelsenkirchen, GE	0.6	-0.4	1.7	-1.4	-0.4	2.7	1.4	0.0	2.5
Duisburg, DU	0.6	-0.2	1.8	-1.0	-0.3	2.7	0.7	-0.6	3.5
Mülheim a.d.R., MH	0.6	-0.4	2.1	-1.4	-0.1	2.6	0.2	0.2	3.6

Source: GWSmbH

5   CONCLUSION

The introduced purchasing power index is able to identify regional discrepancies and reveal demographic effects on purchasing power. The households with the highest disposable income in NRW live in the cities and especially in the metropolitan areas along the Rhine. Due to favourable economic circumstances they are able to keep their wealthy status regardless the age of the households and the development of number of people living there. The region around the Ruhr, the formerly flourishing industrial area, is less promising. High unemployment rates and low disposable income levels can be identified as the main problems. In future, this situation within NRW will consolidate and even worsen. Next to the static regions there are also some that show a prospective development and can enhance their income situation. The highest increases in income and consumption can be expected in areas where the birth rates and the share of younger people in 2008 were comparably high. In 2020 those will be moved to the age groups with high net incomes and most probably even will have given birth to children as future consumers. They often live in more rural areas at the border of NRW.

The general results for NRW can be transferred to other German regions. Good prospects for rising consumption expenditures can be prophesied in metropolitan areas and big cities such as Munich, Nuremberg, Stuttgart, Rhine-Ruhr (Cologne, Düsseldorf), Berlin, Sachsendreieck (Leipzig, Dresden, Chemnitz and Halle), Frankfurt-Rhein-Main etc. Rural areas with young a population like Cloppenburg, Emsland, Borken, Grafschaft Bentheim or Biberach can look to the future with confidence as well. In contrast, locations that are faced with only slowly increasing or even shrinking future demand are situated in regions where a lot of inhabitants have no job, are old, the fertility rate is low or the population is already decreasing. For example, this is the case for most parts of Sachsen-Anhalt and Mecklenburg-Vorpommern, the Bavarian Forest, Northern part of Schleswig-Holstein etc.

A more detailed picture could be interesting and is a possible subject for future work. Being not part of this work price effects might be of higher interest as well. Most probably the low growth rates in income and consumption expenditures in some regions of NRW will be even negative when inflation is considered.

LITERATURE

Attfield, C.L.F. & Cannon, E. (2003): The Impact of Age Distribution Variables on the Long Run Consumption Function. Discussion Paper 03/546, University of Bristol.

BBSR [Hrsg.] (2009): Raumordnungsprognose 2025/2050. Bundesinstitut für Bau-, Stadt- und Raumforschung, Berichte Band 29, Bonn.

Blake, D. and Mayhew, L. (2006): On the sustainability of the UK state pension system in the light of the population ageing and declining fertility. The Economic Journal 116(512), pp. F286-F305.

Bohn, H. (2001): Social Security and Demographic Uncertainty: The Risk-Sharing Properties of Alternative Policies. In: Campbell, J.Y. and Feldstein, M. (eds.): Risk Aspects of Investment-Based Social Security Reform, University of Chicago Press, pp. 203-246.

Buslei, H., Schulz, E. & Steiner, V. (2007): Auswirkungen des demographischen Wandels auf die private Nachfrage nach Gütern und Dienstleistungen in Deutschland bis 2050. DIW Berlin: Politikberatung kompakt 26.

Distelkamp, M., Hohmann, F., Lutz, C., Ulrich, P. & Wolter, M.I. (2011): Blick in die Zukunft: Flächeninanspruchnahme bis 2020. Modellgestützte Projektion der Flächeninanspruchnahme in den Kreisen Deutschlands bis zum Jahr 2020. In: Bock, S., Hinzen, A. & Libbe, J. (eds.): Nachhaltiges Flächenmanagement - Ein Handbuch für die Praxis: Ergebnisse aus der REFINA-Forschung, Berlin, S. 32-38.

Distelkamp, M. & Ulrich, P. (2009): Sustainable settlement development - Assessing the effects of state measures in scenario analysis. Paper presented at the 15th International Sustainable Development Conference at the Utrecht University (Netherlands), July 2009, GWS Discussion Paper 2009/9, Osnabrück.

Dowd, T., Monaco, R. & Janoska, J. (1998): Effects of Future Demographic Changes on the US Economy: Evidence from a Long-term Simulation Model. Economic Systems Research, 10(3), pp. 239-262.

European Commission and the Economic Policy Committee (2011): The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies. European Economy 4/2011, European Union.

Erlandsen, S. & Nymoen, R. (2008): Consumption and population age structure. Journal of Population Economics, 21(3), pp.505-520.

Fair, R.C. & Dominguez, K.M. (1991): Effects of the Changing U.S. Age Distribution on Macroeconomic Equations. The American Economic Review, 81(5), pp.1276-1294.

Federal Statistical Office (2011): Sample survey of income and expenditure (EVS). http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/press/abisz/Einkommens__Verbrauchsstichprobe__e,templateId=renderPrint.psml. Dated:10.05.2011.

Feldstein, M. and Siebert, H. (eds.) (2002): Social Security Pension Reform in Europe. University of Chicago Press, National Bureau of Economic Research.

Fisher, I. (1907): The rate of interest: its nature, determination and relation to economic phenomena. Macmillan, New York.

Fisher, I. (1922): The Purchasing Power of Money – Its Determination and Relation to Credit, Interest and Crisis. 2nd edition, Macmillan, New York, www.econlib.org.

Fisher, I. (1930): The theory of interest: as determined by impatience to spend income and opportunity to invest it. Macmillan, 1st edition, New York, www.econlib.org.

Horioka, C.Y. (1997): A Cointegration Analysis of the Impact of the Age Structure of the Population on the Household Saving Rate in Japan. The Review of Economics and Statistics, 79(3), pp. 511-516.

International Monetary Fund (2004): How will Demographic Change Affect the Global Economy? In: World Economic Outlook, September 2004: The Global Demographic Transition. Chapter III, p.137-180.

Kerschbaumer, J. and Schroeder, W. (eds.) (2005): Sozialstaat und demographischer Wandel – Herausforderungen für Arbeitsmarkt und Sozialversicherung. VS Verlag für Sozialwissenschaften, Wiesbaden.

Liddle, B. (2011): Consumption-driven environmental impact and age structure change in OECD countries: A cointegration-STIRPAT analysis. Demographic Research, 24, pp. 749-770.

Lux, Alexandra (2009): Wasserversorgung im Umbruch – Der Bevölkerungsrückgang und seine Folgen für die öffentliche Wasserwirtschaft. Campus Verlag, Frankfurt/New York.

Masson, P.R., Bayoumi, T., Samiei, H. (1998): International Evidence on the Determinants of Private Saving. The World Bank Economic Review, 12(3), pp.483-501.

Modigliani, F. and Brumberg, R. (1954): Utility analysis and the consumption function: an interpretation of cross-section data. In: Kurihara, K. (ed.): Post-Keynesian Economics, Rutgers University Press, New Brunswick, pp. 388-436.

Neu, M. (2012): Regionale Disparitäten. In: Bartelheimer, P., Fromm, S. & Kädtler, J. (eds.): Berichterstattung zur sozioökonomischen Entwicklung in Deutschland – Teilhabe im Umbruch, 1st edition, VS Verlag, Wiesbaden.

OECD (2011), Pensions at a Glance 2011: Retirement-income Systems in OECD and G20 Countries. OECD Publishing, http://dx.doi.org/10.1787/pension_glance-2011-en.

Pollak, R. & Wales, T. (1981): Demographic Variables in Demand Analysis. Econometrica, 49(6), pp. 1533-1551.

Ramsey, F.P. (1928): A Mathematical Theory of Saving. The Economic Journal, 38(152), pp. 543-559.

Schnur, P. & Zika, G. (Hrsg.) (2009): Das IAB/INFORGE-Modell – Ein sektorales makroökonometrisches Projektions- und Simulationsmodell zur Vorausschätzung des längerfristigen Arbeitskräftebedarfs. IAB-Bibliothek 318, Nürnberg.

Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2011): Herausforderungen des demographischen Wandels – Expertise im Auftrag der Bundesregierung. Wiesbaden.

Statistical Office NRW (2010): Statistical working table 2.4.4 from EVS: Einkommen und Einnahmen sowie Ausgaben privater Haushalte 2008 nach Alter der Haupteinkommensbezieher und -bezieherinnen und Haushaltstyp. Glied.Nr.: 05 2.4.4 01 V. Dated: 28.09.2010.

Stöver, B., Szlachetka, R. & Ulrich, P. (2010): Der Einzelhandel und die für ihn relevante Kaufkraft im regionalen Fokus. GWS Discussion Paper 10/3, Osnabrück.

Vikat, A., Spéder, Z., Beets, G., Billari, F.C., Bühler, C., Désesquelles, A., Fokkema, T., Hoem, J.M, MacDonald, A., Neyer, G., Pailhé, A, Pinnelli, A., Solaz, A. (2007): Generations and Gender Survey (GGS): Towards a better understanding of relationships and processes in the life course. Demographic Research, 17, pp. 389-440.

ANNEX

THE MODEL INFORGE

The model INFORGE (INterindustry FORecasting GErmany) can be used for forecasting and simulations and was already applied in many different studies (see e.g. Mönnig and Stöver 2010, Ahlert et al. 2009; Meyer et al. 2007). A model comparison confirmed the ability to simulate even detailed scenarios (Eurostat 2008, p. 527ff., BMU 2002, p. 104). Furthermore, it has been updated since 1996 on a yearly basis.

INFORGE consistently describes the annual inter-industry flows between 59 sectors, their contributions to personal consumption, government, equipment investment, construction, inventory investment, exports as well as prices, wages, output, imports, employment, labor compensation, profits, taxes, etc. for each sector as well as for the macro economy. The complete system of national accounts is integrated in the model.

Intermediate demand – endogenously explained and extrapolated to any point in time – is a key component of INFORGE. Intermediate demand is modelled using cost-push or autonomous technological progress, i.e. firms adapt their intermediate demand to price changes and innovation. As a result, the shares of intermediate consumption, salaries and wages as well as consumption of fixed capital in costs of production can vary. The varying material costs, personal costs and consumption of fixed capital formation to total production directly affect profit. The overall output of goods finally results from the sum of intermediate demand, final demand and balances of exports and imports of goods and services.

Being part of final demand, private consumption is modelled using 41 individual consumption purposes. Changes in consumption are determined by disposable income, which is adjusted for prices. The average price trend of individual consumption and relative prices are taken into account.[10] Other explanatory variables are demographic trend, time trends etc.

The development of the labour market is often of public and political interest. Total number of employees as well as unemployment rates are well known parameters. The need to investigate labour market interdependencies in detail calls for thoughtful modelling. The labour market combines technological progress, changes in prices and wages, overall employment as well as development of working hours. It thus represents one of the core areas within the model, and has a main impact on the iteration method and the interdependencies within INFORGE. Raises in wages and salaries, mostly achieved by collective bargaining between unions and employees, change the cost structure and consequently influence the price setting behaviour of firms. This again triggers adapting processes in demand. Simultaneously, the price setting behaviour and changes in wages combined with demographic trends define labour demand. The number of employed persons in each economic sector therefore depends on the price adjusted gross annual wage

---

[10] The relative price arises from the change of price for one good in relation to the average price trend. If one good gets more expensive compared to the average price of consumption the private household would generally reduce the share of that good in the whole consumption bundle. The price elasticities differ depending on the good and are empirically set.

rate of the same sector. A negative correlation between real wage and number of employees is assumed. Besides real wage, production is important, too, as an increase in production generally implies a larger labour input.

In the behavioral equations decision routines are modeled that are not explicitly based on optimization behavior of agents, but are founded on bounded rationality.

LITERATURE

Ahlert, G., Distelkamp, M., Lutz, C., Meyer, B., Mönnig, A. & Wolter, M.I. (2009): Das IAB/INFORGE-Modell. In: Schnur, P. & Zika, G. [Hrsg]: Das IAB/INFORGE-Modell. Ein sektorales makroökonometrisches Projektions- und Simulationsmodell zur Vorausschätzung des längerfristigen Arbeitskräftebedarfs. IAB-Bibliothek 318, Nürnberg, 15-175.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) (Hrsg.) (2002): Vierte und abschließende Stellungnahme des Beirats „Umweltökonomische Gesamtrechnung", Wiesbaden.

Eurostat (2008): Eurostat Manual of Supply, Use and Input-Output Tables. Luxembourg.

Kempkes, G. (2010): Rapid demographic change and the allocation of public education resources: evidence from East Germany. Discussion Paper Deutsche Bundesbank, Series 1: Economic Studies, No 16/2010.

Meyer, B., Lutz, C., Schnur, P. & Zika, G. (2007): Economic Policy Simulations with Global Interdependencies: A Sensitivity Analysis for Germany. Economic Systems Research, 19(1), pp. 37-55.

Mönnig, A. & Stöver, B. (2010): Change in Private Consumption Expenditure and its Consequences for the Economy – How Important is the Purchase of Cars? In: Počs, R., Auziņa, A. & Ozoliņa, V. [ed.]: Development and Applications of Multisectoral Macroeconomic Models, Riga, pp. 75-98.

Schnur, P. & Zika, G. (Hrsg.) (2009): Das IAB/INFORGE-Modell – Ein sektorales makroökonometrisches Projektions- und Simulationsmodell zur Vorausschätzung des längerfristigen Arbeitskräftebedarfs. IAB-Bibliothek 318, Nürnberg.