

The power of elderly consumers

- How demographic change affects the economy through private household demand in Germany

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PRELIMINARY RESULTS



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Abstract

The needs and desires of young and old people differ due to their living environment and habits. Hence their respective consumer behaviour and expenses are different as well. An ageing population is faced with a changing consumption structure compared to a population with stable age distribution. The objective of this paper is to quantify the impact of age specific consumer behaviour and demographic change on production and GDP components. It shows that the overall consumption expenses are lower. Next to that service sectors, especially household related health services, gain importance relative to industries providing consumer durables (e.g. furniture, consumer electronics). The changing consumption structure affects the whole economy but the direct effects on consumption expenditures are higher than the secondary effects on production and GDP components.

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1 Introduction

"Old men in the bad old days used to renounce, retire, take to religion, spend their time reading, thinking – thinking!"

The reduced or changing propensity to consume when growing old was prohibited in Aldous Huxley's "Brave new world" by preserving "[the] powers and tastes [at sixty] what they were at seventeen" (Huxley, 2008, p. 68). This was accomplished by indoctrination and conditioning all people on consumption, sex and the drug Soma. As we are not living in that kind of utopic society most industrial economies are faced with an ageing population and its changing needs and desires.

Demographic change challenges the economy in many ways. The impact on pension systems, health care, labour force etc. has already been widely analysed. An ageing population directly increases the number of retired persons, the need for nursing places and the contribution rates for social security systems for example. It also indirectly influences the production structure by shifts in the composition of final demand through changes in consumer behaviour.

The objective of this paper is to quantify the impact of age specific consumer behaviour and demographic change on production and GDP components. Consumption functions for consumption purposes on COICOP-2-level depending on the age structure of the German population are implemented in the macro-econometric input-output model INFORGE (INterindustry FORecasting Germany) developed by GWS. The model structure gives the opportunity to trace impact and linkages of changes in the structure of private household demand on production and other parts of the economy.

Two different scenarios are calculated and compared in order to quantify the impact of age induced changes in demand. The first scenario bases on the future population composition given by the population projection of the Federal Statistical Office. The results will be used as baseline. In the second scenario it is assumed that the population composition does not change, i.e. the shares of the single age groups stay the same over the projection period.

Due to demographic change shares of older age groups increase giving the specific consumption structure of elderly more weight. The result is a lower GDP compared to an economy with a stable population composition. Other characteristics are a demand shift from durable goods to services. Generally the direct effects on consumption expenses are considerably higher than the indirect effects on production. Production sectors are much more dependant on foreign demand showing hence higher reactions to changes in exports.

The paper is structured as follows. The next section starts with a short description about the calculation of consumption coefficients for age dependant consumer expenditures. Section 2.2 introduce the general structure of the model and is followed by the scenario assumptions. Section 2.4 gives the scenario results. Section 3 concludes.

2 Measuring the impact of elderly consumers

2.1 Coefficients for age dependant consumption expenditures

The estimation of consumption functions that take into account age specific behaviour are the main component for the simulation. The methodology and concept of those consumption functions was presented by the author at the EcoMod conference 2012 in Sevilla (forthcoming) and bases mainly on the concept of Fair and Dominguez (1991) and Erlandsen and Nymoen (2008). The structure and estimation procedure was refined and adapted as follows. The coefficients resulting from the regressions basing on quarterly data had to be implemented into a model with annual data (see section). Overcoming the problem of heteroscedasticity and autocorrelation by using generalised least squares including AR processes had to be discarded as lags during the year cannot be considered in the model with annual data. Hence, the former estimations were reestimated and evaluated with bootstrapping¹. The estimation approach proved to be robust. The bootstrapped regressions functions were carried out with annual data as well. The resulting annual coefficients proved to be very similar to the quarterly coefficients. Nevertheless, the quarterly coefficients were preferred over the yearly coefficients as the quality of the regressions with annual data was worse due to the short observation period (1991-2011).

Another discrepancy between consumption coefficients and model was the level of detail regarding consumption purposes (COICOP, Classification of individual consumption by purpose). The consumption functions basing on quarterly data encompass information on a 1-digit-level whereas the economic model uses information on 2-digit-level.

Summarising, the following steps were taken:

1. Main data source is the system of national accounts (SNA).
2. Age specific consumption shares on total consumptions on 1-digit-level are estimated by ordinary least squares and bootstrapped pairs method using quarterly SNA data. The estimation functions are of the general form $c_{it} = \alpha_0 + \beta_1 nicc_t + \beta_2 wicc_t + \beta_3 uer_t + \beta_4 (p_{it}/p_{jt}) + \delta_1 Z_{1t} + \delta_2 Z_{2t} + \varepsilon_t^2$ varying according to the significance of the parameters and

¹For a description of the bootstrapping method see e.g. Chernick (1999) or Davison and Hinkley (1997).

² c_{it} consumption share i on total consumption C_t , $nicc_t$ non-wealth income, $wicc_t$ wealth income, $nicc_t + wicc_t =$ disposable income, uer_t unemployment rate, p_{it}/p_{jt} cross price elasticities between good i and j with $i \neq j$, $Z_{1t} = \sum_{k=1}^8 k pop_{kt} - 1/8 \sum_{k=1}^8 k \sum_{k=1}^8 pop_{kt}$, $Z_{2t} = \sum_{k=1}^8 k^2 pop_{kt} - 1/8 \sum_{k=1}^8 k^2 \sum_{k=1}^8 pop_{kt}$. Z_{1t} and Z_{2t} indicate the age effects on the consumption shares. It is an indirect estimation of $\sum_{k=1}^8 \gamma_k pop_{kt}$ with $\sum_{k=1}^8 \gamma_k = 0$ and $\delta_0 = -\delta_1 1/8 \sum_{k=1}^8 k - \delta_2 1/8 \sum_{k=1}^8 k^2$. pop_{kt} is the share of age group k on total population.

the relative price elasticities. The values are in logarithms, real terms and per capita.

3. For the age specific shares on 2-digit-level the Household Budget Survey (HBS) was used as additional data source. The HBS gives information on the average monthly household expenditures by age groups for the year 2008³. It is assumed that the single age groups keeps their age group specific distribution of 2-digit-consumption purposes on the superior consumption purpose. Adding up the respective budget shares weighed by the age group shares gives the age dependant share of the 2-digit on the 1-digit consumption purpose: $c_n/C_N = \sum_{k=1}^8 ((c_{nk}/C_N) pop_k)$ ⁴
4. Thus, the 2-digit-consumption shares are influenced in two ways: directly by an shift in the age group weights and indirectly by changes in the estimated age dependant superior consumption shares.

The resulting age dependant consumption shares on 2-digit-level were integrated into the economic model INFORGE (INterindustry FORecasting Germany) developed by GWS. The model structure gives the opportunity to trace impact and linkages of changes in the structure of private household demand on production and other parts of the economy. The effect of ageing consumers and their specific behaviour on the economy can be simulated. The model is shortly described in the next section.

2.2 Model environment

INFORGE is a macro-econometric input-output model designed by GWS. The model has been used for economic forecasts and simulation or scenario analysis in many projects and studies. Amongst other features its structure follows the ideas of bottom up and full integration (Almon 1991). It bases on the system of national accounts and balancing items and incorporates interindustry relations on a high level of detail. Demand as well as the supply side are equally considered taking the interacting relationship between production sectors and private household demand as well as price effects into account. Irrationality and imperfect markets are allowed. It is annually updated and often combined with modules for specific projections and simulations (e.g. Maier *et al.* 2012, Ulrich *et al.* 2012, Drosdowski *et al.* 2010). The model projects until the year 2030.

³2008 is the latest edition. The HBS is updated every five years, i.e. the Federal Statistical Office conduct at the moment the survey for 2013. The results will be published most probably in 2015.

⁴ c_n consumption expenditures by purpose n on 2-digit-level, C_N consumption expenditures of superior consumption purpose N on 1-digit-level with $\sum c_n = C_N$, c_{nk} consumption expenditures by purpose n by age group k , pop_k share of age group k on total population. $\sum_{k=1}^8 pop_k = 1$.

The complete structure and methodology of the model is for example described in Ahlert *et al.* (2009) or as version for Austria in Stocker *et al.* (2011).

Overall, the model structure provides a good possibility to trace the effects of changing private demand on all parts of the economy. The impact on macroeconomic quantities as well as single industrial activities can be equally quantified.

2.3 Scenario Assumptions

The baseline shows the economic development under the ongoing demographic change. The ageing process runs according to the 12th coordinated population projection (Statistisches Bundesamt 2012) published by the Federal Statistical Office. The standard variant is chosen, i.e. V1W1 implying a total fertility rate of 1.4 children per woman, life expectancy of newborn babies in 2060 of 85 years for males and 89.2 years for females and a migration balance of 100,000 people per year from 2014 on.

The baseline is compared to a scenario with constant population composition. In the scenario the shares of the single age groups stay the same over the projection period. The total population will reduce according to the baseline in order to exclude any effects of quantity.

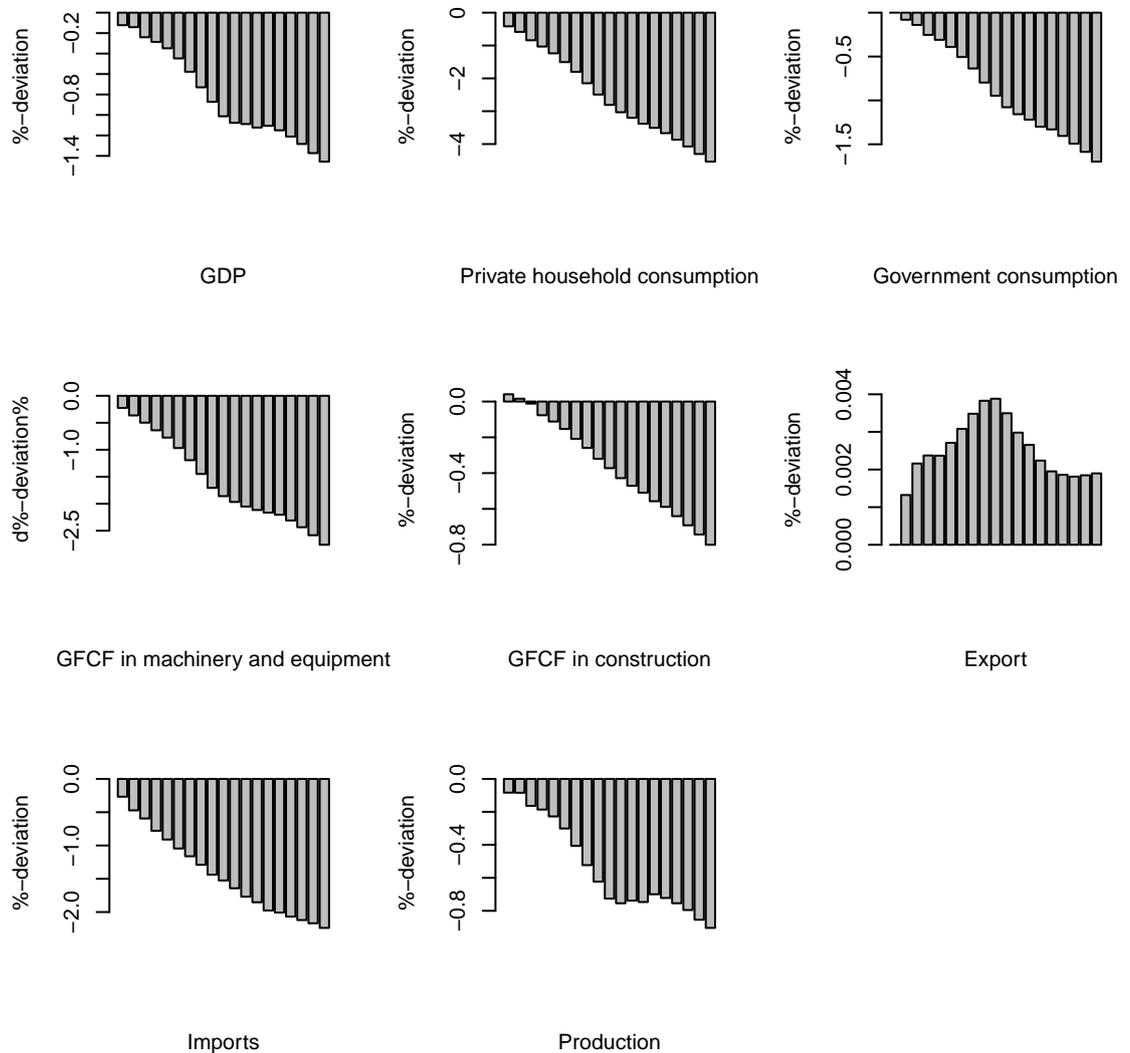
The simulation solely focus on changes in consumption expenditures due to a changing population composition. The aim is to show the effects on production and the whole economy resulting only from different consumer behaviour. As the effects would be minor compared to income effects, changes in the saving behaviour are not considered.

2.4 Scenario Results

The projection including an ageing population (BAU) is compared to the projection considering a constant population composition (SIM). The results are given in current prices. Figure 1 shows the percentage differences between the projections for the variables Gross Domestic Product (GDP), its components and production from 2012 to 2030. In general, the percentage deviation of all variables are relatively small in the first year of the simulation (2012) and increases when the differences in the population composition become more apparent. With an ageing population GDP is 1.5% lower in 2030 than with an unchanging population composition. This is mainly due to the fact that private households consume 4.5% less with an older population. Other sectors showing high deviations in 2030 are gross fixed capital formation (GFCF) in machinery and equipment as well as imports being 2.8% and 2.2% lower than with an constant population composition. Imports are negatively affected in two ways: firstly consumer goods are characterised by a high amount of imports, so that the overall reduction in consumption ex-

penditures reduces the need for imports. Secondly there can be identified a shift towards services that are less import intensive (see below). The government sector reduces its expenditures by 1.7%. The deviation for production and GFCF in construction lies quite low with under -1%, while almost no changes can be recognised for exports.

Figure 1: Percentage deviation for GDP, its components and production from 2012 to 2030



When going into more detail the highest negative impulses are caused by the consumption purposes communication, operation of personal transport equipment as well as furniture and furnishings, carpets and other floor coverings. In 2030 they are less consumed by about 36%, 19% and 19% due to the higher number of older consumers. Contrary to that, the consumptions expenses for outpatient and hospital services, for medical products, appliances and equipment as well as for education increase by 67%, 63% and 8% compared to the expenditures done by a non-ageing population. The complete deviation process is given in figure 2.

The age induced changes in private household demand transfer to production affecting some sectors positive and others negative. Economic activities that profit from an ageing population and its specific consumption behaviour are for example human health activities, the manufacture of basic pharmaceutical products and pharmaceutical preparations as well as Insurance, reinsurance and pension funding. In 2030, their output is higher by 14%, 6% and 2% compared to a situation with a constant population composition. The opposite is true for e.g. telecommunications, manufacture of food products, beverages and tobacco products as well as retail trade. Those economic activities would produce 16%, 8% and 7% more if the population composition did not change. Additional results for the highest/lowest deviations and the development from 2012 to 2030 are given in figure 3.

Figure 2: Highest and lowest percentage deviation for consumption expenditures by purpose from 2012 to 2030

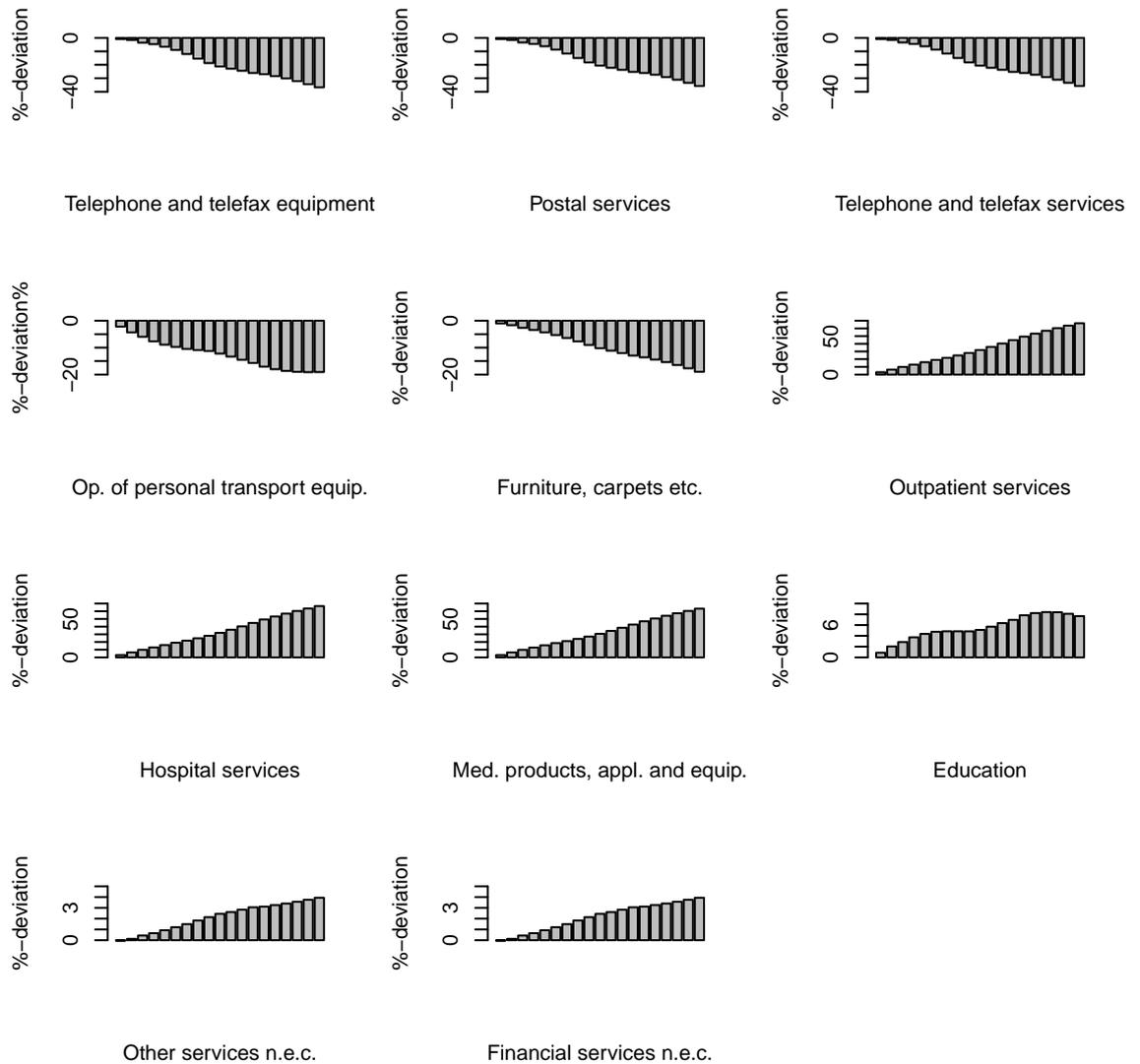
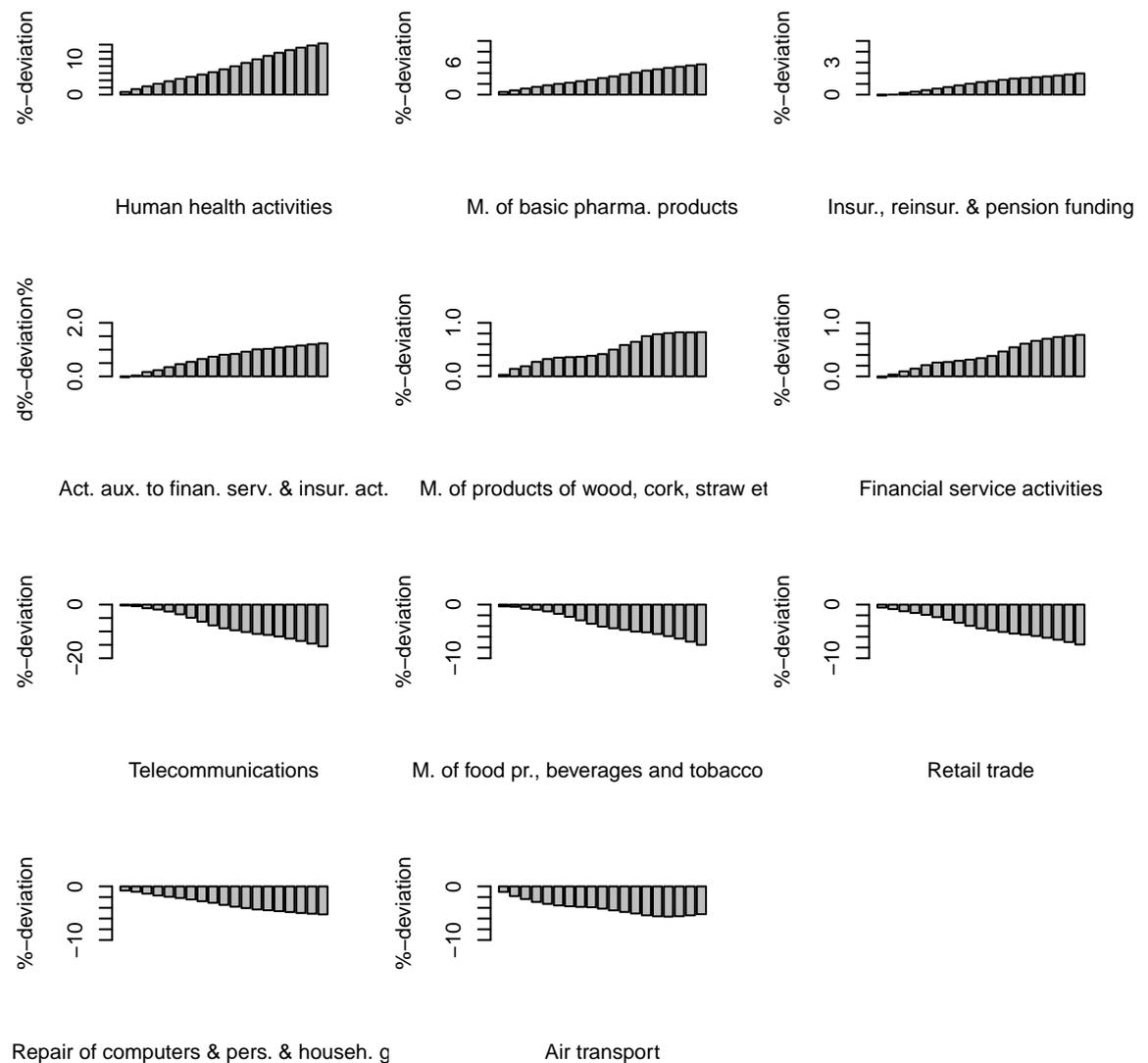


Figure 3: Highest and lowest percentage deviation for production by economic activities from 2012 to 2030



3 Conclusion

An ageing population consumes differently compared to a population with stable age distribution. The overall consumption expenses are lower. Concerning the kind of goods and services consumed the expenditures shift from durables like furniture to services especially connected to health. Overall,

the changing consumption structure affects the whole economy. However, the direct effects on consumption are much higher than the secondary effects on production and the other components of GDP.

It has to be noted that the paper solely concentrated on the domestic point of view, i.e. sectors that produce mainly for export are barely affected from changes in private household demand. But Germany is not the only country with an ageing population. Important trade partners also are in different stages of demographic change and will experience changes in the consumer behaviour. Similar to Germany their imports will alter as well giving a feedback to the German export-oriented industries. Taking the global development into account could possibly produce much higher changes for the production sectors and the GDP.

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