PAULA ALBURQUERQUE: ECONOMIC IMPACTS OF AGEING: AN INTERINDUSTRY APPROACH

1. Introduction

The contemporary demographic trends in western societies have increased the importance of studying the economic and social consequences of ageing. Broad demographic changes that started to take place after World War II are replacing a traditional pyramidal structure with an inverted pyramid (see Figure 1).

The main issues have been the labour market effects, the sustainability of social security systems and long-term care of the elderly (see, e.g. Fertig and Schmidt (2004); Onofri (2004); Poole and Wheelock (2005); Martins *et. al.* (2009)).

In this paper, we address a different research topic, quantifying the sectoral impacts of the evolution of consumption patterns associated with ageing, along the lines suggested in Dewhurst (2006) and Kronenberg et al (2008).

Firstly, we use data from the Family Spending Survey of 2005/06 published by Statistics Portugal (INE) to characterise the consumption patterns of Portuguese households by age of the reference person (Section 2).

Next, we make the correspondence between household consumption by COICOP commodity groups and (domestic) consumption demand directed to each of the 55 (input- output) industries with positive production in Portugal, then disaggregating the Household column of the Portuguese Input-Output Table into two different age groups (young and old) and comparing the respective sectoral structures (Section 3).

At this stage of our research, we use the demographic projections of INE until 2060 (presented in Section 4) to highlight (and quantify) feasible changes in the relative importance of specific productive sectors (Section 5).

In a future stage of research, we plan to quantify also the energy and environmental impacts of ageing in Portugal (for an interesting application to the German case, see Kronenberg et al, 2008) and integrate some flexibility in demand and supply behaviours on the lines of the study of demographic changes in the Chicago Region made by Yoon and Hewings (2006).

2. Consumption behaviour of households

Based on data from the Portuguese Household Budget Survey, 2005-06, Figures 2 and 3 below show the allocation of current consumption expenditure by age categories. Expenditures are aggregated into the following 12 categories (COICOP division):

01 - Food and non-alcoholic beverages

02 - Alcoholic beverages, tobacco and narcotics

03 - Clothing and footwear

04 - Housing, water, electricity, gas and other fuels

05 - Furnishings, household equipment and routine household maintenance

06 - Health

07 - Transport

08 - Communication

09 - Recreation and culture

10 - Education

11 - Restaurants and hotels

12 - Miscellaneous goods and services

Take in Figures 2 and 3

The middle-age households are those that consume more, on average. Of course, this is an average consumption per household and household composition is not independent of age. Expenditure on transport, education, recreation and culture, restaurants and hotels clearly declines with age, whereas the current older households spend a larger share of their budget on housing, water, electricity and fuel, or on health.

This paper assumes that this pattern will not change in the future – a strong assumption since tastes and purchasing power of different age categories may change, but a reasonable starting point - to measure the effect of the demographic composition of population on production.

3. Conversion of household spending into (domestic) consumption demand

3.1 Correspondence COICOP – NACE/CLIO

The impact of changes in consumption resulting from the modification of the demographic composition of the population must be obtained with the help of input- output matrices. These matrices use a different classification of goods and services - CPA instead of COICOP (for a full list of these classifications, see UN, 2008).

This fact causes a problem of conversion between the two classifications. Since it has not been possible to obtain a conversion matrix from INE, we use the corresponding matrix for Germany (published by the German Federal Statistical Office - Statistisches Bundesamt - and kindly provided to us by Tobias Kronenberg). Although this is a source of inaccuracy, we expect the consumption structure by age to be reasonably close between the two countries, since both are western European, developed countries.

With the data of the Household Budget Survey (INE, 2007), we were able to calculate the expenditure by product category that was made by households whose reference person was younger than 65 years old (*young households*) and the corresponding expenditure that was made by households whose reference person was 65 or older (*old households*). The calculated proportions are to be found in the appendix to the paper, in Table A.3.1. Data was weighted using the household weights provided in the survey.

Using the correspondence matrix, we allocated this expenditure to goods and services of the NACE/CLIO notation. This allowed us to calculate the proportion of produced commodities that was consumed by young households and the proportion consumed by old households.

3.2 Adjusting total consumption spending to domestic consumption demand

The procedure described in sub-section 3.1 leaves us with a column of total (or two columns of age-specific) consumption flows at purchaser prices (see Table A.3.2). In order to obtain domestic consumption flows at basic prices, necessary to calculate the sectoral production impacts on domestic firms only, we must consider several issues, namely, imported components of consumption, margins and (net) product taxes (for a discussion of these methodological issues, see Mongelli *et al.*, 2008).

Although we have matrices for the base year – 2005 – that allow us to make these adjustments (Dias, 2008), we opt not to do so this way, because at an early stage, we discovered (substantial) differences between actual total consumption, registered in the Total Flows Matrix at purchaser prices and estimated total consumption, using the Household Budget Survey, 2005-06.

To overcome this limitation, we apply to the actual value of domestic consumption at basic prices of 2005 the (vertical) structure of consumption (total and by age groups) calculated with the results described in sub-section 3.1.

Earlier, we made another simplifying assumption, considering null the consumption flows directed to Portuguese industries with null production in 2005 (these industries have been excluded from the analysis, as indicated in Section 5 below).

After completing these procedures, we have a column vector of estimated household domestic consumption demand by industry (at basic prices) in the base year 2005 (see Table A.3.3).

4. Projecting domestic consumption demand

In the next step, we project private consumption from 2005 to 2060, assuming constant the patterns of consumption of the old and young households and incorporating the demographic transformations that are expected.

The recent demographic projections issued by INE provide values for the expected number of individuals by age category. For this paper, we would have liked to have a household projection, but this does not exist. Therefore, we use another working assumption: that the expected change in the composition of households is zero, that is, we do not expect households in 2060 to be either larger or smaller than today.

We consider that the expected number of young households will rise in the same proportion as the number of young individuals and that the expected number of old households will rise in the same proportion as the number of old individuals. However, there are two alternatives when we calculate the growth rate of young and of old individuals: we may calculate the proportion of individuals under 65 and the proportion of individuals aged 65+ by comparison with the number of all individuals in the two years, or by comparing with the number of individuals aged 15 and over, since there are no reference persons in the survey under 15 years old.

In the first case, the base of comparison – the Portuguese population - is expected to decrease between 2006 and 2060; in the second case, the base of comparison – individuals older than 14 - is expected to increase. In both cases, we multiply the base year per household expenditures by the expected number of households in each age group in 2060. This leads to two different reference values of household expenditures.

However, the consumption patterns of young and old people are the same, this difference having only a level effect, which is not relevant for calculating the sectoral impacts.

In fact, we are only interested in capturing the impact on industry outputs of changes in the demographic age structure of population (and corresponding consumption patterns of young versus old individuals). So we proceed as if the total value of domestic consumption at basic prices in 2060 is exactly the value observed in 2005, but the projected vector of domestic consumption demand by industry is very different due to the substantial increase in the relative weight of old consumers, reinforcing some industries and diminishing the importance of others. The demographic figures used in this study are presented in Table A.4.1 and the vector of domestic household consumption projected for 2060 in Table A.4.2.

5. Sectoral impacts of demographic changes

Based on the methodologies and results described in the previous sections, we have the final demand changes presented in Table A.5.1. Our analysis embraces 55 industries, obtained after eliminating the industries with null production in 2005 (10 - Coal and lignite; peat; 11 - Crude petroleum and natural gas; 12 - Services incidental to oil and gas extraction excluding surveying; Uranium and thorium ores; 95 - Private households with employed persons).

We highlight the industries with the greatest (consumption) percentage growth and with the greatest decline in Tables 1 and 2.

Take in Tables 1 and 2

Taking into consideration the final demand changes induced by ageing trends, and using the well known output multipliers given by the Leontief inverse matrix of the base year (see Miller and Blair, 2009), we can calculate the industries' output changes between 2005 and 2060 (see Table A.5.2).

The main output percentage variations, positive and negative, are presented in Tables 3 and 4, respectively. Note that the numerical results and even the rankings of industries do not necessarily coincide with the previous ones, because of the indirect effects induced by the inter-industry linkages.

Take in Tables 3 and 4

6. Concluding remarks

In this paper, a first approach to the economic consequences of ageing in Portugal is made, with a particular incidence in multi-sectoral (or inter-industry) relationships.

After a brief description of the consumption patterns of households by age of the reference person, the separation is made between two major groups (*young*: between 15 and 64; *old*: 65 and over), the consumption structure of these groups being quantified using the Family Spending Survey of 2005/06, by commodity classification of COICOP.

Next, by applying an appropriate correspondence procedure to COICOP values, the *young* and *old* household total consumptions at purchaser prices by goods and services of the NACE-CLIO nomenclature are obtained.

After making some inevitable simplifying assumptions to deal with the problems of imported consumption, margins and commodity taxes, the structures of household domestic final demand directed at industries is calculated and used to generate base year (2005) sectoral productions. Supposing that these structures remain unchanged between 2005 and 2060, but considering the effects of demographic changes (the process of significant ageing of the Portuguese population visible in the demographic projections conducted by INE), we quantify final demand and productions in 2060 and the corresponding (significant) percentage changes in this long period of time, even if the values of global domestic consumption are the same in both of the limiting years.

As would be expected, some sectors gain importance in an ageing society (Medical instruments; Chemical products – pharmaceuticals; Health services; Electricity, gas and water, etc.), while other sectors suffer a relative decline (Public administration and defence services, compulsory social security services; Education services; Office machinery and computers; Radio, television and communication equipment and apparatus; Tobacco products; Other transport equipment; etc.).

Input-output analysis is a convenient methodology to quantify these changes, because it gives not only the

direct effects on demands and outputs but also the indirect and induced effects via multipliers and sectoral linkages.

However, the results of this type of study provide only approximate and very crude trend indications, since they are based on strong assumptions (constant consumption behaviour of each age group; fixed technologies; unchanged relative prices of goods, services and factors; etc.). This is why the extrapolations made in this paper are not predictions for the future. Nevertheless, they indicate the change in the relative importance of sectors resulting from the expected change in the population decomposition into *young* and *old*, using the available information that may be of use in devising economic, social and environmental policies in an ageing society.

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