TAXATION CHALLENGES OF POPULATION AGEING: COMPARATIVE EVIDENCE FROM THE EUROPEAN UNION, THE UNITED STATES AND JAPAN

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Fructuoso Borrallo, Susana Párraga-Rodríguez
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Abstract

Using microdata from the European Union, the United States and Japan, we show that the elderly bear lower effective tax rates than the young. This difference is explained by the income gap and the different generational consumption baskets. However, tax reforms enacted in recent decades have led to an increase in the relative contribution of the elderly to public finances.

Keywords: population ageing, tax collection, direct taxes, indirect taxes.

JEL classification: H2, H24, H25, J14.

Resumen

Presentamos evidencia basada en microdatos para la Unión Europea, Estados Unidos y Japón que indica que los contribuyentes de mayor edad soportan tipos impositivos efectivos más reducidos que los más jóvenes (por caída de renta y tipo de cesta de consumo). No obstante, los cambios impositivos de las últimas décadas han dado como resultado un aumento de la contribución relativa de este grupo a las finanzas públicas.

Palabras clave: envejecimiento de la población, recaudación impositiva, impuestos directos, impuestos indirectos.

Códigos JEL: H2, H24, H25, J14.

Contents

1 Introduction

The increase in the average age of the population has led to rising concerns about the sustainability of public finances, mainly in advanced economies but also in many emerging economies, where demographic transition is gaining speed (Berganza et al., 2020). Firstly, more aged societies demand greater government spending, particularly in pensions and health (European Commission, 2018; OECD, 2019; Hernández de Cos et al., 2017). Secondly, intertemporal changes in income, savings and consumption patterns over the life cycle may have a significant impact on tax revenue (Banco de España, 2019). Therefore, population ageing exerts a two-fold pressure on public finances, increasing spending and reducing tax revenue. The former, which relates to government spending, has been widely dealt with in the economic literature, while the second issue has been relatively unexplored.

Against this backdrop, this article helps to fill the gaps in the existing literature through a comprehensive international analysis of the effect of the increase in average population age on tax collection. To this end, we present comparative evidence from the European Union (EU), the United States and Japan (the world's three major advanced economies) on the revenue-raising capacity of direct and indirect taxes, by age group, between the late 1990s and 2015, based on household level data (microdata).[1] Apart from being the three major advanced economies, they were selected for this study for two additional reasons. First, because these economic areas have different average population age levels. Thus, Japan's population is very elderly, the United States' is significantly younger and the European Union falls somewhere in between. Second, because these are economies with relatively distinct tax systems, in terms of both the weight of taxes in GDP and the composition of the basket of taxes (see chart 1). These different characteristics translate into a certain heterogeneity in tax revenue by age group, in particular as regards the distribution of tax payments and effective tax rates by age. They also imply heterogeneity in terms of the changes in consumption patterns over the life cycle.

Notably, our sample includes Japan. As noted earlier, Japan is the country with the oldest population and may serve as a reference for the outlook of economies such as that of the EU, and of Spain in particular. Japan's early ageing has made its experience in connection with its population age structure garner much attention. However, international comparisons rarely include the Japanese economy, possibly because of the language barrier, although the information available in English has increased in recent years (OECD, 2017).

Our results show that, overall, the shift of the population towards taxation segments with less tax revenue-raising capacity has been partially offset by changes in the taxation

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1 As regards direct taxation, the European data come from two household surveys: the European Union Statistics on Income and Living Conditions (EU-SILC) survey and its predecessor, the European Community Household Panel (ECHP) survey; Japan's are drawn from the Survey on Income Redistribution and those for the United States from the Consumer Expenditure Survey (CES) and the Internal Revenue Service (IRS). In the case of taxation on consumption, the data sources used are the Household Budget Survey (HBS) and Eurostat for the EU, the National Survey of Family Income and Expenditure for Japan, and the CE and the US Census Bureau (1997-2017) for the United States.

Chart 1

## TAX STRUCTURE IN THE EU, THE UNITED STATES AND JAPAN

1 TOTAL TAX REVENUE

% of GDP

UNITED STATES   JAPAN   EU

2 EU (a)

% of total taxes

OTHER   ON CORPORATE INCOME
ON PROPERTY   ON GOODS AND SERVICES
SOCIAL SECURITY CONTRIBUTIONS   ON PERSONAL INCOME

3 UNITED STATES

% of total taxes

4 JAPAN

% of total taxes

OTHER   ON CORPORATE INCOME   ON PROPERTY   ON GOODS AND SERVICES
SOCIAL SECURITY CONTRIBUTIONS   ON PERSONAL INCOME
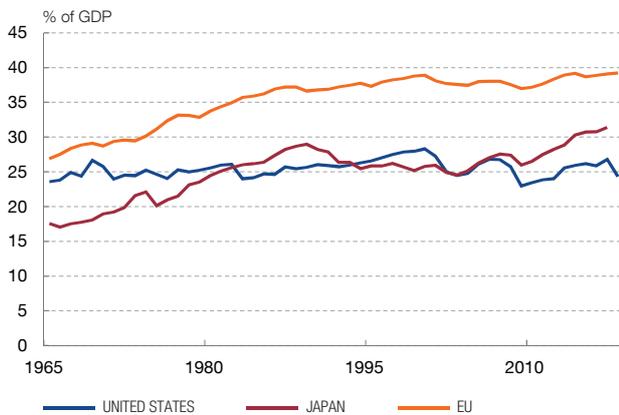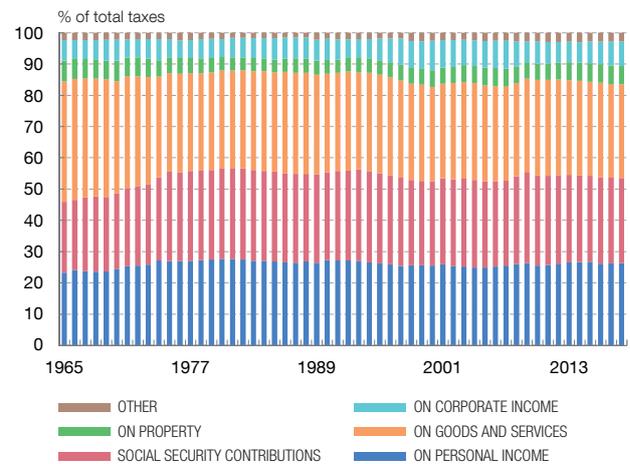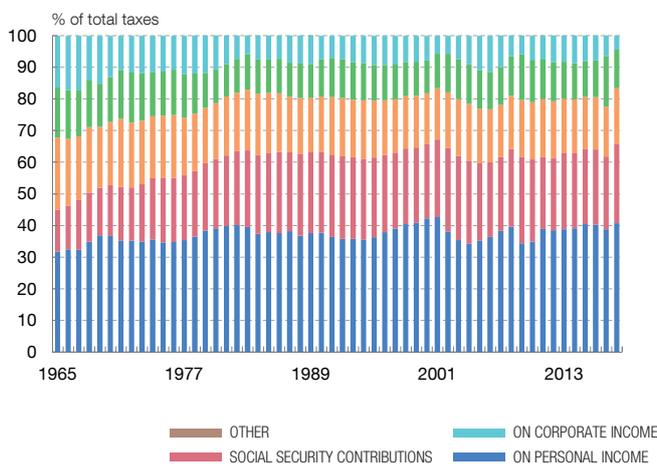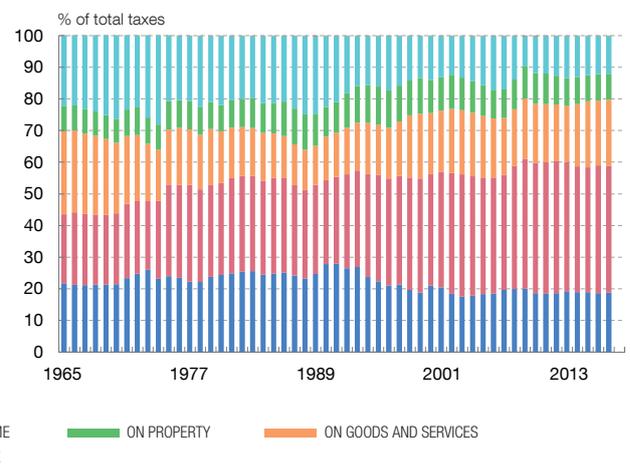
SOURCE: OECD.

a Data for the EU-15.

structure in recent decades. Consequently, the contribution of the elderly to public finances has increased. These results are in line with the studies available for the Japanese case (Yashio and Hachisuka, 2014; Ohno and Kodama, 2017).[2] By contrast, we focus on the resilience of tax systems to population ageing, without assessing different taxation systems, which is an extremely complex matter in comparative analysis, particularly considering that we are including Japan in the study.

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2 According to these studies, the impact of ageing on Japanese public finances is significant. First, a result of retirees' lower income and deductions applied to the direct taxation of pensions is that tax revenue from the elderly is significantly lower than that from working-age individuals. At the same time, the elderly receive more social aid in the form of transfers or public services.

The remainder of this article is structured as follows. Section 2 first includes a set of indicators evidencing the increase in the average age of the world population and then reviews the channels through which this situation can have a bearing on tax revenue-raising capacity, according to the theoretical and empirical literature. In Section 3, the main part of the study, we show evidence of the link between taxation (for both income and consumption taxes) and the age structure of the economies analysed (the European Union, the United States and Japan). Finally, Section 4 presents the main conclusions.

2 Ageing and government revenue: channels of impact

2.1 Ageing indicators

Chart 2 illustrates the population ageing process worldwide, comparing the changes in the dependency ratio for people over 65 (the ratio of persons in the oldest age group to the working-age population) between 1970 and 2015. An increase in this ratio is observed across the board, but the intensity of this process varies considerably across the different economies. In 1970 the dependency ratio for countries with the oldest population represented in Chart 2 hardly exceeded 20%. However, by the late 1990s there were already three countries crossing the threshold of 25% (Belgium, Sweden and Italy). More than a decade later, in 2015, only five countries out of the 22 represented had a dependency ratio for people over 65 below this threshold.

Also, Chart 2 shows that the increase in this ratio has been highly uneven across countries. For example, while the ratio hardly rose in Ireland, the United States or Poland, the ageing process has been notable in Greece, Italy and Japan. Japan's experience is particularly noteworthy because it has become the most elderly economy of the sample, after having experienced the greatest increase in the dependency ratio, which was close to 45% in 2015.

A different way of visualising population ageing is by representing the population structure by age group (see Chart 3). The increase in the share of people over age 65 in Japan to the detriment of the rest of the population is noteworthy. In Europe and the United States the increase in the elderly population coincides with a decline in dependent minors as a result of plummeting birth rates. The reduction in fertility rates has been the most important factor

Chart 2
DEPENDENCY RATIO OF THE ELDERLY

DEPENDENCY RATIO (a)

● 1970   ● 1998   ● 2015
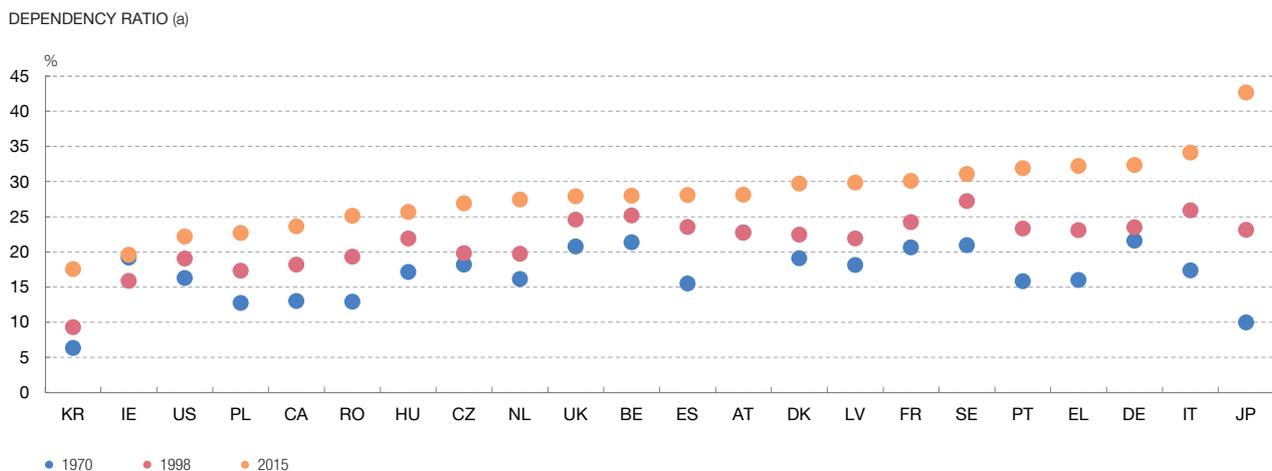
SOURCE: World Bank.

a Data for the EU-15.

Chart 3
POPULATION STRUCTURE BY AGE

POPULATION STRUCTURE (a)

■ LATE 1990s   ■ MID-2010s
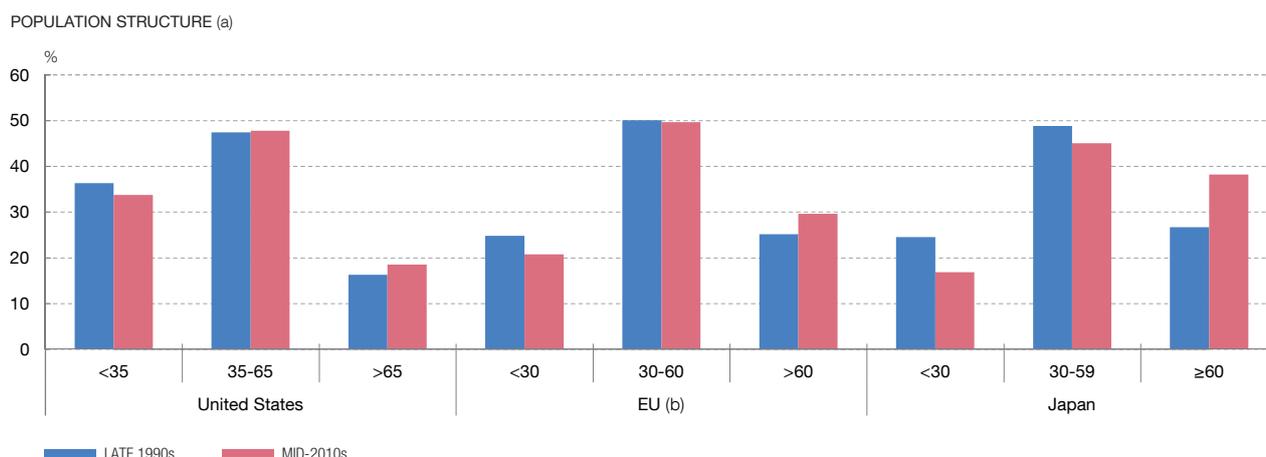
SOURCE: World Bank.

a Late 1990s refers to 1997 for the United States and 1999 for the EU. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.
b Data for the EU-27.

underlying the ageing process of these economies (Goodkind and Kowal, 2016). Given the prospect of a future population decline, immigration may be a key factor in trying to maintain the working-age population (United Nations, 2017). However, the relationship between these three phenomena (ageing, low birth rates and immigration) is outside the scope of this study.

2.2   Theoretical channels and literature

The traditional life-cycle economic theory suggests that the progressive increase in the percentage of the elderly in an economy would affect tax revenue. First, retirees earn lower incomes than the younger cohorts, resulting in a decline in the income tax base. At the same time, the theory predicts that retirees progressively use the savings they have accumulated over their working lives in order to maintain steady consumption levels. Thus, the older population has lower saving rates. Accordingly, aged societies will tend to show greater aggregate consumption and lower aggregate saving. As a result, the increase in tax revenue arising from consumption and capital could partially mitigate the loss in tax collection owing to lower revenue from direct taxes.

However, the empirical evidence shows that consumption tends to decrease, rather than increase, upon retirement (Jappeli and Pistaferri, 2010). This means that the economic theory and the empirical evidence appear to provide contradictory views on the effects of ageing on tax revenue from capital income and consumption taxes.

On the side of consumption, there is also evidence that the relative demand for goods and services changes with age. Thus, ageing induces changes in consumption patterns and in the relative demand for goods and services, skewed towards the latter (Groneck and

Kaufmann, 2017). Older cohorts tend to consume a larger proportion of certain non-durable goods (such as food) and services that are usually subject to lower taxes or are even tax-exempt (United Nations, 2009; Credit Suisse, 2015; Eurostat, 2019). A possible outcome of these changes in consumer patterns is a decline in the effective rate paid by households.

More detailed analyses of these consumption patterns conclude that population ageing will lead to changes in the relative demand for goods and services. Should this prove to be true, and the decline in aggregate demand – owing to people over 65 tending to have a lower *average* propensity to consume than the working-age population – also concentrates in goods and services with lower price increases, then population ageing would generate a certain downward pressure on the inflation rate (Aguiar and Hurst, 2013; Luengo-Prado and Sevilla, 2013; Broniatowska, 2019).

Furthermore, these consumption trends would entail changes in the sectoral and occupational composition of employment, with repercussions on the process of setting wages and prices in a differentiated manner by type of good (Groneck and Kaufmann, 2017). Thus, the job polarisation trend observed from the early 1990s, normally attributed to technological developments resulting from automating routine tasks, could also accelerate for demographic reasons (Sebastian, 2018), affecting tax revenue (Blix, 2017).

At the same time, aged societies are associated to a greater extent with situations of labour shortage relative to capital, owing to the smaller number of working-age individuals. Also, if population ageing were to result in a decrease in aggregate demand, demand for labour would also decline. Consequently, the interaction between labour supply and demand may ultimately exert upward pressure on wages, which, in turn, would increase the income tax base (Dolls et al., 2017; Prammer, 2019). That said, the indirect effects that ageing might have on revenue, for instance via lower potential growth (Shirakawa, 2012), or its consequences on real wages derived from a smaller working-age population, fall outside the scope of our study.

Owing to the complex nature of tax collection and the sheer number of factors involved, the net effect of ageing remains an empirical matter. In any event, there is scant empirical evidence about the effects of ageing on tax revenue. Many studies have addressed this issue tangentially, while others have focused their analysis on specific countries. For example, Banco de España (2018), Felix and Watkins (2013) and Creedy et al. (2010) researched the effects on Spain, the United Kingdom and New Zealand, respectively. These studies revealed a common pattern: ageing not only alters total tax revenue, it also has considerable effects on revenue from income and consumption taxes. Population ageing would also affect the redistributive capacity of taxation (Bussolo et al., 2019). For example, Dang et al. (2006) used microdata to calculate the tax burden by age group for the OECD countries, finding that older (even high-income) households are subject to a relatively lower direct tax burden in most of the countries analysed.

3 Population age group structure and tax revenue

3.1 An initial approach based on aggregate data

As a starting point, Charts 4 and 5 present an international comparison of direct and indirect taxation of households, respectively, as a fraction of total fiscal revenue between 1970 and 2018. In these charts, the size of the markers represents the increase in the dependency ratio between those years.

Contrary to what might be expected, ageing does not seem to be associated with tax revenue. For example, two of the countries with the lowest increase in the dependency ratio, i.e. the United States and the United Kingdom, have experienced a reduction in direct taxes paid by households between 1970 and 2015. By contrast, the fraction of direct taxes paid by households has increased in countries such as France, Italy and Spain. Chart 5 shows that the fraction of indirect taxes relative to total revenue has remained approximately constant for most countries, regardless of the changes that have taken place in their demographic structure.

The previous charts show the limitations of addressing the issue at hand using aggregate data, since these might not only be affected by the demographic structure of the countries analysed, but also by other factors such as changes in the tax system or income distribution. In this regard, political economy considerations would become particularly significant, since, as the ageing rate has risen, the design of fiscal reforms may have been geared to favour the elderly, which has a growing share in the total population and, therefore, has greater influence on electoral outcomes (Katagiri et al., 2020). Consequently,

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Chart 4
THE WEIGHT OF TAXES ON PERSONAL INCOME IN RECENT DECADES

WEIGHT OF TAXES ON PERSONAL INCOME (a)
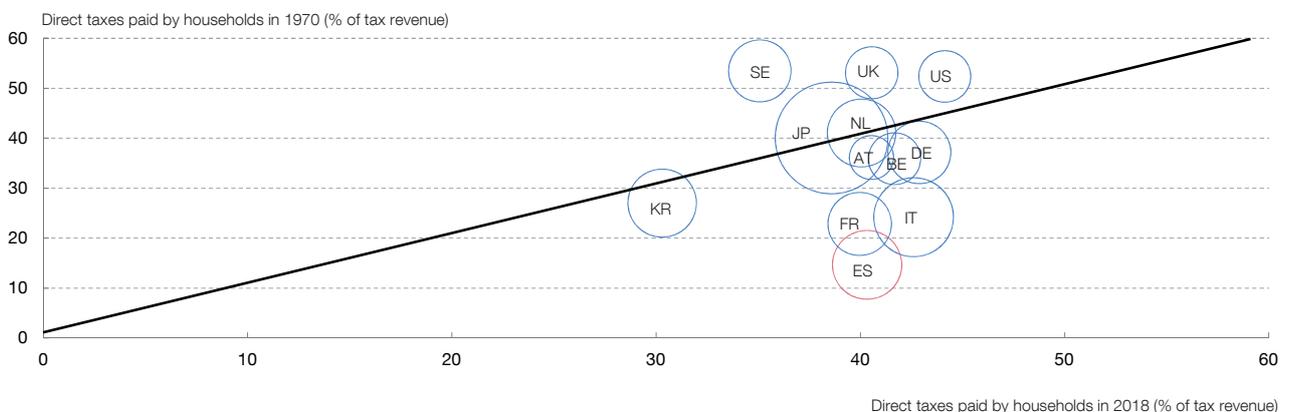
Direct taxes paid by households in 1970 (% of tax revenue)

Direct taxes paid by households in 2018 (% of tax revenue)

SOURCE: Own calculations.

a The fiscal data for South Korea and France are for 1975 and 1978, respectively.

Chart 5

THE WEIGHT OF TAXES ON GOODS AND SERVICES IN RECENT DECADES
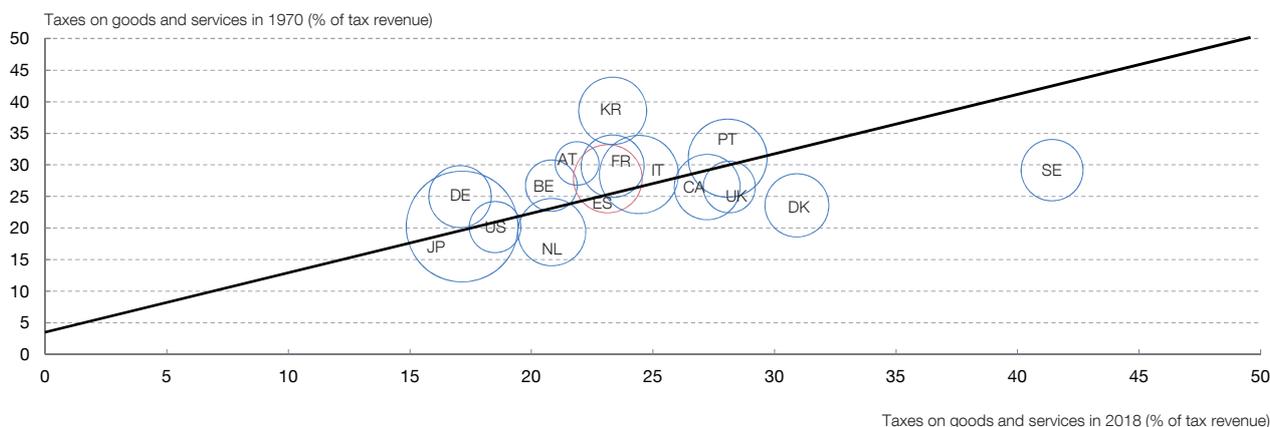
WEIGHT OF TAXES ON GOODS AND SERVICES (a)

Taxes on goods and services in 1970 (% of tax revenue)

Taxes on goods and services in 2018 (% of tax revenue)

SOURCE: Own calculations.

a The fiscal data for South Korea and France are for 1975 and 1978, respectively.

in order to analyse how resilient the different tax systems are to population ageing, the following subsection provides evidence of the effect of ageing on the fiscal structure by analysing different parameters by age group.

3.2 Evidence based on microdata

Aggregate data do not provide sufficient detail to analyse the effects of ageing on fiscal systems. For this reason, this section expands the analysis with evidence based on household survey data. The main advantage of microdata over aggregate data is that households can be grouped based on attributes such as age, which is particularly relevant in this case. However, the use of microdata is not without its drawbacks. In particular, they are not available for such protracted periods as would be desirable to analyse a phenomenon which is secular by nature. Owing to these limitations, this section focuses on the period from 1997-1999 to 2015. Our European aggregate was also necessarily limited to those countries that participated in the household surveys of the late 1990s: Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, the Netherlands, Ireland, Italy, Luxembourg, Portugal, the United Kingdom and Sweden.

3.3 The data

As regards direct taxation, the data for Europe were drawn from two household surveys: the European Union Statistics on Income and Living Conditions (EU-SILC) survey and its predecessor, the European Community Household Panel (ECHP) survey. These annual surveys aim to gather comparable cross-sectional data among the participating European countries, including detailed information on household income. For Japan, the income data were drawn from the Survey on Income Redistribution. This survey is conducted every three

years and captures the transfers received and the tax burdens borne by households. In the case of the United States, we supplemented the information from the annual Consumer Expenditure Survey (CES) – the only national household survey providing detailed information on the household consumption and income basket – with special Internal Revenue Service (IRS) publications on tax payments by age group. This latter source differs slightly from the former ones, however, in that it provides detailed information based on somewhat broader age groups, i.e. individuals under 35, households in which the reference person is between 35 and 65, and those over 65, rather than the 30 and 60 year-old thresholds used for the European countries and Japan.

With regard to the data on consumption and its taxation, European household spending charts are drawn from the Household Budget Survey (HBS), which is the main statistical source used to calculate weights for the consumer price index of European Union Member States. The consumption taxes are constructed using Eurostat's spending data by product category, age group and country. Owing to exemptions and reduced rates for certain spending categories, we supplement the spending information with estimates for effective consumption tax rates. Thus, the consumption figures are multiplied by the effective consumption tax rates for each product category and country, which are calculated by compiling the tax rates per product laid down in national value added tax laws, with subsequent weighting by their share in the consumption basket.

The consumption data for Japan are drawn from the National Survey of Family Income and Expenditure, a five-yearly survey that examines the income of working households and the breakdown of general household consumption. This survey also includes information on households' assets, savings and liabilities. No data on consumption tax are extracted, since a flat tax rate was applied in Japan in the two years of the sample. Lastly, as indicated above, household spending data for the United States are drawn from the CES. Consumption taxes in the United States are set in a highly decentralised manner,

Table 1

CLASSIFICATION OF CONSUMER SPENDING BY FUNCTION AND TYPE OF GOOD AND SERVICE

Function	Type of good and service
Food and non-alcoholic beverages	Non-durables
Clothing and footwear	Durables
Housing and utilities	Durables, Services
Furnishings and household equipment and services	Durables, Non-durables, Services
Health	Durables, Non-durables, Services
Transport	Durables, Services
Communications	Services
Restaurants, hotels and entertainment	Services
Miscellaneous goods and services	Durables, Non-durables, Services

SOURCE: Devised by authors.

that is at the state and local level. We therefore simplify the analysis by using the national averages calculated by the US Census Bureau.

Given that the data are drawn from various surveys, we adopt standardisation criteria to ensure cross-economy comparability. First, for all of the surveys we define a household as a group of people living together or a single person living independently. Second, common criteria for defining income and tax burden are likewise important. We use the values reported for taxes paid, whenever they are available in the surveys. Otherwise, we calculate these as the difference between gross and net income. In any event, the effective income tax rates correspond to the percentage of taxes paid relative to gross income. Lastly, we establish a classification of equivalent goods and services across the three economies based on the function of consumption and the durability of the goods (see Table 1).

3.4 Direct taxes by age group

Upon retirement, many households experience a decline in income that reduces their income tax base. The population ageing process may also undermine direct tax collection if the tax base reduction also entails a drop in effective tax rates; this depends on the progressivity of tax rates by income bracket and whether there are special deductions and exemptions for older people. To shed light on this matter, Chart 6 shows changes in effective income tax rates between the late 1990s and 2015 in the European Union (15 countries), the United States and Japan. The effective tax rates are shown for the three main age groups: under-30s (35 in the United States), 30-60 (35-65 in the United States) and over-60s (65 in the United States).

Chart 6
**EFFECTIVE INCOME TAX RATE BY AGE GROUP**

PERSONAL INCOME TAX RATE (a)
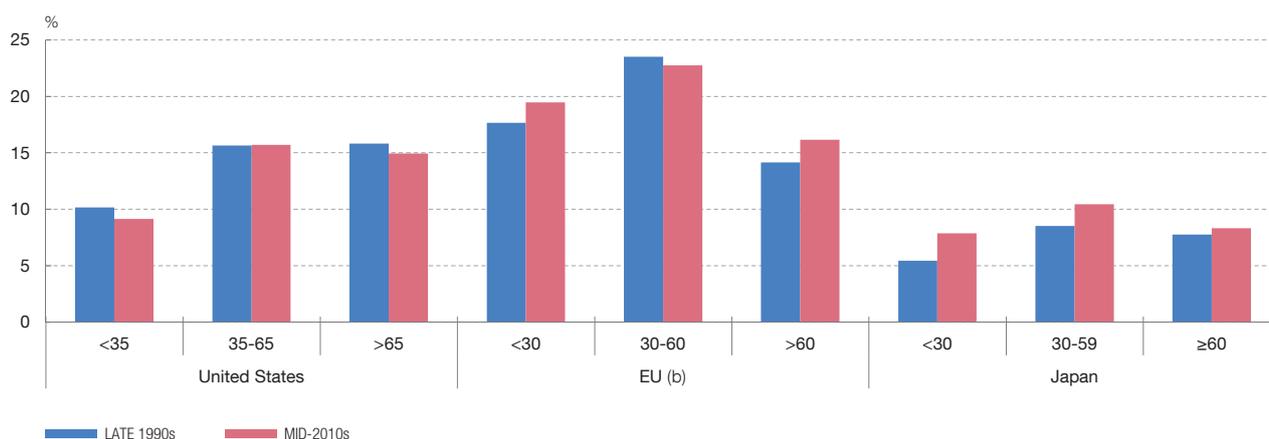
SOURCE: Own calculations.

a Late 1990s refers to 1997 for the United States, 1998 for the EU and 1999 for Japan. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.
b The EU aggregate includes Denmark, the Netherlands, Belgium, France, Ireland, Italy, Greece, Spain, Portugal, Austria, Finland, Sweden, Germany, Luxembourg and the United Kingdom. 1999 excludes Luxembourg and Sweden.

Chart 7
INCOME TAX REVENUE BY AGE GROUP

PERSONAL INCOME TAX COLLECTION (a)
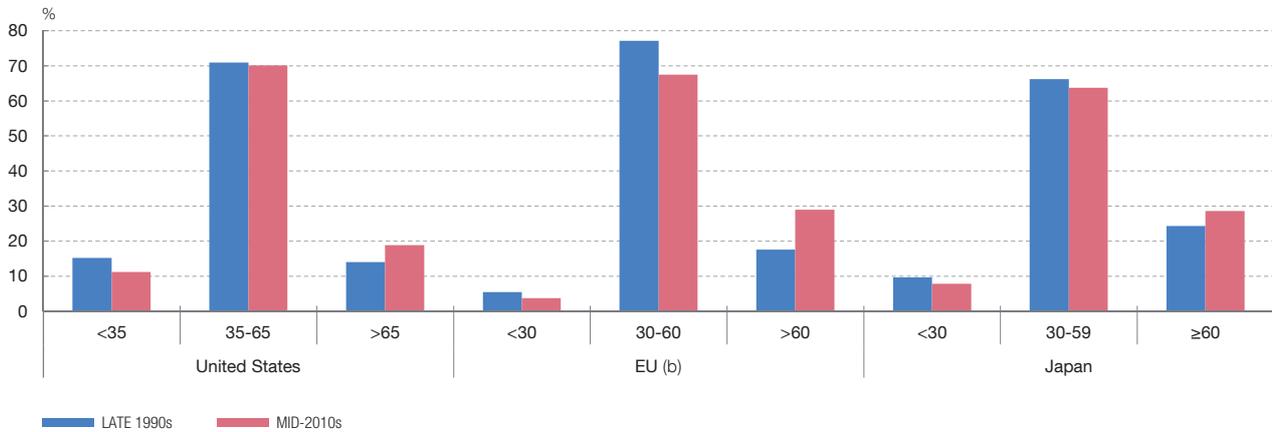
SOURCE: Own calculations.

a Late 1990s refers to 1997 for the United States, 1998 for the EU and 1999 for Japan. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.
b The EU aggregate includes Denmark, the Netherlands, Belgium, France, Ireland, Italy, Greece, Spain, Portugal, Austria, Finland, Sweden, Germany, Luxembourg and the United Kingdom. 1999 excludes Luxembourg and Sweden.

The effective income tax rate is higher in Europe than in the United States or Japan. The rate in Japan is particularly low, since the country relies (insofar as direct taxation is concerned) to a greater extent on social security contributions to finance public expenditure (Tajika and Yashio, 2018; again see Chart 1).

Developments in effective tax rates by age group have differed for each region studied. In Europe, effective rates have risen for the youngest and the oldest groups but have declined for the middle-aged segment. By contrast, in the United States the effective tax rate has held steady for the middle-aged population, while falling for both the younger and older groups. Lastly, the effective income tax rate in Japan has risen across the board, albeit with a marginally slighter increase in the older segment.

Setting aside the tax rate levels, the distribution of the implicit effective tax rates by age group displays an inverted U-shape, which is to be expected according to the life-cycle economic theory. This theory states that income rises with age but declines prior to and, in particular, after retirement. This fall in income results in the oldest households bearing a lower effective tax rate. In Europe, our calculations indicate a lower effective tax rate for the oldest segment, either because their income is lower or because of special deductions for that age group. A similar phenomenon, albeit less pronounced, is observed for Japan and the United States.

The United States in 1997 would appear to represent an exception to the inverted U-shape. However, two factors temper this conclusion. First, a classification of households

Chart 8
AVERAGE INCOME TAX CONTRIBUTION BY AGE GROUP
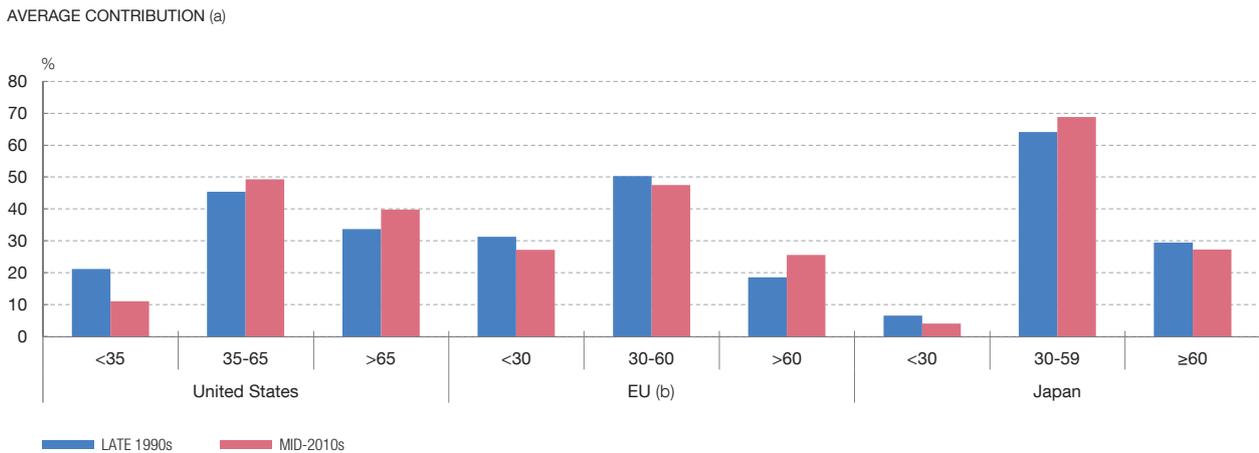
AVERAGE CONTRIBUTION (a)

SOURCE: Own calculations.

a Late 1990s refers to 1997 for the United States, 1998 for the EU and 1999 for Japan. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.
b The EU aggregate includes Denmark, the Netherlands, Belgium, France, Ireland, Italy, Greece, Spain, Portugal, Austria, Finland, Sweden, Germany, Luxembourg and the United Kingdom. 1999 excludes Luxembourg and Sweden.

into 10-year age groups shows a difference of more than 1 pp between effective tax rates for the oldest workers and for retirees. Second, the tax rate calculations are based on information drawn from tax returns, which would not take into account the considerable number of pensioners in the country who do not pay income tax (Marr and Huang, 2012).

The distribution of tax revenue by age group (see Chart 7) reveals a common trait among all of the economies and years analysed. The middle-aged group bears the largest tax contribution, since it earns the highest average income and is the largest group among income earners. However, the older group's relative weight in tax payments increased between the late 1990s and 2015. The higher contribution made by seniors essentially owes to their rising volume relative to the rest of the population, since their effective tax rate increase is equivalent to or less than that of other age groups. In Europe, however, the increase in the over-65s' contribution was also influenced by higher effective tax rates.

The above reasoning is borne out by the distribution of the average contribution of individuals in each age group (see Chart 8). In the EU, the older group's increased weight in the distribution is partly due to a higher average contribution and a higher effective rate, and partly to this age group's larger proportion, as shown in Chart 3. In the United States, the more prominent role of seniors in income tax revenue owes above all to their higher average contribution and, to a lesser extent, to a marginal increase in their share of the population. As a consequence, in terms of average contribution, the reduction of the average effective rate for this age group has been offset by an increased tax base. Lastly, in Japan the average

contribution of the most senior segment has declined; nonetheless, it accounted for a higher percentage of tax revenue on account of the average effective income tax rate and, in particular, its larger share of the population.

Several lessons can be drawn from the analysis of how population ageing affects direct tax revenue. First, the increase in the effective rates for seniors in Japan and Europe, along with their higher contributions to total revenue, indicates that population ageing entails a decline in intergenerational redistribution. Further, despite shrinking tax bases, the widespread rise (albeit mostly concentrated among middle-aged adults) of effective tax rates in Japan suggests that direct tax revenue has a degree of resilience to population ageing. This would be consistent with the aggregate level evidence that direct tax revenue has held stable in the country over recent decades (see developments in Japan in Chart 4). In Europe, although there is some cross-country dispersion, the average seems to indicate a degree of stability, while the effective rates estimated for each age group seem to signal that this stability stemmed from a reduction in the income tax differences between the over-60s and middle-aged adults.

3.5 Consumption patterns and indirect taxation by age group

The analysis of consumption patterns by age group indicates that, both in terms of international comparison and in a single country over time, services account for the bulk of consumer spending across all age groups, in some cases exceeding 50% (see Chart 9). Moreover, in the United States the weight of services has increased substantially over time, which is not the case in Europe and Japan.

In the United States and Japan, durable goods and services account for a larger proportion of the younger population's consumption basket than that of the older population. Spending on non-durable goods is higher in the older group, while spending on services makes up a smaller share of the consumption basket than for young adults. In Europe, services have a higher weight in the older group, while the patterns for non-durable and durable goods are similar to the other two economies.

As for implicit consumption tax rates, Chart 10 shows a clearly higher average rate in Europe than in the other two areas. As has been noted, changes in consumption patterns over the life cycle entail greater spending on goods and services taxed at relatively lower rates. Thus, the implicit consumption tax rates form an inverted U-shape in Europe and the United States, albeit far more pronounced in Europe, as was also true of direct taxes. Further, the increase in the average rate over time in Europe presents the same inverted U-shape and accentuates the effect of the differences between the consumption baskets of the elderly and the other age groups, as a result of relatively smaller increases for the former.

In Japan, it should be noted that a flat consumption tax rate was applied until very recently, and only the tax increase that took place in early 2014 is observed. In October 2019

Chart 9

BREAKDOWN OF CONSUMER SPENDING BY TYPE OF GOOD AND AGE GROUP

1 EU (1999)

2 EU (2015)

3 UNITED STATES (1999)

4 UNITED STATES (2015)

5 JAPAN (1999)

6 JAPAN (2014)

SERVICES   NON-DURABLES   DURABLES
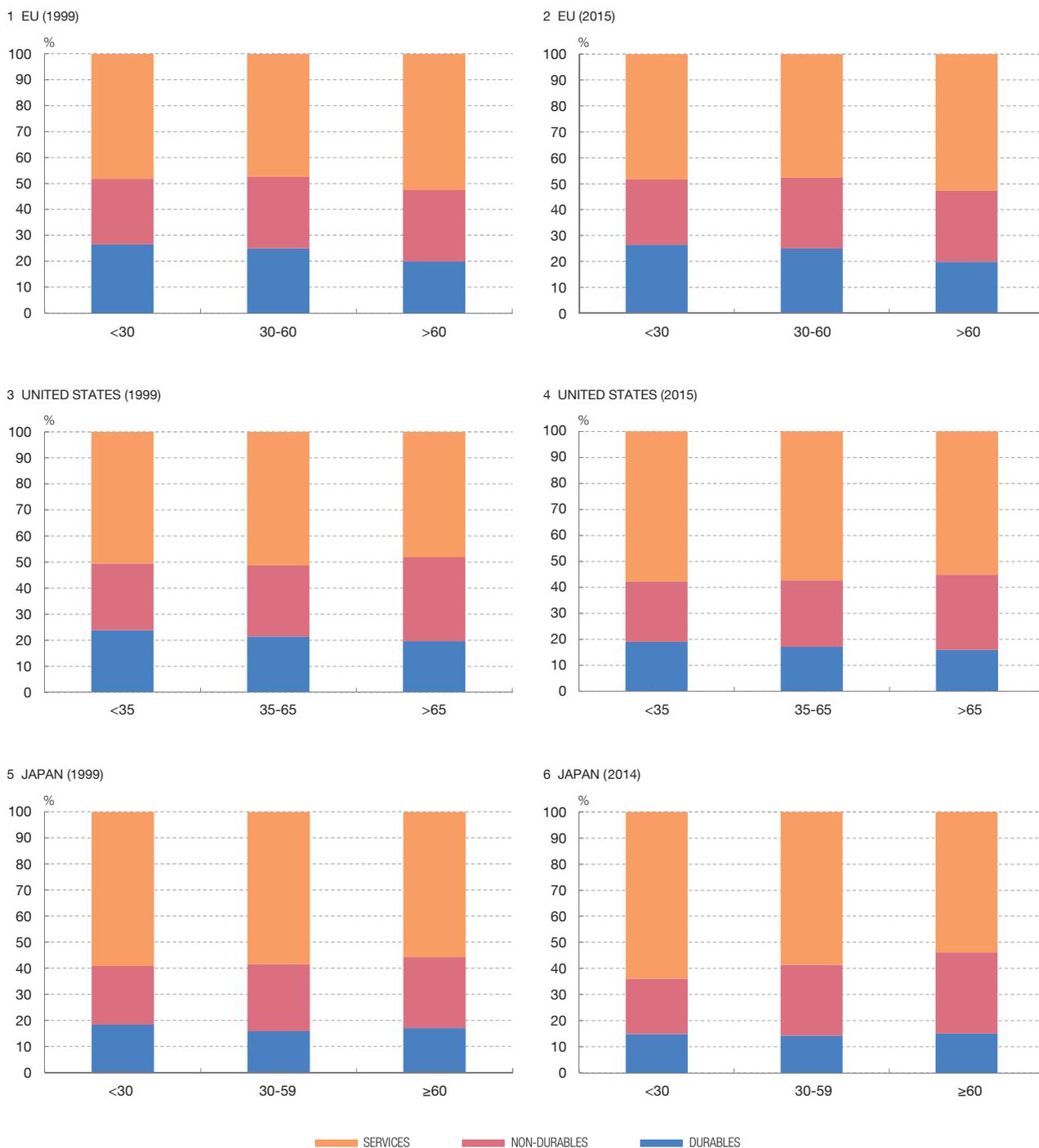
SOURCE: Own calculations.

the consumption tax rate was raised to 10%, but some food and non-alcoholic beverages and newspapers remained taxed at the previous 8%. The data available do not allow an assessment of whether the introduction of reduced rates for specific food products (inelastic) will result in lower tax revenue than would have been the case had consumption taxes been raised to 10% across all products, or how the different consumption patterns

Chart 10
AVERAGE CONSUMPTION TAX RATE BY AGE GROUP

AVERAGE CONSUMPTION TAX RATE (a)
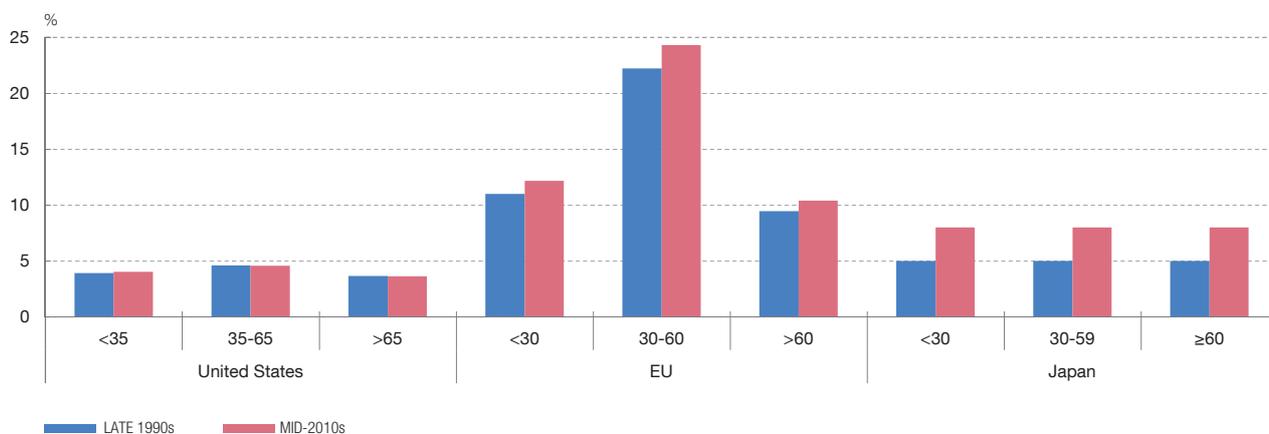
SOURCE: Own calculations.

a Late 1990s refers to 1999. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.

Chart 11
CONSUMPTION TAX REVENUE BY AGE GROUP

CONSUMPTION TAX REVENUE (a)
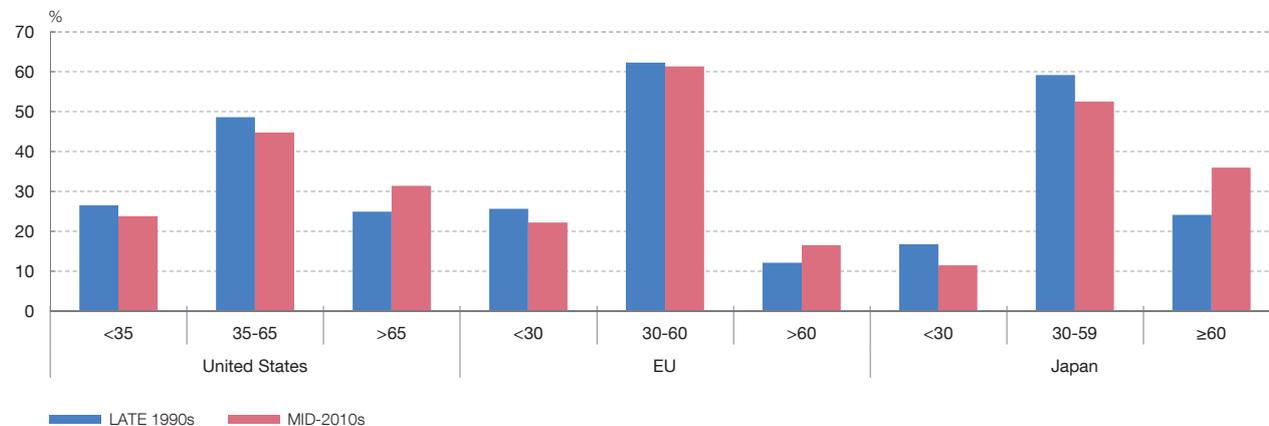
SOURCE: Own calculations.

a Late 1990s refers to 1999. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.

among the older population may be affected. That said, reduced rates can be offset by a higher standard consumption tax rate to achieve the same tax revenue (IMF, 2011).

Like direct taxation, the distribution of tax revenue by age group reveals commonalities to all of the economies and years assessed. Specifically, the middle-aged

Chart 12

AVERAGE CONSUMPTION TAX CONTRIBUTION BY AGE GROUP

CONTRIBUTION TO CONSUMPTION TAX (a)
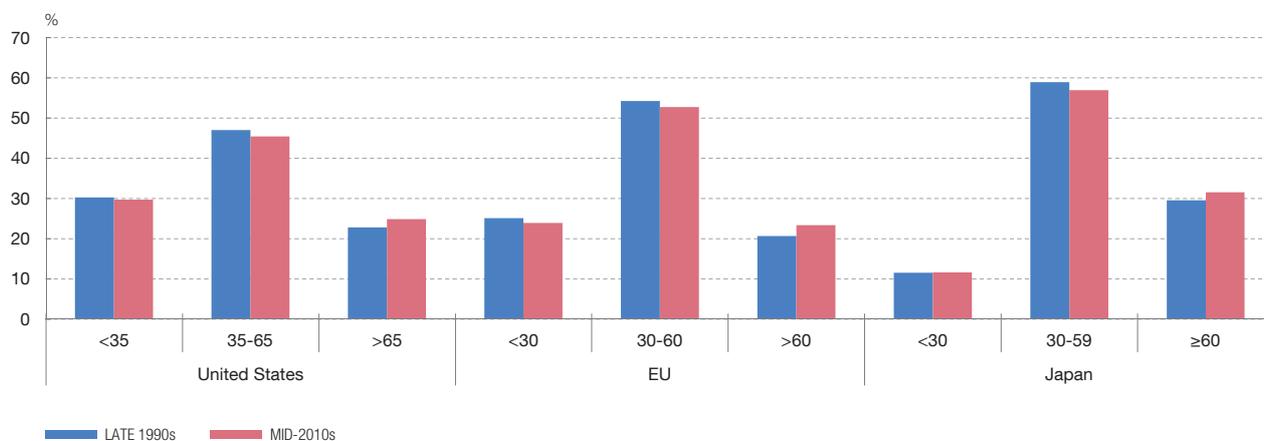
SOURCE: Own calculations.

a Late 1990s refers to 1999. Mid-2010s refers to 2015 for the United States and the EU and 2014 for Japan.

group bears the largest tax contribution, since it earns the highest average income and, consequently, it enjoys higher levels of consumption than the younger and older groups (see Chart 11). However, the oldest group's relative weight in tax payments increased between the late 1990s and 2015. The increase in the contribution made by seniors essentially owes to their rising volume relative to other age groups, since their effective tax rate increase is equal to or less than that of other age groups.

Looking at the distribution of the average individual consumption tax contribution by age group (see Chart 12), the average has risen for the oldest citizens and has decreased in the other groups across all of the countries studied. Given that there has been no increase in the average effective rate for the oldest group relative to the other groups, we can associate its greater share in indirect tax revenue to a larger weight in the population, i.e. to population ageing.

In short, the increase in average tax rates across all age groups and countries has offset the composition effect of population ageing, which tends to drive up the consumption of non-durable goods subject to lower taxation, such as food (see Chart 9). This agrees with the aggregate evidence presented above that indirect tax collection, as a percentage of tax revenue, has held largely constant over recent decades in countries such as Japan and the Netherlands.

4 Conclusions

Demographic structure and taxation are linked in a complex manner through various channels. These channels would be affected by institutional changes (changes to the tax system) that take place in tandem with, or as a result of, population ageing, in addition to temporary and structural macroeconomic developments. The microdata-based analysis conducted in this article on tax collection by age group in the European Union, Japan and the United States allows us to identify a set of stylised facts.

First, in the three economies studied the average tax burden for the oldest population has declined. This, per se, is a factor of vulnerability for the welfare systems in the economic areas assessed vis-à-vis the demographic phenomenon of population ageing. Second, and at the same time, the tax burden (both direct and indirect) borne by the elderly has generally risen over the last three decades; consequently, that of the other age groups has declined. Third, it can be said that this increase, while largely owing to demographic factors (the elderly now makes up a larger percentage of the population), also seems to reflect changes in taxation. Regarding income tax, effective rates for the most senior age group have risen in tandem with (and perhaps partially because of) the phenomenon of population ageing. The same pattern is likewise observed in consumption taxes. The latter tax rates have scarcely changed in the United States (the most youthful of the economies studied) during recent decades, whereas they have risen in Japan (the world's most elderly population) and Europe.

Accordingly, the oldest segment is making a larger contribution to public finances owing to its increased relative weight in the population and, in some cases, to this group's larger tax burden via direct and indirect taxes. The aggregate level patterns show a weak or even non-existent relationship between population ageing and tax revenue. However, our in-depth analysis reveals that this apparent contradiction disappears once we take into account, among other factors, the adaptation of the tax system in the three economies to changes in the population structure. Ultimately, these results evidence some resilience in tax revenue-raising capacity to the population ageing process.

References

Aguiar, M. and E. Hurst (2013). "Deconstructing Life Cycle Expenditure". *Journal of Political Economy,* 121(3), 437-492.

Banco de España (2019). "Economic consequences of demographic change". *Annual Report,* 2018, Chapter 4.

Berganza, J. C., R. G. Campos, E. Martínez Casillas and J. J. Pérez García (2020). "The end of the demographic dividend in Latin America: challenges for economic and social policies", *Economic Bulletin,* 1/2020, Banco de España.

Blix, M. (2017). *The effects of digitalisation on labour market polarisation and tax revenue.* CESifo Forum, 18(4), 9-14.

Broniatowska, P. (2019). "Population ageing and inflation". *Journal of Population Ageing,* 12(2), 179-193.

Bussolo, M., C. Krolage, M. Makovec, A. Peichl, M. Stöckli, I. Torre and C. Wittneben (2019). *Vertical and horizontal redistribution: the cases of Western and Eastern Europe.* EROMOD, Working Paper Series EM1/9.

Credit Suisse (2015). *Demographic focus – Changing global consumers.* Global Demographics Research.

Creedy, J., J. Enright, N. Gemmell, and A. Mellish (2010). "Population ageing and taxation in New Zealand". *New Zealand Economic Papers, Taylor & Francis Journals,* 44(2), 137-158.

Dang, T. T., H. Immervoll, D. Mantovani, K. Orsini, and H. Sutherland (2006). *An age perspective on economic well-being and social protection in nine OECD countries.* EUROMOD, Working Paper Series EM3/06.

Dolls, M., K. Doorley, A. Paulus, H. Schneider, S. Siegloch and E. Sommer (2017). *Fiscal sustainability and demographic change: a micro-approach for 27 EU countries.* International Tax and Public Finance, 24(4), 575-615.

European Commission (2018). *The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016-2070).* Institutional Paper 079.

Eurostat (2019). *Ageing Europe 2019 edition – Looking at the lives of older people in the EU.* Eurostat Statistical Books.

Felix, A. and K. Watkins (2013). "The impact of an Aging U.S. population on state tax revenues". *Economic Review,* Fourth Quarter 2013, Federal Reserve Bank of Kansas City.

IMF (2011). *Raising the consumption tax in Japan: Why, when, how?* IMF, Staff Discussion Note.

Goodkind, H. W. and P. R. Kowal (2016). *An aging world: 2015.* International Population Reports.

Groneck, M. and C. Kaufmann (2017). *"Determinants of relative sectoral prices: the role of demographic change".* Oxford Bulletin of Economics and Statistics, 79(3), 319-347.

Hernández de Cos, P., J. F. Jimeno Serrano and R. Ramos (2017). *The Spanish public pension system: current situation, challenges and reform alternatives.* Occasional Paper No 1701, Banco de España.

Jappelli, T. and L. Pistaferri (2010). "The consumption response to income changes". *Annual Review of Economics,* 2, 479-506.

Katagiri, M., H. Konishi and K. Ueda (2020). *"Aging and deflation from a fiscal perspective".* Journal of Monetary Economics, 111, 1-15.

Luengo-Prado, M. J. and A. Sevilla (2013). "Expenditure at Retirement in Spain". *The Economic Journal,* 123, 764-789.

Marr, C. and C. Huang (2012). *Misconceptions and realities about who pays taxes.* Center on Budget and Policy Priorities.

OECD (2017). "Ensuring fiscal sustainability in the context of a shrinking and ageing population". OECD *Economic Surveys: Japan 2017.* OECD Publishing.

OECD (2019). *Pensions at a Glance 2019: OECD and G20 Indicators.* OECD Publishing.

Ohno, T. and T. Kodama (2017). *Estimation of tax and social insurance burden on households: verification of the validity and assessment of actual status.* PRI, Discussion Paper Series No.17 A-02.

Prammer, D. (2019). "How does population ageing impact on personal income taxes and social security contributions?" *Journal of the Economics of Ageing,* 14(100186), 1-18.

Sebastián, R. (2018). *Explaining Job Polarisation in Spain from a Task Perspective.* SERIEs, 9(2), 215-248.

Shirakawa, M. (2012). *Demographic Changes and Macroeconomic Performance: Japanese Experiences.* Opening Remark at 2012 BOJ-IMES Conference, hosted by the Institute for Monetary and Economic Studies, the Bank of Japan.

Tajika, E. and H. Yashio (2018). "What needs to be done of personal income tax of Japan? A perspective for reform under deflation and aging population". *Policy Research Institute, Ministry of Finance, Japan, Public Policy Review,* 14(2), 217-244.

United Nations (2009). *Older persons as consumers.* Policy Brief on Ageing No. 3.

United Nations (2017). *Migration and population changes – drivers and impacts.* Population facts No. 2017/8.

US Census Bureau Annual Survey of State and Local Government Finances (1977-2017). Compiled by the Urban Institute via State and Local Finance Data: Exploring the Census of Governments. Retrieved on June 2020 04:34.

Yashio, H. and K. Hachisuka (2014). "Impact of population aging on the personal income tax base in Japan: simulation analysis of taxation on pension benefits using micro data". *Public Policy Review,* 10(3), 519-542.

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