Population Ageing and Sectoral Growth: The Case of the U.K., 2006-2026

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Abstract

This paper examines the relationship between age structure and the growth (decline) of product markets. The results are generated by a methodology that combines demographic and economic information. They are based on life-cycle theory that has a respected tradition in economics, marketing and gerontology. Empirically, the paper uses the latest family expenditure survey for the U.K. to systematically evaluate the impacts of population growth and ageing on sector growth and composition of the U.K. economy through the first two decades of the new millennium. The United Kingdom is a useful country since it is ageing like much of continental Europe, only not as fast, and at the same time it is not as young as the United States. It therefore represents a nice median between the two cases. Not surprisingly, the results confirm that population ageing benefits the heath sector and disadvantages the education sector. The results also indicate that the fuel and power (primarily gas and electricity) sector is a big winner, while the clothing and footwear sector is a big loser in a future ageing population. The reasons stem from a mixture of physiologically induced occurrences (e.g. as we age we become more sensitive to temperature change) and to global warming effects that amplify temperature extremes. Interesting results within sectors are presented, as well as the implications that demographic transitions may have for corporate strategy.

Introduction

In recent years the economic and social impacts of population ageing have received increasing attention in the OECD and throughout the developed world. Concerns with the future viability of pension plans and health care systems have captured particular attention and the impacts of ageing on labour force growth and hence economic growth are now recognized. What is perhaps less understood are the effects of age structure change on the components of spending and hence on sectoral growth. This paper addresses the latter question. In more precise terms, the idea motivating this paper is that age structure change provides a powerful (unifying) explanation for the long-run secular growth or decline of particular industries and sectors. Since the turn of the century most Western countries have experienced alternating periods of demographic booms and busts: for example, in the United Kingdom the low birth rate during the Great Depression and the war years was followed by the baby-boom of the 1950s and early 1960s and the baby bust of the 1970s and finally followed by the echo of the late 1980s and early 1990s. These birth waves have resulted in systematic changes in the age structure of the population over the last sixty years, roughly corresponding to periods of boom and bust in many sectors of the economy such as the boom and bust of stock-market to the growth and decline of the tourism industry.

This paper uses the latest family expenditure survey for the United Kingdom to systematically evaluate the impacts of population growth and ageing on sectoral growth and composition of the British economy over the first two decades of the new millennium. Britain is a useful country to look at since it lies between the fast aging countries of Continental Europe and the relatively younger populations of Australia, the United States and Canada. The results indicate that the fuel and power (primarily gas and electricity) sector is a big winner, while the clothing and footwear sector is a big loser in the future ageing British population. The reasons for growing energy consumption stem from a mixture of physiologically induced occurrences (i.e., as we age we become more sensitive to temperature changes)and to the effects of global warming which amplifies temperature extremes. Interesting results within sectors are also presented. For example, an ageing British population favours tea, coffee and milk over fizzy drinks, soft furnishings and bedding over furniture and hairdressing over cosmetics. Also, newspapers appear to have a better future than magazines, while the growth in horticultural-related products is over four times that of sports-related products. Finally, the results suggest that population ageing will continue to compound the problems in the British rail sector.

Theoretical Background

A general characteristic of population ageing is slowing population growth and, perhaps, population decline. A condition for population decline in the absence of immigration is that the death rate exceeds the birth rate. Currently, this demographic condition has already been achieved in a number of European countries including Croatia, Germany, Greece, Italy, Sweden and the Baltic nations (Estonia, Latvia and Lithuania) in the west and by Belarus, Bulgaria, the Czech Republic, Hungary, Moldavia, Romania, Russia and the Ukraine in the east. Many more countries are expected to be in this situation within the next few years including Austria, Belgium, Poland, Portugal, Slovakia, Spain and the United Kingdom. By 2025, the population of all Europe is projected to decline from 727 to 717 million people.

Associated with these demographic changes is a declining share of the population in younger age groups and an increasing share of the population in older age groups. Currently in Europe 18 per cent of the population is under age 15 and 15 per cent is 65 years and over. Within two decades these figures will be reversed. Currently, the countries of Northern and Eastern Europe, including the United Kingdom, have a slightly higher proportion in the younger age group while the countries of Western and Southern Europe have a slightly higher proportion in the older age group. While the exact shares in each country will be slightly different in the future, the ageing trends are universal.

Other developed countries outside of Europe are experiencing similar trends. Japan has already moved further along the ageing path than Europe with 17 per cent of its population 65 years and over and only 15 per cent under age 15. Its population will begin to decline by the end of 2005. Even in the United States, which is one of the youngest countries in the developed world (with 21 per cent under 15 and 13 per cent 65 and over), the impacts of population ageing are receiving considerable attention in the academic and policy literature.

Slowing and perhaps declining population growth presents considerable management challenges. Growth objectives for product sales become increasingly difficult to achieve and return on investment (ROI) is likely to decline even with no additions to company capital. Without sales growth,

resource allocations may require absolute rather than relative reductions, which can reduce flexibility and "nimbleness" in an increasingly competitive global marketplace.

One way to ameliorate or, perhaps, avoid this challenge is to operate globally and sell products and services in countries with younger populations. This might explain the increasing interest by companies in the developed world for unfettered access to the global marketplace. Another way to lean against the ageing trend of slower growth is to operate in sectors of the economy that benefit from population ageing; that is, sectors that produce products and services that are purchased more by customers as they get older. Many of these sectors, such as health care related products and services are obvious, but many others are not.

The Life-Cycle Model

So which sectors will likely grow over the next twenty years as a result of demographic ageing? To answer that question we need to look at a model of individual and household behaviour that is linked to demographic ageing. In this respect, the life-cycle model of consumer behaviour is quite ubiquitous and appears in economics, marketing and gerontology. Each discipline has a slightly different interpretation of the life-cycle model. Below we review what the life-cycle model has to say regarding consumption and activity patterns as we age.

The first formal use of the life-cycle model in economics stemmed from a puzzle regarding income and consumption. In macro-economic data sets, consumption and income seemed to rise at a fixed or constant rate. That is, for every 1 dollar increase in national income a fixed portion (i.e., 70 cents) would be directed into consumption. The problem for economists occurred when they examined data at the micro-economic level i.e., at the level of the individual. Individual and household consumption appeared more or less constant and did not vary with income in the same way. The answer to this puzzle was provided by Modiglianni and Brumberg (1954) with their life-cycle theory and by Friedman (1957) whose article on the permanent income theory carried the argument forward both theoretically and empirically. Empirically, the life-cycle theory predicts that the consumption and saving behavior of an individual has less to do with current income and more to do with age, material status, and other socioeconomic conditions during various stages of the individual's life.

From the saving side, the life-cycle hypothesis posits that saving is negative for the young, positive for middle-aged households and negative for the retired, so that wealth should be hump-shaped (Modigliani 1954, 1986). The idea motivating this model is that people have distinct financial needs at different periods of their life, typically borrowing when young, paying back the loans and then saving for retirement when middle-aged and dissaving during retirement. Stocks (along with other assets such as real estate and bonds) are vehicles for the savings of those preparing for their retirement. It seems plausible therefore that a large middle-aged cohort seeking to save for retirement will push up the prices of these securities and that the prices will be depressed in periods when the middle-aged cohort is small. A recent paper by Geanakapolos et al (2004) finds that this is indeed the case for the U.S. Moreover, since saving in the aggregate is important for economic growth a number of recent papers have linked age structure to saving and economics growth (Lindh, 1999; Lindh and Malmberg, 1999; Andersson, 2001).

A second strand of the economic literature examines the life-cycle model from the perspective of the opportunity costs of time and time-use decisions. Specifically, this research stream addresses the well-documented fact that expenditure and labour supply are hump-shaped over the lifecycle. This hump is present even when economists control for changing family composition. As noted by Becker (1965) household consumption is the output of combining market activities and expenditure with time spent in home production. To the extent that the relative price of time increases (as we gain labor market experience and wages rise it costs us more to enjoy leisure), individuals will substitute money spent on market goods for time by undertaking less home production and by searching (shopping) less intensively for cheaper goods and services. In a recent a paper by Hurst and Aguiar (2004), it is shown that the large heterogeneity in prices paid across households for identical consumption goods in the same metro area at any given point time corresponds directly with the households opportunity cost of time. For example, the authors -- using URL code data which uniquely identifies a good -- find that middle aged households (with high wages and lots of family commitments) pay 6% higher prices for the *same goods and services* than 24 year olds and 8% higher prices than 66 year olds. The data suggest a doubling of shopping frequency (i.e., more time spent searching for the lowest price) lowers the purchase price of a good by 15%. From this, the authors impute an opportunity cost of time for shoppers. Not surprisingly the price of time peaks in middle-age, and is roughly 35% higher than that of retirees.

This model has particular relevance for time-use over the lifecycle. In particular, older consumers shop more frequently and also spend more time on each trip. Time spent in home

production is therefore driven by two age-related forces: home production needs such as children and the opportunity cost of time. The authors find that both forces explain the pattern in the data: home production needs drive the peak found in home production in the late 30s while declining opportunity costs of time explain the increase in home production starting in the late 50s.

A final strand in the literature looks at the stages in the life cycle and links these to the generic needs of the consumer. A generic need is an inherent need of physical or social life. These needs are generic in the sense that they tell us when an individual will likely move from public transportation to the purchase of car - this happens at a fairly predictable stage in someone's life, i.e., mid-twenties. The model, of course, cannot predict the colour or the make of the car chosen, but despite this limitation, the life-cycle needs of an individual (household) are useful in predicting which sectors may witness demographic induced growth and what others may face demographic-related challenges.

The household is typically segmented into roughly four stages. The average age for first marriage in the UK is 24.4 for females and 26.5 for men (similar patterns hold in the US). This changes depending on level of education (i.e., the higher educated tend to marry later than the national average) but we can use this is our benchmark. Stage one therefore includes households in the twenties, usually without children. Whether married or not, young groups are more likely to rent than to own, spend more money than other groups on cinema (movie) tickets, take-out food, beer, and clothes.

The second stage, which includes households in their thirties and forties, typically involves children and brings with it changes in lifestyle and consumption. Household needs increase and commensurate with this, spending increases on baby clothes, furniture, televisions and television viewing on children's programming increases. Noisy restaurants and fast food are preferred to quiet expensive dinners. This is a time of high debt, households borrowing for their car, home and other family purchases.

In stage three, the household is now middle-aged and here the typical portrait begins to diverge. There are middle-aged married couples with children in their late teens or early twenties experiencing high costs of higher education and car insurance. Middle-aged singles without children may have many of the same needs as married households, but tend to live in condominiums or smaller homes. Some middle-aged stage three households may also be sandwiched between support for children as well as ageing parents. Household cleaning services or other types of time-saving services are typically demanded by this group. Stage three households with no children have higher travel expenditures, enjoy luxury items and may take up gambling, golf and spa treatments.

In stage four, older married and singles are typically in the 65 and older group. If in good health, the consumption patterns of young retirees are quite distinct from older retirees. Young retirees are heavy travellers and supporters of culture. As people are living longer and healthier, the age range of the actively retired keeps getting pushed upward. In the latter years, regardless of health status, estate planning , rearranging insurance, health care, assisted living and retirement homes become important. As frequently noted by gerontologists, this is a good reason to separate stage four into at least two distinct groups.

Given periodic fluctuations in birth rates, each of these groups will display differing rates of growth. This, in turn, will cause the needs within each life-cycle stage to grow or shrink depending on the growth in the size of each demographic cohort. It is this last insight that drives our demographic based projections, the methodology of which is explained below.

Methodology

The results presented in this paper are generated by a methodology that combines demographic and economic information. They are based on the life cycle model above, which shows that people have different needs and opportunity costs of time as they move through the various stages of their lives. Budget allocations and purchase decisions, as a result, vary systematically with age for the average or representative consumer. At any point in time the number of consumers at different stages in their life cycle is captured by the age structure of the population. This, in turn, reflects the fertility, mortality and migration history of the previous century. As previously noted, population ageing results in a smaller share of the customer base in the younger ages and a larger share of the customer base in the older ages. Products and services with larger budget allocations later in the life cycle will benefit from population ageing while products and services with smaller budget allocations will be disadvantaged. Sales growth for the former category will be higher than the economy-wide average, whereas the latter category will experience below-average growth.

Life-cycle budget allocations also reflect the living conditions of the customer over their life. The family or multi-person household offers opportunities for achieving economies of scale in consumer purchases. Rental or mortgage payments are one example. Expenditures associated with

motoring is another since these expenditures incorporate both individual and family uses. Some purchases are clearly individual-specific (e.g. clothing) while others are clearly family-related (e.g. furniture). Consequently, it is useful to test the sensitivity of the conclusions to the choice of demographic unit used in the analysis. The methodology can be adapted to accommodate information presented on an individual or a family/household basis. The results will incorporate this extension and will demonstrate that the findings presented in the paper are substantially insensitive to the choice of demographic unit (household or population projection) used in the analysis.

A formal treatment of the methodology is presented in the Appendix, but the logic of the approach can be set out as follows: the overall participation rate for any activity in the population is a weighted average of demographic group-specific participation rates, where the weights are the age-group shares in the population. Participation in this context refers to purchase decisions by the representative consumer. Changes in the aggregate participation rate can therefore be due to behavioural changes and/or a population compositional change. Population ageing is captured through the composition change component. By limiting behavioural changes to life-cycle behaviour and combining this with demographic changes we can isolate the impacts of population growth and ageing on the economy and its component parts. Our results depend on two factors: variation in the compositional component (i.e., changes in the size of age groups), and variation and relative stability in the behavioural effect (group specific participation rates).

Data

The data used in this paper are derived from two sources. First, we use the latest population projections for the U.K. from the Office of National Statistics (ONS). These projections include detailed age structure breakdowns from 2003 to 2036. Second, we have U.K. spending data from the Family Expenditure Survey (FES), which is also broken down by a host of demographic variables. In the results that follow we use data from the most recent 2002-03 FES.

The FES is a voluntary survey of a random sample of private households in the UK carried out by the ONS. The FES is primarily a survey of household expenditure on goods and services, and household income. The original purpose of the survey was to provide information on spending patterns for the Retail Price Index. Over the years the range of uses has grown and the survey is now multi-purpose. It provides an invaluable supply of economic and social data to central government, to other public and commercial organizations and to researchers in universities and independent research institutions. The basic unit of the survey is the household and in 2002-2003, 6637 households took part in the FES. The response rate from the last FES was 59% in Great Britain and 56% in Northern Ireland. Data is collected throughout the year to cover seasonal variations in expenditures. In addition to expenditure and income data, the FES collects information on socio-economic characteristics of the households, e.g. composition, size, social class, occupation and age of the head of household. The survey has been conducted annually since 1957.

These data are combined using the methodology presented in the Appendix. First, the impacts of population growth and ageing are analysed at the aggregate sectoral level using the expenditure categories identified in the FES. These results are then further explained by extending the analysis to the components of each of the sectors.

Results

Before presenting the results of our analysis, we briefly summarise and comment on the data inputs. In particular, we first review the results of the ONS population projections for the U.K. for the period 2006 to 2026. These are the data that capture the impact of population ageing. Then we review the FES results by sector, which are broken down into life-cycle stages to capture the impact of life-cycle behaviour. Finally, we present our results for the U.K. economy over the period 2006-26 and offer some observations on the implications for business and government.

Population Projections

Table 1 summarizes the ONS projections for the adult (20 plus) U.K. population over 2006-26. These projections show a population continuing to grow, albeit at a slower rate. Population growth gradually slows from an annual rate of 0.7 per cent over 2006-11 to 0.4 per cent over 2021-26. Slowing population growth is a characteristic of an ageing population.

Another, often more familiar, indicator of population ageing is the share of the population in the senior (or fourth stage) ages. In these population projections, this share increases from 21.3 per cent

of the adult population in 2006 to 27.3 in 2026. Of particular note is that by 2026 older retirees 75 and over outnumber younger retirees aged between 65 and 74. The oldest age group is the fastest growing throughout the projection.

[Table 1]

These data capture, in part, the post war baby boom that occurred in many countries in Europe and, more especially, in North America and Australasia. Because of post war reconstruction, the baby boom in the U.K. did not start until the mid-1960s and continued throughout the 1970s. Someone born in 1956, for example, is aged 50 in 2006 and 70 in 2026, and this phenomenon contributes to the growth of numbers in the third and fourth stages of the life cycle over the projection

Other population compositional changes are also captured in these data. Over 2006-16 the slowest growing age group is in the second stage of the life cycle (30-49). In fact, the numbers in this group actually declines over the decade, a trend that continues until 2021. This negative growth reflects the decreases in births that followed the baby boom that occurred over the 1970s in the U.K. following the introduction and increasing use of the birth control pill. As in other developed countries it also reflects the interrelated phenomena of increased female participation in higher education and the labour force.

However, despite lowered fertility, the boomers had their children over the 1980s, which is reflected in a comparatively high growth rate for the young adult population over 2006-11. Births then declined again in the 1990s as the 1970s generation gradually became of childbearing ages. Over 2016-26 the boomer children enter their family stage, but the impact on second stage population growth is masked by the slower growing groups on either side. Foot (1996) identified and described the impacts of the boom, bust and echo population profile in North America.

Finally, it should be noted that the ONS population projections incorporate the impacts of international migration as well as projected slight declines in fertility and increases in life expectancy. Nonetheless, most of the population compositional change in the results is a result of the ageing of the boom-bust-echo-bust population profile initially associated with the post war baby boom generation.

Life-Cycle Expenditures

Table 2 summarizes the FES expenditure data broken down by life-cycle age groups. The data show that average weekly household expenditure (in pounds) is highest in the second life cycle stage. This is not surprising since these are the traditional family years and household size is at a maximum. The average household size is three, which also reflects childless and single person households in the group. Perhaps of greater interest is that third stage (aged 50-64) households on average outspend first stage (20-29) households by 12.8 per cent even though they are on average smaller (2.2 compared to 2.4 people per household). This reflects the life-cycle incomes of the two groups. The younger group is early in the life cycle often borrowing to finance its expenditures while the older group is in its accumulating ages preparing for retirement. With children leaving and higher incomes they can *both* save and spend more. This means that expenditures do not automatically decline in the accumulating stage of the life cycle as is so often assumed. This finding has important implications for the economy in an ageing population.

[Table 2]

Not surprising, as average household size decreases in the older ages households spend less. The average weekly spending of the oldest (75 plus) group is less than half than that of the youngest (20-29) group even though average household size remains at almost 60 per cent (1.4 versus 2.4 people). However, the two groups spend their money very differently.

The composition of household spending for the major expenditure categories in the FES is summarised in Table 3. These categories correspond to broad sectors in the economy.

Given the FES categories, the highest average expenditure category is transportation, closely followed by "other" (primarily mortgage interest payments and donations) and recreation and culture. Next is food, followed by housing, restaurants and hotels, "miscellaneous"(mainly insurance and personal care) and household goods and services. Clothing and communication are next. Household spending on education and health, both primarily provided in the public sector, are the two smallest categories. It is worth observing that if mortgage interest payments are added to housing, this is the highest average expenditure category (£76.30). If house insurance (from the miscellaneous category) is added, the housing total is £80.80, which is almost twenty per cent of the average household budget (net of taxes). It is important to keep these definitions in mind when interpreting the FES expenditure categories.

[Table 3]

As predicted by theory, the average household's allocation of expenditures varies over the life cycle. The proportion of the U.K. household budget allocated to food increases with age while the proportion allocated to restaurants decreases with age. Housing expenditures (including rent, fuel and power, but net of mortgages and insurance) consume the highest proportions of the household budget at the youngest and oldest ages. Alcohol purchases are a bigger proportion on the budget of the 50 plus generations, as are purchases of household goods and services, while clothing purchases and education expenditures shares are highest in the prime family ages. Young households allocate proportionately more to communication, while the third stage (50-64) households allocate the highest budget share to transportation, primarily associated with the operation of personal transport. Recreation and culture is most supported in budget allocations by the 50 to 74 groups. Finally, the two residual categories (miscellaneous and other) include items that are associated primarily with families (personal care, insurance and mortgage payments). If house insurance and mortgage payments are combined with housing, the maximum expenditures occur in the family ages (£103.50), but the highest budget share is experienced by young households (23.2%).

Finally, the FES records information on other expenditures including taxes, national insurance contributions, purchases of dwellings, life insurance and pension fund contributions. These will be included in the results that follow.

Empirical Results

The results of combining the ONS population projections with the FES data are presented in Table 4. The population projections embody both the growth and changing composition of the future U.K. population, thereby including the impact of population ageing. The FES data embody life-cycle behaviour , thereby enabling the impacts of population ageing through the life cycle on the economy and its sectors to be measured. All economic impacts are real, that is they are measured in constant pounds and do not include any allowance for inflation. Consequently, the difference between economic growth and population growth is a measure of the economic impact of population ageing.

[Table 4]

Both growth rates and index numbers (2006=100) are presented in Table 4. As previously noted the U.K. adult population continues to grow over 2006-26, albeit at a decreasing rate. Categories with growth rates above the population growth in any period benefit from population ageing, while those categories with lower growth rates are penalized by population ageing.

First, consider total expenditures. Over 2006-11 total expenditure is very slightly above population growth whereas over 2011-21 it is very slightly under population growth. Population ageing, therefore, has virtually no impact on overall spending in the economy over this period. However, over 2021-26 population ageing starts to have a noticeable impact resulting in total economic expenditures that are only 70 per cent of population growth. This divergence is further confirmed by results for 2026-36 (not presented in this paper). Over this latter period population growth continues to contribute to economic growth, thereby ensuring that population ageing does not result in a shrinking economy. Second, this finding carries across to all sectors of the U.K. economy (defined in Table 4) to a greater or lesser degree. Projected population growth, albeit at a slower rate, acts like a rising tide that raises all ships (sectors). But some are raised much more than others. Economic growth is not uniform across sectors. Because of life-cycle behaviour, population ageing has a greater impact at the sectoral level.

The cumulative effects of projected demographic changes can be easily assessed by examining the indexes for 2026 in Table 4. These index numbers summarize the cumulative impacts of population growth and ageing over 2006-26. Once again a number higher than the economy-wide aggregate indicates a sector benefiting from population ageing while a number below has the opposite interpretation.

Not surprisingly, the highest index number and hence the sector that benefits the most from population ageing is the health category, whereas the lowest index and hence the opposite conclusion is experienced by the education category. Since these are both sectors where there is a large public presence in addition to this private spending, this suggests that future government health budgets will have to grow faster than future government education budgets. Population ageing inevitably drives a wedge between these two items in both private and public expenditures.

While the above result is likely to be obvious to many, some of the remaining results contain some surprises. The next highest indexes are for food and housing, including fuel and power. As noted above, the average U.K. household allocates an increasing share of its budget on food over their life cycle. While this does not guarantee increased expenditures (since older households spend less), it does explain why food in the U.K. household is a relatively fast growing category that benefits from

population ageing. This is a clear reflection of U.K. life-cycle behaviour and it would be interesting to see if this finding is transferable to other economies. A similar explanation applies to housing, although here there is likely a physiological reason. As we get older the extremes of temperature appear to have a greater impact on quality of life and there appears to be a willingness if not a necessity to use fuel and power to even out household temperatures over the seasons. These items are used for heating in the winter and air conditioning in the summer. It almost seems ironical that a manufacturing sector with a long history and ageing plant will be a future beneficiary of an ageing population.

The next fastest growing indices that exceed the national average are alcoholic drinks (including tobacco and narcotics) and household goods and services. These categories are primarily associated with the pre-retiree and the healthy young retiree groups experiencing relatively rapid population growth over the period covered by this projection because of the ageing of the boomers. Expenditure shares in both categories remain above average throughout the 50 plus ages.

Average growth is recorded for the recreation and culture and "miscellaneous" categories. Each contain a mixture of expenditures supported by all ages. For example, recreation (sports, computers, etc) is primarily an activity favoured by the young while culture (theatre, museums, etc) is primarily an activity favoured by the 50 plus groups. As previously noted, the miscellaneous category includes personal care and insurance expenditures, which are spread over all ages. As a result, expenditure shares in this category are below average in the young and 50-64 ages, and above average in the family and older ages.

Below average growth is obtained for the communication, clothing, transport and restaurant categories. These are categories with expenditure shares that are highest in the first two stages of the life cycle. The communication sector is dominated by young households, which spend the most on telephone and ancillary services. Clothing expenditures include children and adult clothes, accessories and footwear, all of which tend to be made early in the adult years when wardrobes are being assembled and children are growing. Expenditures on vehicle purchase and operation and on transport fares are above average in the pre-retirement stages and fall noticeably in the senior ages. The restaurant and hotel category is a mixture of take-away, restaurant and café meals, alcohol consumed away from home, accommodation services and holiday spending, all of which have different life-cycle profiles. While the single biggest item in this category is restaurant and café meals (favoured by the 50-64 group), the category is dominated by alcohol and take-away food that are favoured by young households. Consequently, the category as a whole loses to population ageing. Together these four categories accounted for 31.4 per cent of all expenditures, so the negative impact of population ageing on these sectors will have a noticeable impact on the future of the U.K. economy. However where there are challenges there are also invariably some opportunities and this analysis underscores the importance of looking into more detailed sectoral results before reaching final conclusions.

By 2026 the biggest losers to population ageing are the education and "other" sectors. The latter is dominated (68%) by mortgage payments that peak in the family stage of the life cycle, as do private education expenditures. These results have important implications for the banks and private schools in the future U.K. economy.

As noted, the results in Table 4 hide important details in the economy. Tables 5 and 6 present some of these details for selected sectors using the expenditure index for 2026, which summarizes the cumulative impacts of population growth and ageing. Once again, the impact of ageing on the sector can be ascertained by comparing the sectoral index with the overall economy-wide index of 111.

[Table 5]

Table 5 presents results for selected food, alcohol and clothing items. In the U.K., pasta products are consumed primarily by younger households. While this may change in the years ahead, the results demonstrate the challenge potentially presented by population ageing for this sector. On the other hand, consumption of fish and fish products increases after age 50 so population ageing presents a wonderful opportunity for this sector. Milk consumption by older households contributes calcium for good bones, but cheese is primarily a family tradition. As a result, milk consumption grows more than cheese consumption in the future. Fresh fruit is also an important nutritional ingredient that assumes more importance in older household's budgets, so population ageing benefits fresh fruit (and vegetable) retailers. Nonetheless the ageing U.K. consumer currently likes their sugar (and butter). While these consumption patterns might change in the years ahead it is nonetheless likely that these sectors will be beneficiaries of population ageing. Soft drinks are primarily purchased by the young and families so ageing will provide a challenge to the U.K. soft drink industry. On the other hand, tea and coffee purchases increase noticeably over age 50 so these sectors are beneficiaries of ageing. Purchases over the life cycle also provide a unique glimpse into British culture. Per capita coffee purchases peak in the 50-64 years, but tea purchases keep climbing into the most senior years. As a result, while both drinks benefit from population ageing, tea does better than coffee by 2026. Beer, wine and spirits purchases

provide another glimpse into British culture (that is also confirmed in comparable U.S. data). Generally the typical household goes from beer to wine to spirits over their life cycle with per capita beer purchases peaking in the twenties, per capita wine purchases peaking in the fifties and per capita spirit purchases peaking in the senior ages. As a result, population is much kinder to the spirit sector than the beer sector.

Children's clothing shows virtually no growth in these projections. Men's and women's clothing (outer garments) provide yet another glimpse into British spending behaviour. On a per capita basis, men spend most on clothes in their twenties, whereas women spend most in their fifties. As a result population ageing is somewhat kinder to the women's apparel business than to the men's, although both grow slower than average household expenditures. (Spending on adult under garments grow much more rapidly in an ageing population!) The dry cleaning (laundry and dyeing) sector is favoured by an ageing population, whereas the footwear sector is not.

Table 6 presents results for a variety of additional household purchases. Since young households rent, the rental housing sector exhibits slower future growth in an ageing population. On the other hand, households in the future will spend a larger share of their total budget on electricity, gas and other fuels as ageing households attempt to insulate themselves from the extremes in climate variations. Older household in the U.K. spend less on furniture and furnishings but often have to replace household appliances, so population ageing benefits the appliance sector more than the furnishings sector. A real winner from an ageing population is the domestic services sector, which includes household cleaning services.

[Table 6]

All parts of the health care sector clearly benefit from population ageing. By way of example, hospital services register one of the highest indices in Table 6. Vehicle purchases grow more slowly (but repairs and servicing grow more rapidly)than average expenditures as do rail, tube and bus fares. These results are not good news for British Rail.

With fewer younger people, expenditures on toys (including games and hobbies) grows more slowly than average, which is not good news for the children's toys sector. (A similar profile is followed by computer software and games expenditures.) Expenditures on pets and pet food experience above-average growth over the 2011-21 period, but then below-average growth subsequently. Sports admissions do not do well in an ageing population, but gambling payments soar. Older households spend more on newspapers, so it is difficult to understand why the newspaper industry constantly attempts to court the younger reader.

Package holidays do very well in an ageing population, particularly those in the U.K. This is the preferred mode of travel for the older customer. Restaurants and café spending continues to grow slightly faster than average spending (whereas take-out meals do much worse than average).

The insurance sector is a winner in an ageing population. Both household insurance and especially medical insurance premiums grow much faster than average spending (whereas vehicle insurance does not). Moving services are in reduced demand in an ageing population, but donations increase noticeably.

Finally, although not part of the after tax spending of household, the FES collects information on income tax payments (less refunds), national insurance contributions and a variety of other financial-type transactions (e.g. debt payments, gambling windfalls, etc). Of particular interest to governments should be that national insurance contributions and income tax payments grow more slowly than the economy over 2006-26. (In fact, the growth in national insurance contributions becomes *negative* over 2021-26.) This result stems from the fact that per capita national insurance contributions and tax payments drop dramatically in the senior years. (Note that this effect is not limited to the government sector as the growth in debt repayments becomes negative over 2016-26, which has important implications for all lending institutions.) But windfall receipts from gambling boom throughout!

These results correspond closely with results generated with an earlier FES and with results generated using ONS family projections (available for 2001-21). The robustness of life cycle behaviour over most spending categories and the inevitability of the ageing of the U.K. population means that the results presented above provide a solid foundation for strategic planning in both the private and public sectors of the U.K. economy.

Conclusions

This paper has explored the impacts of demographic change on the future U.K. economy. In particular, it has examined the close relationship between age structure and the growth (or decline) of product markets. The results have been generated using a methodology that combines both

demographic and economic information. They are based on life-cycle theory that has a respected tradition in economics, marketing and gerontology. Empirically, the paper combines the latest (2002-03) family expenditure survey for the U.K. with the most recent population projections from the ONS. These population projections embody the inevitable ageing of the U.K. population, which is a feature of the populations of most developed countries in the world. The U.K. provides a useful case study that lies between a more rapidly ageing continental Europe and a less rapidly ageing United States. Because both life-cycle behaviour and population ageing are so well entrenched, the results presented in this paper are likely transferable to many of these other countries to a greater or lesser degree. They can inform decision-makers in both the private and public sectors of likely future trends as a result of slower population growth and population ageing.

The results demonstrate, not surprisingly, that the heath sector is a big winner in an ageing population, while the education sector is a big loser. Other results are not nearly so obvious. Given U.K. consumer behaviour, the food and housing categories continue to outpace population growth, but performance varies within each category. The ageing U.K. consumer purchases less soft drinks and pasta, but more fish, fresh fruit and tea. Alcohol preferences result in spirits outpacing beer in an ageing population. The rental housing sector grow more slowly than the economy average, but the traditional power (electricity, gas and other fuels) grows more rapidly as ageing consumers insulate themselves form seasonal temperature fluctuations. Other sectors that benefit from population ageing are dry cleaning, domestic household services, package holidays (especially within the country), newspapers and gambling. The restaurant sector does noticeably better than take out food, and the insurance sector moves from vehicle to household and medical insurance. Population ageing will present challenges for the clothing and footwear sectors, vehicle sales, transportation (rail, tube bus and coach travel), children's toys and games, sports admissions and moving companies. Mortgage and debt repayments mean reduced demands for loans at financial institutions, while slower growing national insurance premiums and income tax revenues will likely present future governments with some significant budgetary challenges.

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Appendix

Formally, the methodology for deriving demographic based demographic growth projections can be set out by defining a demographic component and behavioural (economic) component that explains aggregate expenditures or participation rates in an economy. Let there be n groups in a population (P) so that

$$P = \sum_{i=1}^{n} P^i,$$

and define $i = 1$ the number of participants or spending (N) in any category (i.e., vacation travel) as:

$$N = \sum_{i=1}^{n} N^i$$

$$= \sum_{i=1}^{n} \left(\frac{N^i}{P^i}\right)\left(\frac{P^i}{P}\right)P$$

so that

$$\frac{N}{P} = \sum_{i=1}^{n} \left(\frac{N}{P}\right)^i \left(\frac{P^i}{P}\right)$$

which implies that the aggregate activity participation rate in the population (N/P) is a weighted average of the group-specific participation rates $(N/P)^i$ where the weights are the group shares in the population (P^i/P).

A change in aggregate activity participation rate can be decomposed into a behavioral change and a population compositional change component. If

$$y = \sum_{j} x_j z_j \qquad then \qquad dy = \sum_{j} z_j dx_j + x_j dz_j$$

hence,

$$d\left(\frac{N}{P}\right) \approx \sum_{i=1}^{n} \left\{\left(\frac{P^i}{P}\right) d\left(\frac{N}{P}\right)^i + \left(\frac{N}{P}\right)^i d\left(\frac{P^i}{P}\right)\right\}$$

where the two effects are seen as the behavioral effect

$$= \sum_{i=1}^{n} \left(\frac{P^i}{P}\right) d\left(\frac{N}{P}\right)^i$$

and the compositional effect

$$= \sum_{i=1}^{n} \left(\frac{N}{P}\right)^i d\left(\frac{P^i}{P}\right).$$

Note that the population compositional effect or ageing effect can be larger than the behavioral effect and given that we are interested in isolating the impact of ageing on spending over time, we hold group-specific behaviour unchanged. If the behavioral component is roughly constant, demographic ageing will be the component driving most of the overall change in aggregate participation. Note, however, that this assumption of group-specific behavioural stability does *not* impose stability in aggregate participation behaviour since the methodology incorporates the important impact of life cycle behaviour through the group-specific participation rates. In order to isolate the impact of demographic change (both population growth and ageing) on sectoral growth (N), we impose stability in life-cycle behaviour and allow for population growth. Consequently, our sector projections include both behavioural change and compositional change, along with population growth. This provides a comprehensive measure of the impact of demographic change on sectoral growth.

TABLE 1

ADULT POPULATION BY AGE, U.K., 2006-26
('000s)

Year	20-29	30-49	50-64	65-74	75+	Total
2006	7,627	17,403	10,868	5,053	4,651	45,601
2011	8,179	17,071	11,473	5,554	4,930	47,207
2016	8,300	16,557	12,051	6,415	5,357	48,681
2021	7,920	16,397	12,834	6,628	6,075	49,854
2026	7,648	16,651	12,681	6,780	7,088	50,849
			growth (%/year)			
2006-11	1.4	-0.4	1.1	2.0	1.2	0.7
2011-16	0.3	-0.6	1.0	3.1	1.7	0.6
2016-21	-0.9	-0.2	1.3	0.7	2.7	0.5
2021-26	-0.7	0.3	-0.2	0.5	3.3	0.4

Source: ONS.

TABLE 2

HOUSEHOLD EXPENDITURES AND SIZE BY AGE, U.K., 2002-03

	20-29	30-49	50-64	65-74	75+	All
Household Expenditures (£/wk)	400.10	496.90	451.4	270.9	177.2	406.2
Average Household Size (persons)	2.4	3.0	2.2	1.7	1.4	2.4

Source: ONS, FES.

TABLE 3

EXPENDITURE SHARES BY AGE, U.K., 2002-03
(%)

Category	20-29	30-49	50-64	65-74	75+	All
Food & Drinks	7.7	9.7	10.6	14.4	16.6	10.5
Alcohol & Tobacco	2.8	2.6	3.0	3.1	2.9	2.8
Clothing & Footwear	5.7	5.9	5.3	4.2	4.4	5.5
Housing, Fuel & Power	14.0	7.8	7.8	10.8	14.6	9.1
HH Goods & Services	5.7	7.2	8.2	8.1	8.4	7.4
Health	0.6	0.9	1.4	2.2	2.0	1.2
Transport	14.6	14.7	16.1	13.0	8.8	14.6
Communication	3.3	2.6	2.4	2.6	2.9	2.6
Recreation & Culture	12.9	13.5	14.5	15.5	13.0	13.9
Education	1.2	1.5	1.4	0.3	0.4	1.3
Restaurants & Hotels	11.0	8.8	8.5	7.4	6.5	8.7
Miscellaneous	7.9	8.3	7.7	8.2	9.5	8.1
Other	12.6	16.5	13.1	10.1	10.0	14.3

Source : ONS, FES.

TABLE 4

HOUSEHOLD EXPENDITURE GROWTH BY CATEGORY, U.K., 2006-26
(%/year)

Category	2006-11	2011-16	2016-21	2021-26
Population	0.69	0.62	0.48	0.40
Food & Drinks	0.77	0.79	0.65	0.47
Alcohol & Tobacco	0.75	0.67	0.50	0.28
Clothing & Footwear	0.64	0.49	0.39	0.21
Housing, Fuel & Power	0.84	0.71	0.45	0.38
Household Goods & Services	0.72	0.68	0.58	0.33
Health	0.88	1.00	0.79	0.50
Transport	0.68	0.55	0.42	0.15
Communications	0.73	0.58	0.40	0.28
Recreation & Culture	0.72	0.65	0.49	0.26
Education	0.52	0.29	0.28	-0.02
Restaurants & Hotels	0.69	0.52	0.35	0.17
Miscellaneous	0.69	0.60	0.49	0.34
Other Items	0.58	0.42	0.38	0.22
Total	0.70	0.60	0.47	0.28

(Index 2006 = 100)

	2011	2016	2021	2026
Food & Drinks	104	108	112	114
Alcohol & Tobacco	104	107	110	112
Clothing & Footwear	103	106	108	109
Housing, Fuel & Power	104	108	111	113
Household Goods & Services	104	107	110	112
Health	104	110	114	117
Transport	103	108	109	109
Communications	104	107	109	110
Recreation & Culture	104	107	110	111
Education	103	104	106	106
Restaurants & Hotels	104	106	108	109
Miscellaneous	104	107	109	111
Other Items	103	105	107	108
Total	104	107	109	111

Source: Calculations by the authors.

TABLE 5

HOUSEHOLD EXPENDITURE, SELECTED FOOD & CLOTHING ITEMS, U.K., 2026
(Index 2006 = 100)

Pasta Products	106	Fish & Fish Products	118
Milk	116	Cheese & Curd	113
Fresh Fruit	117	Sugar & Sugar Products	118
Coffee	115	Tea	120
Soft Drinks	109	Beer, Lager, Cider & Perry	109
Wines	113	Spirits & Liqueurs	120
Men's Outer Garments	108	Footwear	109

Source: Calculations by the authors.

TABLE 6

HOUSEHOLD EXPENDITURE, SELECTED HOUSEHOLD ITEMS, U.K., 2026
(Index 2006 = 100)

Net Rent	107	Electricity, Gas & Other Fuels	116
Furniture & Furnishings	110	Household Appliances	114
Domestic Services & Carpet Cleaning	121	Hospital Services	118
Vehicle Purchases	109	Rail & Tube Fares	105
Games, Toys & Hobbies	106	Pets & Pet Food	111
Sports Admissions, etc	107	Cinema, Theatre & Museums	110
Gambling Payments	116	Newspapers	122
Package Holidays – UK	128	Restaurant & Café Meals	112
Vehicle Insurance (include boats)	110	Medical Insurance Premiums	124
Moving Services	106	Cash Gifts & Donations	115
Income Tax Payments (net)	108	National Insurance Contributions	104

Source: Calculations by the authors.