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Demographic transition

Opportunities and challenges to achieve the Sustainable Development Goals in Latin America and the Caribbean

Cassio M. Turra
Fernando Fernandes



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Opportunities and challenges to achieve the Sustainable
Development Goals in Latin America and the Caribbean

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Fernando Fernandes



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Introduction

The Latin America and Caribbean region has witnessed rapid demographic, social, economic and political transformations in the last 50 years. However, despite reductions in poverty, progress in the supply of essential services to the population, improvements in education, health and gender equity and growth in GDP per capita, many problems remain. Inequality, both within and between generations, is still at unacceptable levels. The speed of the demographic transition has outstripped societies' ability to create the conditions for sustainable development in the region. Population ageing may impose severe constraints on private and public systems that provide financial support to older people, worsening the distribution of resources. Thus, there is still much to learn about the association between resource allocation and well-being in the new demographic context.

In 2015, the 193 Member States of the United Nations approved the 2030 Agenda for Sustainable Development, along with the Sustainable Development Goals (SDGs). This bold agenda sets out a global framework for ending extreme poverty and fighting inequality and injustice. Building on the historic Millennium Development Goals, the ambitious set of 17 SDGs and 169 associated targets is people-centred, has a rights-based approach, is universal (all countries participate on similar terms) and provides a holistic view of development by integrating the economic, social and environmental pillars of sustainable development.

The 2030 Agenda is susceptible to both demographic changes and the way families, governments and the market distribute resources and time within and between age groups. Individual decisions, public policies and the market structure determine the access of population groups to more efficient and equitable distribution systems over the life cycle, affecting investments in human capital and access to private networks, credit, insurance and public welfare systems during adulthood and at advanced ages. In addition, population ageing may require intergenerational systems to adjust, affecting population groups differently depending on how they interact with allocation channels.

In a context of rapid population ageing where the demographic dividend is running out, Latin America and the Caribbean will soon confront the same economic and fiscal challenges as ageing Europe does now, but with three additional challenges. Population ageing will take place faster than it has in Europe, at lower levels of economic development and with high and persistent levels of inequality.

Taking advantage of the opportunities and responding to the new challenges presented by the demographic transition during the SDG period require forward-looking policies which take population dynamics into account. Progress towards SDG targets is inseparably linked to population trends. The ability of countries to provide social protection via pensions and health care is strongly influenced by the changing age structure of their populations. It is impossible to adopt forward-looking policies for improving people's lives without considering population dynamics, which determine the number of people, where they will live and the composition and age structure of future populations. Hence, the success of the 2030 Agenda is very much bound up with anticipating and planning for the effects of the demographic transition that will unfold during the SDG period.

National Transfer Accounts (NTAs) provide the kind of internationally comparable data needed for an evidence-based approach to these challenges. The NTA system provides the first comprehensive approach to measuring all aggregate economic flows across age groups and time: the generational economy. The accounts encompass flows occurring through capital accumulation and transfers, distinguishing those mediated by public institutions from those relying on private institutions, and measure all aggregate flows in a manner consistent with the System of National Accounts. Estimation relies heavily on the analysis of comprehensive household surveys of income, expenditure, assets, the labour force and transfers, and on detailed administrative records available from government agencies.

NTAs have helped to improve various measurement systems by better informing discussions on the consequences of demographic changes for social and economic development. The list of systems that have benefited from the additional knowledge produced in the NTA network includes traditional national accounts, household time-use systems and specific intergenerational allocation schemes such as social security, public health and education. Larger-scale production and dissemination of this kind of information for full incorporation into the design of forward-looking policies for sustainable socioeconomic development has become even more crucial with the adoption of the 2030 Agenda, as well as the Montevideo Consensus on Population and Development. However, no systematic attempt has been made to connect the NTAs with the SDGs, specifically in the Latin American and Caribbean context, despite their promising implications for the debate on inequalities between and within population subgroups in a context of population changes in particular.

I. Objectives and limitations

The main objective of this paper is to relate demographic changes to the NTA measures and SDG indicators. The challenge for it, and its main contribution, is to develop a proper methodological approach that can connect the demographic, generational and development dimensions, casting light on pathways for sustainable growth in the context of rapid demographic transition. Since not all SDGs are directly associated with the generational economy, the paper will focus on those that are (theoretically and empirically) most likely to be related to different patterns of the generational economy and the NTA system.

This paper does not set out to model and test any casual relations between the three dimensions. It is an exploratory and descriptive analysis that proposes to examine the extent to which countries at the same stages of the demographic transition distribute resources over the life cycle when addressing specific economic and social issues. The results are expected to enhance current knowledge about sustainable development in ageing societies. It will also offer policy recommendations to help Latin American and Caribbean governments attain development goals in the context of rapid demographic transition, considering different demographic, political and socioeconomic backgrounds. Of course, in a merely descriptive analysis, care is needed when attempting to disentangle the mechanisms linking the different sets of measures, and any policy recommendations must thus be treated with caution. Yet the findings of this paper may prompt future analyses of the role of specific public policies in promoting social and economic development for all.

The paper comprises four sections in addition to this introduction. Section II examines demographic changes from 1950 to 2100 in Latin America and the Caribbean and other regions of the world. Many studies have looked extensively at the demographic transition, including its history and determinants, differences across countries and regions, and future trajectories. Where the debate on the generational economy is concerned, changes in population age structure are paramount when it comes to understanding the future of socioeconomic conditions and their political implications. This paper thus focuses on the age transition, examining how nations historically characterized by a substantial presence of children and youth are turning into aged populations.

Two main questions guide the analysis. First, how fast has the population of Latin America and the Caribbean aged compared to other regions of the world? Understanding the timing and speed of population ageing is essential for anticipating demographic opportunities and challenges. Second, are

inter- and intraregional demographic differences diminishing over time? The demographic transition has not been a uniform process within Latin America and the Caribbean, but as it has advanced, demographic variables have been converging across countries. Understanding the distinct demographic paths can help elucidate why each society has adopted different policies for allocating public and private resources between and within age groups, and how these policies have been evolving as the demographic transition is completed, resulting in a more stable population age structure.

Section III discusses how the NTA methodology has contributed to the scientific and political debate on the socioeconomic consequences of population ageing, comparing countries in Latin America and the Caribbean with those in other continents for which NTA data are available. One of the challenges is to reduce the many NTA elements into a selected group of measures that cast light on how resources are distributed across generations, particularly for the most vulnerable age groups: children and older people. NTA countries are then grouped by the selected subdimensions to distinguish differences in the generational economy at the various stages of the demographic transition.

The main goal of section IV is to connect demographic and NTA measures with a set of specific SDG indicators and examine potential associations between them. The challenge involved in this task is to design a methodology that can select the indicators most closely related to both the global age transition and the patterns of the generational economy. Once the SDG indicators are chosen, they can show how strongly the existence of an older population that relies more heavily on the public sector to fund consumption is associated with better or worse measures of living conditions.

Lastly, section V provides an overview of the main findings and uses the integration of SDG indicators with NTA measures to summarize the sustainable development challenges that countries face. It then offers a set of recommendations on how to attain and measure the SDGs in the context of critical demographic changes.

II. The demographic transition in the Latin America and Caribbean region

The demographic transition is the shift from high to low levels of mortality and fertility. It is a historical process that began more than 200 years ago in Europe and has spread to other countries of the world over the centuries. The timing and speed of the transition vary between regions and countries, but generally there is a similar sequence of successive stages everywhere.

The main trigger for the demographic transition is the sustainable reduction of mortality levels, which is followed by an increase in the population growth rate. The age structure of the population remains relatively young during this stage as large numbers of births combine with a particularly substantial reduction in mortality rates in the first years of life, which are the most susceptible to initial control of infectious diseases. Historically, different social transformations have followed the mortality transition, including higher urbanization rates, the development of more modern and sophisticated economic systems, greater demand for human capital and increasing female participation in the labour market. Fertility decline follows the mortality transition, beginning in this new social, economic and cultural environment as a feasible and wanted response by families, given increased opportunity costs for women and the need for more significant investment per child.

In the decades immediately following the start of the fertility transition, the growth in the population of reproductive ages, composed of cohorts born in earlier decades, mitigates the reduction in the number of births. Gradually, however, both the growth rate and the age structure of the population change significantly. With fewer births, population growth decreases and the population ages. Initially, ageing results from slowing growth in the number of children, combined with a faster increase in the adult population. In the following decades, population ageing becomes the result of a relative and absolute decrease in the number of children, and eventually of adults. Meanwhile, the largest cohorts, born in the context of high fertility and decreasing mortality, reach older ages. The total growth rate keeps dropping, and population size may even decrease, depending on fertility levels. If there are no further significant alterations in fertility, changes in the age structure gradually become milder, with population ageing being almost exclusively a function of survival gains in old age. By the end of this process, the population age structure has become significantly older and relatively stable.

From the beginning of the demographic transition to its later stages, several demographic variables undergo changes, as mentioned above. In the case of Latin America and the Caribbean (United Nations, 2019c), for example, life expectancy at birth is expected to increase by more than 35 years from 1950 to 2100. In addition, the average number of children per woman, which was close to six before the demographic transition, is projected to decrease to less than a third of that number, reaching levels below 1.8 by the end of the period. Thus, the population growth rate, having remained high for decades, with a projected increase of more than 500 million people by 2100, is expected to reach slightly negative, near-zero levels. Moreover, the very young population age structure of the past (51% of the population was under 20 years old in 1950 and only 3.5% over 65) will become much older by 2100, with almost a third of the population being over the age of 65. Lastly, modernization and improved gender equity have led to the emergence of different types of families, while families have also become smaller and more vertical, being characterized by the coexistence of a larger number of surviving generations.

Demographic changes are not independent of economic, social, political and cultural contexts. As the demographic transition takes place, then, society in all its complexity and dynamism is also modified. Countries around the world have become more urban, more democratic and wealthier. Meanwhile, health and living conditions have improved, and several windows of opportunity have opened that favour economic growth and the mitigation of inequalities (gender, racial and ethnic, income and regional inequality, to mention a few). Changes in population size and composition have also altered the roles of families, markets and the State as channels of resource allocation. In the international arena, the differing timing and speed of the demographic transition mean that a regional redistribution of the world population is taking place, with consequences for migratory flows, global markets and political processes. The economies of the countries that pioneered the demographic transition (Western Europe, Japan and the Anglo-Saxon countries) have become increasingly dependent on foreign consumption and a supply of labour from other regions of the world, chiefly Africa, Asia and Latin America and the Caribbean.

A. Synthetic measures of the demographic transition: child-age and old-age dependency ratios

A number of economic and social changes are associated with the demographic transition, and an increasing number of studies, in different fields of knowledge, have addressed these interrelations. As mentioned in the introduction, it is not the purpose of the present study to establish and test causal relationships or to discuss models of economic development involving demographic variables. Nor is the intention to take forward the debate on the demographic determinants of population ageing and possible alternative scenarios for fertility and mortality functions. Rather, this is an exploratory analysis seeking to identify aspects of the demographic transition that can help contextualize the relationship between the structure of the generational economy, as measured by National Transfer Accounts (NTAs), and progress towards some of the Sustainable Development Goals (SDGs). Another objective is to cast light on the different ways in which societies have responded to population change by examining similarities in the demographic transition process among countries for which NTA and SDG data are available, with a focus on the Latin America and Caribbean region. The main question that arises, then, is which demographic transition measures could serve to explore the possible connections between NTAs and the SDG indicators.

The methodology used in this section took account of some key aspects. First, it was necessary to identify synthetic and straightforward demographic measures, since the inclusion of the NTA and SDG indicators in the next sections will significantly increase the number of dimensions to be analysed simultaneously. At the same time, the measures need to describe the demographic transition fully and must be strongly associated with the main demographic variables, especially mortality and fertility. Furthermore, they must distinguish countries according to the various stages of the demographic transition and describe unique trajectories that may exist in the transition from high to low population pressure regimes.

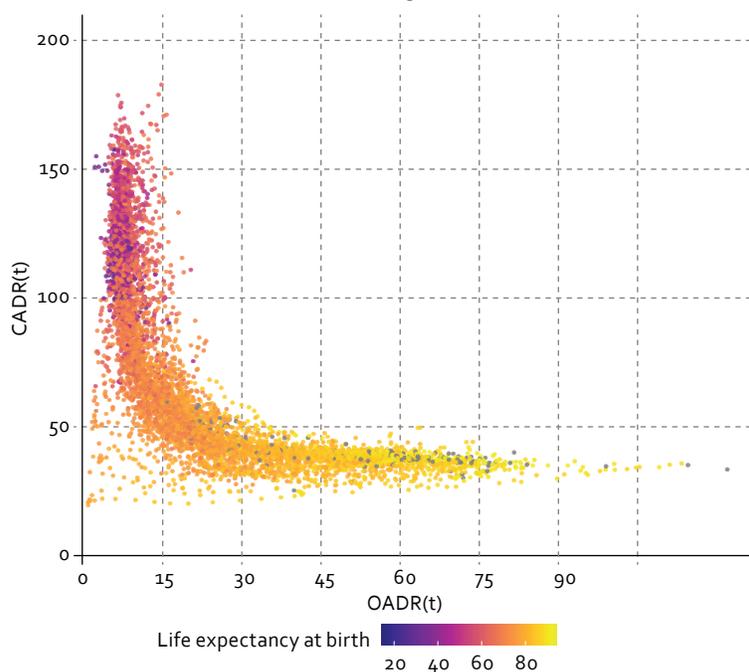
Two measures were therefore selected: the child-age and old-age dependency ratios (CADR and OADR). The first is calculated by dividing the number of people aged 0 to 19 by the working-age population, here defined as people aged from 20 to 64. The OADR is calculated by dividing the number

of people aged 65 and over by the same working-age group. One of the characteristics of the life cycle in contemporary societies is the existence of two phases of economic dependency, in the early and late years of life. Demographic dependency ratios thus tie in closely with the discussion on intergenerational transfers that follows in the next section. They can also be connected to the indicators of SDGs aimed at improving the well-being of children and older people. Lastly, they are a direct consequence of fertility and mortality transitions, reflecting the change in the composition of the dependent age groups during the demographic transition: an increasing number of older persons offsets a decrease in the number of children and youth, with significant consequences for the economy and society in general.

The measures were calculated on the basis of the medium-fertility variant of the 2019 revision of World Population Prospects, which gives the official United Nations population estimates and projections (United Nations, 2019a, 2019b and 2019c). The estimates and projections cover 150 years, with estimates from 1950 to 2020 and projections from 2020 to 2100. A total of 233 countries or areas are included, but detailed data (population by age group, for instance) are available only for the 201 countries with more than 90,000 inhabitants in 2019. Taking these 201 countries or areas, information for people of both sexes was combined from four separate United Nations databases: the complete list of coded locations (United Nations, 2019d), demographic indicators for five-year periods (United Nations, 2019e), the OADR series (ages 65+/20–64) (United Nations, 2019f) and the CADR series (ages 0–19/20–64) (United Nations, 2019g).

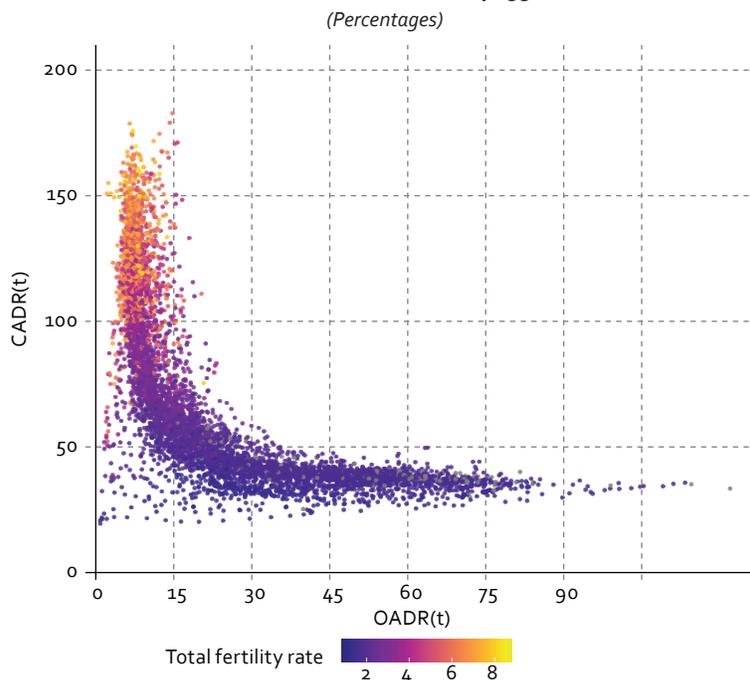
In the first set of results, each country is represented at distinct points in time determined by the availability of data in the United Nations databases. Thus, a country can be represented by up to 30 different measures calculated for the five-year periods between 1950 and 2100. Figures 1 and 2 present these estimates, correlating them with two key demographic variables: mortality, measured by life expectancy at birth, and the average number of children per woman, measured by the total fertility rate. The CADR is presented on the vertical axis (y), while the OADR is plotted along the horizontal axis (x). Scatter plots are used to analyse the changing composition of the dependent population, together with the demographic transition.

Figure 1
Child-age and old-age dependency ratios (CADR and OADR) by life expectancy at birth,
selected countries of the world, 1950–2100
(Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 2
Child-age and old-age dependency ratios (CADR and OADR) by total fertility rate,
selected countries of the world, 1950–2100



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

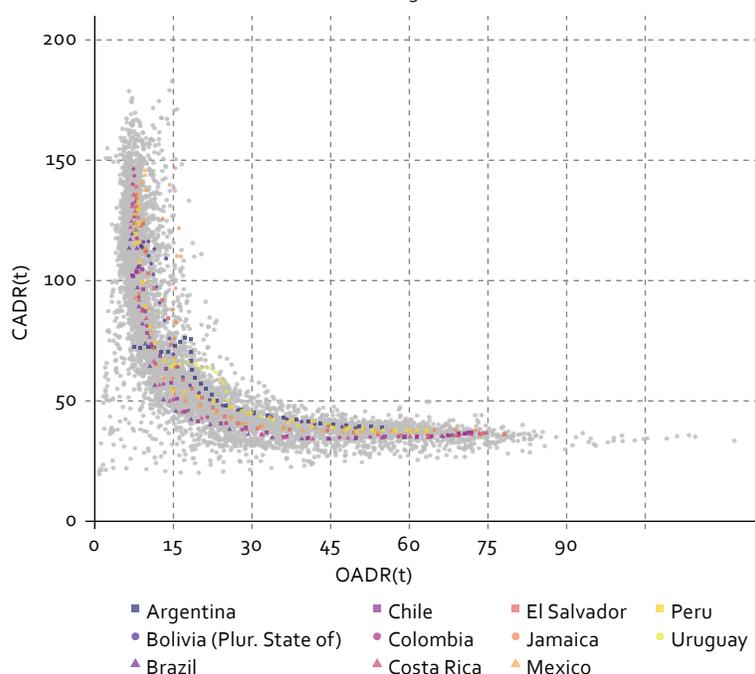
The two dependency ratios are negatively associated, although not linearly. As mentioned above, there is a high proportion of children and young age groups during the early stages of the demographic transition, when births are numerous and mortality levels high. The ratio can be as great as 150 individuals aged 20 and younger for every 100 adults aged 20 to 64. At the same time, there are fewer than 7.5 older persons (aged 65 and over) per 100 adults in the earliest stage of the demographic transition.

As the demographic transition advances, driven by declining mortality and fertility, there is a substantial reduction in the CADR without a commensurate increase in the OADR. The latter remains virtually constant at around 7.5 older persons per 100 adults until the CADR decreases to approximately 100 to 75 youths per 100 adults. From that point on, the OADR begins to grow slowly while the CADR shrinks faster. At the lower limit of this phase, the CADR can reach levels of between 50 and 75 young people per 100 adults, i.e., up to two thirds lower than its initial average level, without the OADR exceeding 15 older people for every 100 adults. This stage is thus marked by a dramatic reduction in the total dependency ratio (CADR + OADR) and rapid growth in the proportion of the working-age population. On average, there is a reduction of around 90 total dependents (young and old) per 100 adults between the beginning of the transition and the point where the total dependency ratio is lowest. This phase coincides with the so-called demographic dividend, a period in which numerous windows of opportunity open up for improvements in countries' social, economic and political conditions.

Gradually, life expectancy increases (figure 1) while the number of births decreases owing to both declining fertility (figure 2) and changes in the age structure. There is less variation in the CADR, which holds steady at between 25 and 50 youths per 100 adults, slowly approaching its probable lower asymptote. At the same time, the OADR grows monotonically, climbing from 15 per 100 to levels above 65 per 100. There is an evident change in the composition of dependents over the course of the demographic transition: at the beginning, the ratio between young and old is 20 to 1, whereas by the end, when population ageing has been consolidated, the preponderance is reversed, with a ratio of 1 to 1.8.

What are the expected trajectories of dependency ratios in the Latin American and Caribbean countries? Figure 3 highlights the estimates for 11 countries in the region that have recent NTA data. In general, Brazil, Colombia and Costa Rica follow a similar pattern, although there are differences in the initial and final dependency ratio values. The trend is typical of populations that began the fertility transition only in the second half of the twentieth century but have experienced a rapid and sharp reduction in the average number of children per woman since then. Primarily, for these countries, there is a significant reduction in the total dependency ratio (a sharp drop in the CADR with slow growth in the OADR). Owing to the intensity of the changes, this type of trajectory generates substantial economic and social opportunities. Decades later, however, it also translates into rapid population ageing, characterized by comparatively high levels of old-age dependency that can even surpass those of the countries which pioneered the demographic transition.

Figure 3
Child-age and old-age dependency ratios (CADR and OADR), Latin American and Caribbean countries participating in the National Transfer Accounts Project, 1950–2100
(Percentages)



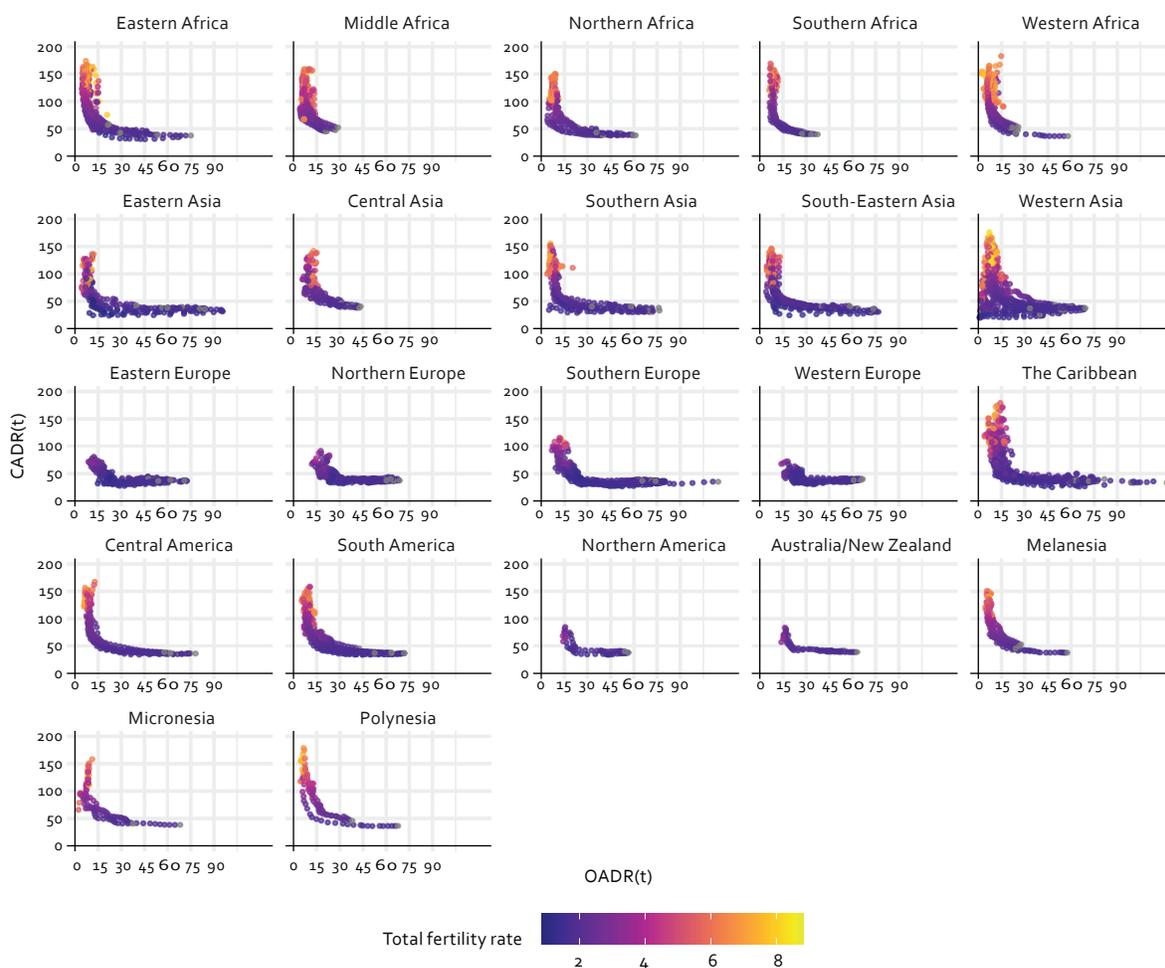
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Among the pioneers in Latin America and the Caribbean are Argentina, Uruguay and, to a lesser extent, Chile, which began the demographic transition in the nineteenth century or at the turn of the twentieth century. Not surprisingly, then, by 1950 (the earliest observation available in the United Nations dataset) the CADR was already up to 50% lower for Argentina, Chile and Uruguay than for the other Latin American and Caribbean countries. However, by the end of the twenty-first century, having pioneered the demographic transition and experienced a more prolonged and less intense process of population change, Argentina and Uruguay are projected to reach a lower degree of population ageing as measured by the CADR and the OADR than countries whose mortality and fertility transitions started later but were more rapid.

Other Latin American and Caribbean countries such as El Salvador, Mexico, Peru and the Plurinational State of Bolivia have followed patterns similar to those of Brazil, Colombia and Costa Rica, although their demographic transitions have not been marked by such a dramatic reduction in the ratio of total dependents (young and old) as these three countries'.

The differences shown in figure 3 bring to light an important methodological aspect of the present analysis: as United Nations estimates started only in 1950 and there are no projections beyond 2100, it is not possible to describe complete transitions for all countries. The pattern of changes in dependency ratios over time is arrived at by combining the experiences of countries at different stages of the demographic transition. Thus, it is also advisable to look at specific trajectories for subregions and countries to avoid confounding effects. For example, figure 4 shows the relationships between the CADR and the OADR in 22 different subregions. First, it highlights the concentration of Middle and Sub-Saharan African countries at the points of highest CADR and lowest OADR, since these are countries that have just started the demographic transition. Second, the charts show that countries in Northern America, Oceania and Europe (Western, Southern, Northern and Eastern) are clustered at the more advanced stages of the demographic transition, characterized by a low CADR and a high OADR. Third, combining the CADR and the OADR shows that Asian and Latin American and Caribbean countries are more evenly spread over the many stages of the demographic transition. This pattern is explained by the fact that the observation period (1950–2100) coincides with the occurrence of most of the demographic changes in these subregions.¹

Figure 4
Child-age and old-age dependency ratios (CADR and OADR), by total fertility rates,
selected subregions, 1950–2100
(Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

¹ Figure A1.1 in annex 1 presents specific estimates for each of the Latin American and Caribbean countries.

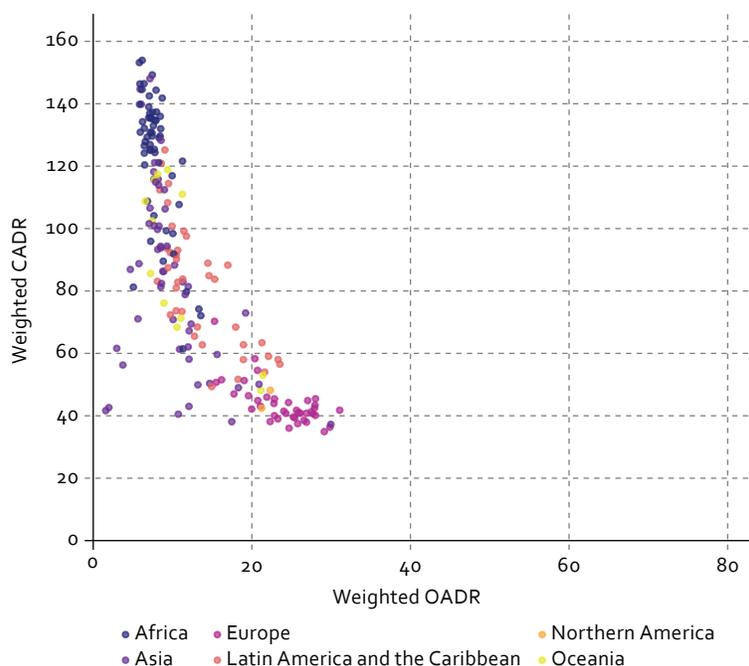
B. Weighted child-age and old-age dependency ratios

Although the patterns described in the previous section reveal important features of the demographic transition, they include too many observations for each country. To summarize country-specific trajectories, the most natural solution would be to calculate simple averages for the CADR and the OADR from the distribution of estimates by five-year periods. However, simple averages would not tell when the changes happened. Therefore, two complementary methodological strategies were applied to address this issue. First, the 1950 to 2100 period was divided into three major phases: 1950–1980 (past), 1980–2020 (present) and 2025–2100 (future). Although this division is arbitrary, it isolates the 1980–2020 period with a view to representing the present time, which will serve as the demographic context for analysing the NTA and SDG indicators in the next sections.

Second, weighted averages of the CADR and the OADR were calculated, with the weights being given by the respective years. The weighted measures were estimated for each of the phases as well as for the whole observation period (1950–2100). It thus became possible to distinguish the various countries not only by CADR and OADR values but also by differences of timing. This section will focus on the results obtained for the two periods of greatest interest: 1980–2020 (present) and 2025–2100 (future). Results for the total observation period (1950–2100) and estimates for specific subregions are available in figures A1.2 to A1.6 of annex 1.

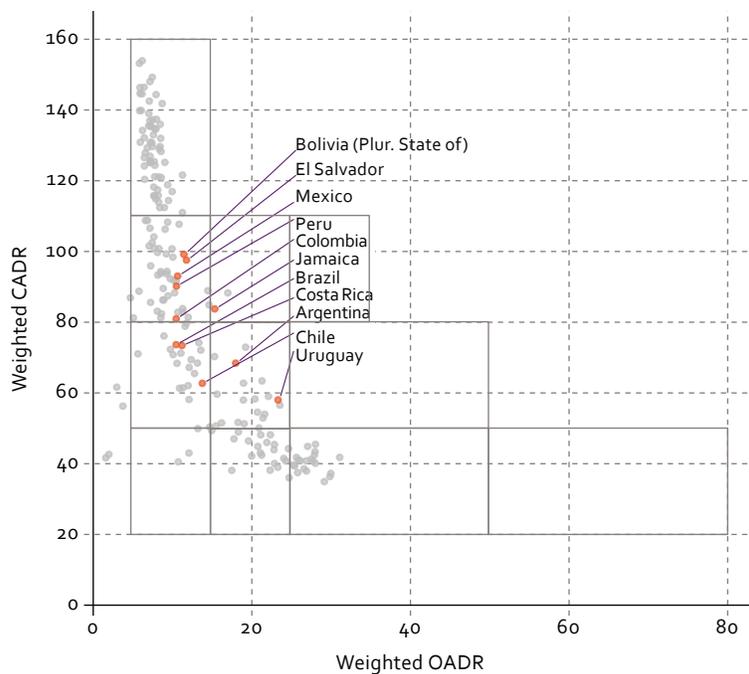
Figures 5 and 6 show the weighted CADRs and OADRs estimated for the 1980–2020 period (present). The results are consistent with the previous analysis: on average, African countries are still in the early stages of the demographic transition, showing very high CADRs (higher than 120 children per 100 adults) and very low OADRs (fewer than 10 older people per 100 adults). On the other hand, the pioneer countries of the demographic transition, situated in Northern America, Oceania (only Australia and New Zealand) and Europe, show CADRs lower than 55 per 100 and OADRs higher than 20 per 100. The African and pioneer countries have the highest total dependency ratios in 1980–2020, although with different age compositions.

Figure 5
Weighted child-age and old-age dependency ratios (CADR and OADR) by world regions, 1980–2020
(Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 6
Weighted child-age and old-age dependency ratios (CADR and OADR) for Latin American and Caribbean countries participating in the National Transfer Accounts Project, 1980–2020
(Percentages)

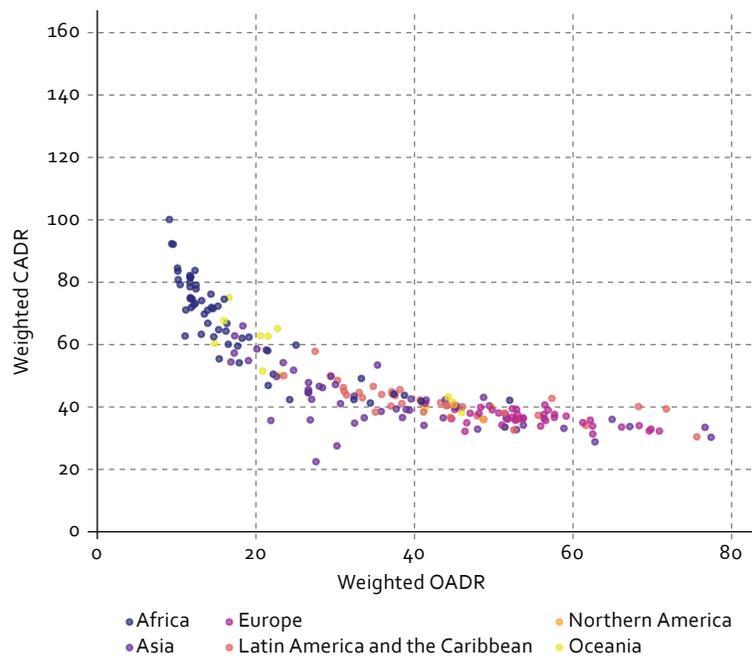


Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

During the same period, Asian and Latin American and Caribbean countries are distributed across the intermediate stages of the demographic transition. Thus, they are now experiencing the most promising phase of the transition, characterized by a decreasing CADR and a low OADR. During this stage, the total dependency ratio is falling and approaching its lower limit. Figure 6 highlights the relative positions of the 11 countries in Latin America and the Caribbean that are also participants in the NTA project. Not surprisingly, the synthetic measures indicate that Uruguay, Argentina and Chile started the demographic transition earliest in Latin America and the Caribbean, followed by Costa Rica, Brazil, Jamaica and Colombia, and finally by Peru, Mexico, the Plurinational State of Bolivia and El Salvador.

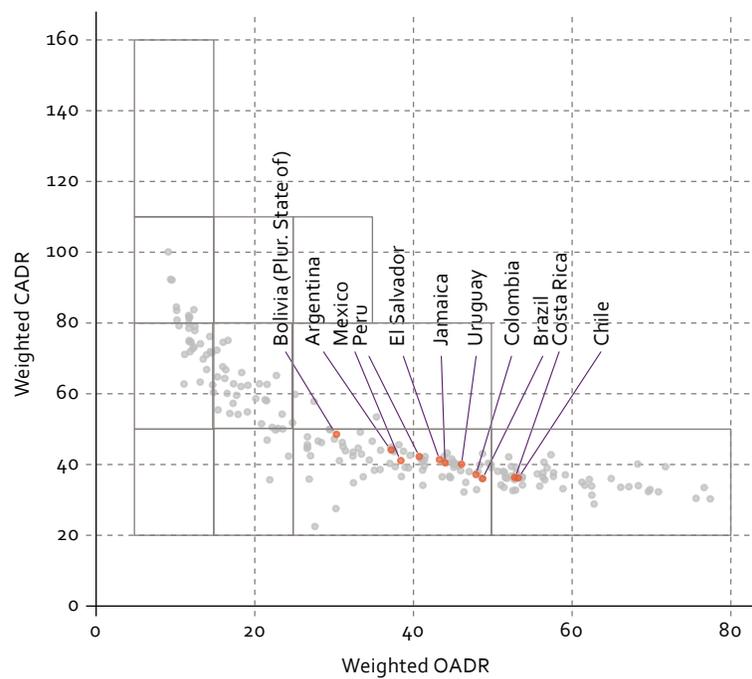
Figures 7 and 8 give weighted CADRs and OADRs for the period 2025–2100 (future). The estimates show the progression of countries to positions with higher degrees of population ageing, in its different forms. In the case of African countries, ageing is represented by a reduction in the proportion of young people (CADR) and an increase in the share of adults. For the pioneer countries of Europe, Northern America and Oceania, almost the only change expected is an increase in OADRs, with average levels rising above 50 per 100. Lastly, the United Nations projects an acceleration of population ageing in the countries of Asia and Latin America and the Caribbean, with these regions expected to have lower CADRs (less than 50 per 100 on average) and higher OADRs (more than 30 per 100 on average). Specifically, for the NTA countries in Latin America and the Caribbean (figure 8), the coming decades will be marked by even lower CADRs (close to 40 per 100) and by OADRs ranging from just under 40 to slightly over 50 older people per 100 working-age adults. As discussed in the previous section, NTA countries in Latin America and the Caribbean that have experienced a very sharp and rapid fall in fertility levels will surpass the pioneer countries in the degree of population ageing. This group includes Brazil, Colombia and Costa Rica.

Figure 7
Weighted child-age and old-age dependency ratios (CADR and OADR) by world regions, 2025–2100
 (Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 8
Weighted child-age and old-age dependency ratios (CADR and OADR) for Latin American and Caribbean countries participating in the National Transfer Accounts Project, 2025–2100
 (Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

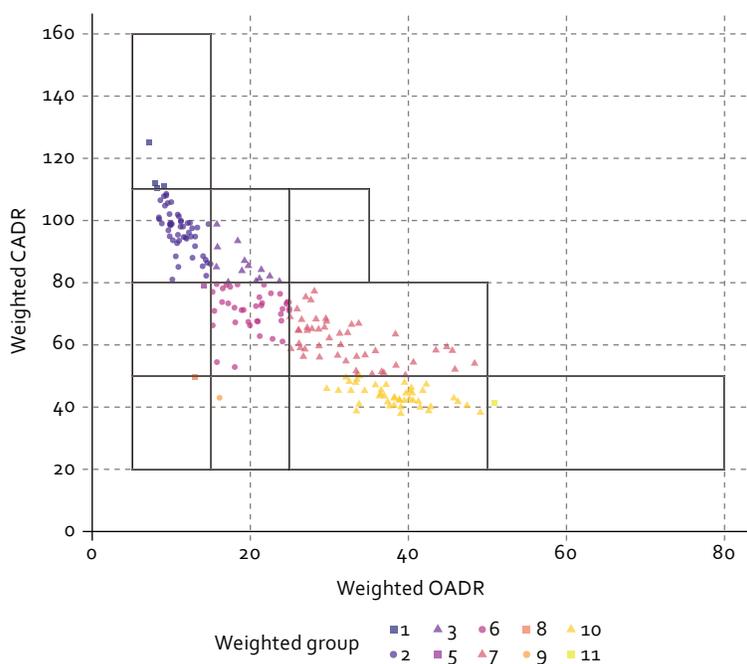
C. Clustering countries by phase in the demographic transition

The last part of this section proposes a classification for countries according to the phase of the demographic transition they are in, described by the relationship between their weighted CADR and OADR. Clustering countries is important because it provides a basis for the analysis that will be carried out in the following sections to determine how far countries in the same demographic transition stages differ in their generational economic structures (NTAs) and living conditions (SDGs). Two different methodological approaches were applied. In the first, the groups were constructed by arbitrarily selecting weighted cut-off points for the CADR and the OADR, considering the entire observation period from 1950 to 2100. By means of visual inspection, 11 categories were identified so that groups of countries could be formed along the whole length of the demographic transition (1950–1980, 1980–2020 and 2025–2100).

The second method was based on statistical data analysis. Observations (countries) were categorized into groups or classes by a common characteristic or similar set of features. Among the various tried and tested techniques available, the k-means clustering method was selected. It distributes observations into a specific number of clusters, assigning them to the nearest cluster centre, such that within-group variance is minimized. This method yielded results very similar to those from the more straightforward methodology, in which CADRs and OADRs were visually inspected.² The categorization based on the more straightforward method was thus selected, since it is also more intuitive. Of course, other classifications could be proposed, but the conclusions are unlikely to be significantly different.

Figures 9 to 14 show the distribution of countries according to the 11 categories created from weighted dependency ratios. The results are shown for the entire period 1950–2100 and the two partial stages: 1980–2020 (present) and 2025–2100 (future). The cut-off points for each category are specified in table 1 and were chosen by varying the CADR for different OADR levels. Thus, CADR categories can range from very high (110–160) to low (20–50), whereas OADR categories range from very low (5–15) to very high (50–80).

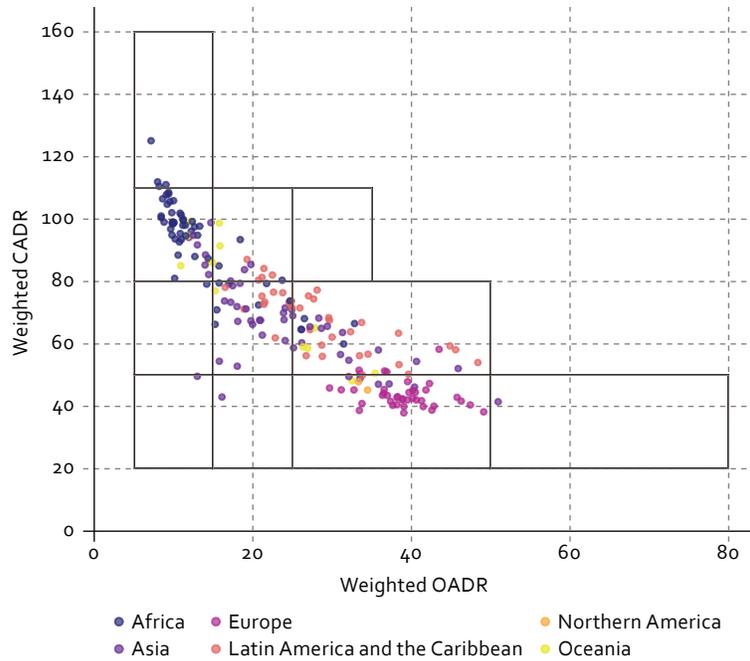
Figure 9
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition, 1950–2100
(Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

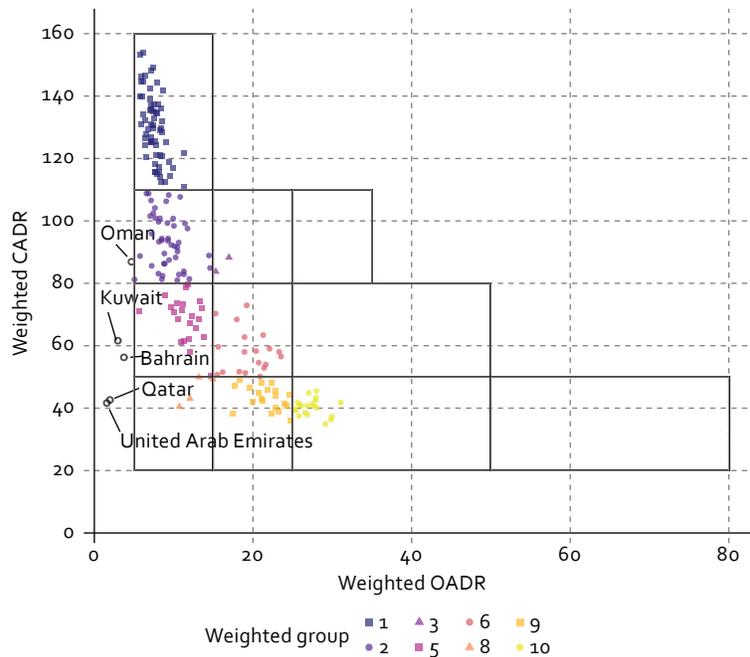
² Figure A1.7 in annex 1 presents the k-means estimates.

Figure 10
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition and world regions, 1950–2100
 (Percentages)



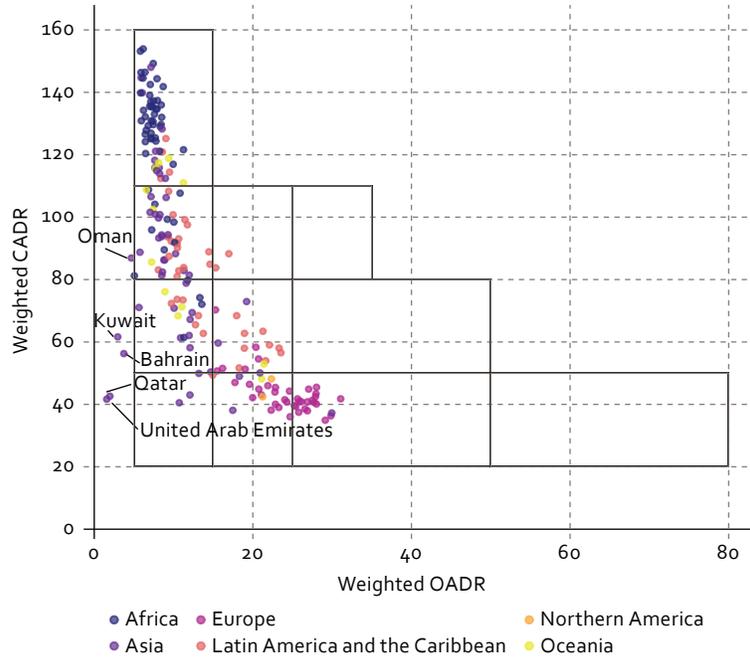
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 11
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition, 1980–2020
 (Percentages)



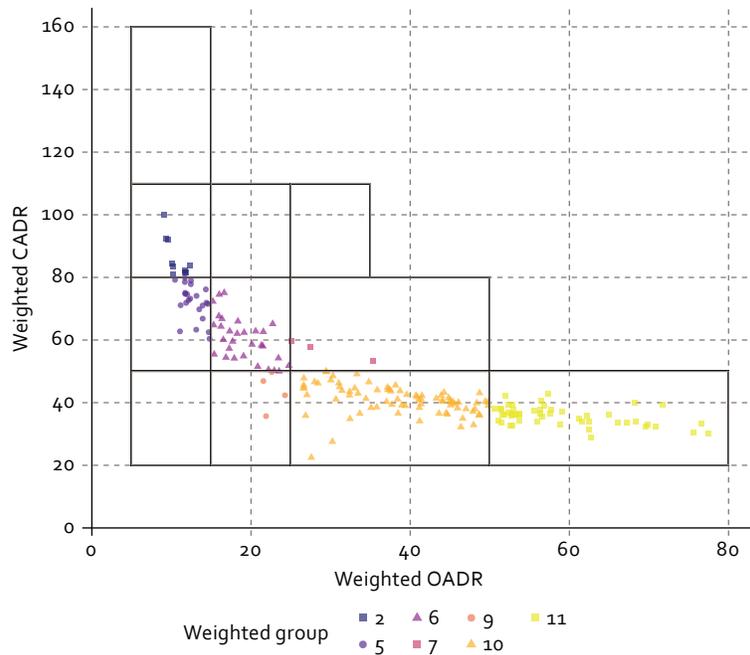
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 12
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition and world regions, 1980–2020
 (Percentages)



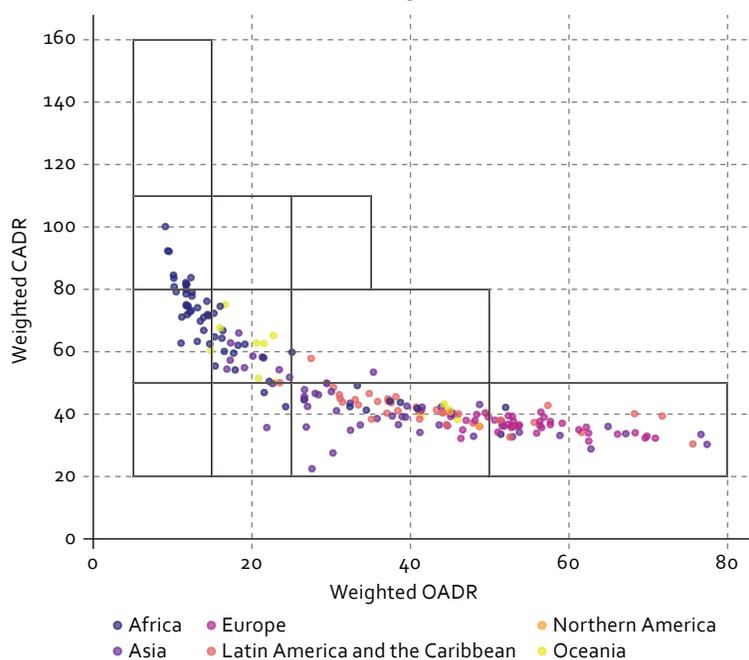
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 13
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition, 2025–2100
 (Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure 14
Weighted child-age and old-age dependency ratios (CADR and OADR), countries grouped by stage in the demographic transition and world regions, 2025–2100
 (Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Table 1
Classification of countries participating in the National Transfer Accounts Project by stage in the demographic transition, as determined by weighted child-age dependency ratios (CADRs) and old-age dependency ratios (OADRs), 1980–2020

Group	Weighted CADR (per 100)	Weighted OADR (per 100)	Latin American and Caribbean countries		Other countries	
			1980–2020	2025–2100	1980–2020	2025–2100
1	110–160 Very high	5–15 Very low			Ghana, Kenya, Mozambique, Nigeria, Senegal	
2	80–110 High	5–15 Very low	Bolivia (Plurinational State of), Colombia, El Salvador, Mexico, Peru		Egypt, India, Iran, Philippines, South Africa, Viet Nam	
3	80–110 High	15–25 Low	Jamaica			Nigeria
4	80–110 High	25–35 Intermediate				
5	50–80 Intermediate	5–15 Very low	Brazil, Chile, Costa Rica		China, Thailand, Turkey	
6	50–80 Intermediate	15–25 Low	Argentina, Uruguay		Republic of Moldova	Ghana, Kenya, Mozambique, Senegal
7	50–80 Intermediate	25–50 High				
8	20–50 Low	5–15 Very low			Republic of Korea	
9	20–50 Low	15–25 Low			Australia, Canada, Russian Federation, Slovenia, United States	
10	20–50 Low	25–50 High		Argentina, Bolivia (Plurinational State of), Brazil, Colombia, El Salvador, Jamaica, Mexico, Peru, Uruguay	Austria, Finland, France, Germany, Hungary, Italy, Japan, Sweden, United Kingdom	Australia, Canada, Republic of Moldova, Russian Federation, Turkey
11	20–50 Low	50–80 Very high		Chile, Costa Rica		Austria, China, Italy, Finland, Republic of Korea, Slovenia, Thailand, United States

Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org/>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>; and Project 1617 AO, “Demographic transition: opportunities and challenges to achieve the Sustainable Development Goals in Latin America and the Caribbean”, coordinated by CELADE Population Division of ECLAC.

In the period 1980–2020 (figures 11 and 12), the categories into which most of the world's NTA countries fall are very high and very low (1), high and very low (2), intermediate and very low (5), medium and low (6), low and low (9) and low and high (10). Thus, many countries, including those of Latin America and the Caribbean, are in the first stages of the age transition, characterized by a high or declining CADR and a low or increasing OADR. Colombia, El Salvador, Mexico, Peru and the Plurinational State of Bolivia are in category 2 (high CADR and very low OADR) together with Egypt, India, Iran, the Philippines, South Africa and Vietnam. A second group consisting of Brazil, Chile and Costa Rica is in category 5 (intermediate CADR and very low OADR), at a more advanced stage of the age transition. In this same category are China, Thailand and Turkey. Lastly, Argentina and Uruguay are in category 6 (intermediate CADR and low OADR), characterized by higher values for the OADR.

During the third phase, 2025–2100, all NTA countries in Latin America and the Caribbean are expected to move to groups 9 and 10, which are characterized by a low CADR (20–50) and a high (25–50) or very high (50–80) OADR. NTA countries in Europe and Asia will be at the same demographic transition stages, although most of them are expected to be concentrated in group 10.

At this point, it is still unclear whether similar stages in the demographic transition correlate with indicators of the generational economy (NTAs) and living standards (SDGs), an issue that will be examined in the next sections. It is also essential to discuss what can be learned from this categorization, as applied to the 2025–2100 projections (figures 13 and 14), about the risks and challenges entailed in social and economic development.

III. The generational economy and National Transfer Accounts (NTAs)

The objectives of this section are to discuss the NTA project, measure dimensions of the generational economy that could potentially be associated with both the demographic transition and the SDGs, and use the selected measures to propose a clustering strategy for Latin America and the Caribbean and other NTA countries.

A. An overview of the NTA project

Individuals play different social and economic roles over the life cycle. In contemporary societies, in what has been called the life cycle deficit, per capita consumption exceeds production at younger and older ages. Intergenerational transfers usually originate from those of working age, and asset-based reallocations fund the deficits of children and older people. In any society, there are at least three channels for allocating resources across the life cycle: families, markets and the public sector.

The study of the economic life cycle is not a new field of research, but recent methodological developments have yielded improved, more comprehensive and comparable estimates of the generational economy throughout the world. Since 2004, the National Transfer Accounts (NTA) Project has provided estimates of intergenerational and inter-age transfer accounts for a growing number of countries, based on a coherent theoretical framework. The project's fundamental principles and concepts, as well as its implications for the association between demographic and economic variables, have been discussed elsewhere (Lee and Mason, 2011a; United Nations, 2013). There are now a myriad publications about the national accounts calculated for each participating country, including international comparative analyses (Lee and Mason, 2014).³

Before NTAs, the creators and lead authors of the project, Ronald Lee and Andrew Mason, had already made numerous pioneering scientific contributions to the study of interrelations between demographic dynamics and economic growth and development. The NTA Project has expanded knowledge in the field by connecting research from all continents and providing a complete dataset, which is available

³ See AGENTA Project [online] <http://www.agenta-project.eu/en/index.htm>; "Latin America and Caribbean Region National Transfer Accounts" [online] <http://latin-america.ntaccounts.org/web/nta/show>.

online. It has also drawn the attention of national statistical agencies, governments and international organizations by providing a more in-depth discussion of existing structures for allocating resources over the life cycle in different political, social, economic and demographic contexts (ECLAC, 2009 and 2011).

More broadly, four main functions, estimated by age, comprise NTAs. The first two are labour income and consumption. These describe the economic life cycle, and particularly the ability of individuals to fund consumption out of production, from birth to death. In contemporary societies, as mentioned earlier, working-age years are characterized by an excess of labour income over consumption, whereas deficits distinguish the first and last stages of life. To examine how resources are allocated throughout the life cycle, NTAs also provide estimates of the two main inter-age flows: intergenerational transfers and asset-based reallocations. In other words, the NTA framework depicts production, consumption, sharing and saving during a lifetime. However, the estimates are not limited to these four functions but are decomposed into several other components that enhance understanding of the generational economy in each country. Table 2 describes the elements that are most commonly available for all countries, emphasizing how they relate to the four main functions of NTAs. For example, intergenerational transfers may be public or private, while public transfers may be both in-cash and in-kind. Other subcomponents not mentioned in table 2 may be available for many countries, including, for instance, income, payroll, property, goods and services taxes.

Table 2
Main components of the National Transfer Account (NTA) framework

Labour income	Consumption		Intergenerational transfers		Asset-based reallocations	
	Private	Public	Private (inflows and outflows)	Public	Private	Public
Labour earnings, self-employed income	Education, health, other	Education, health, other	Inter-household, intra-household	Inflows: education, health, pensions, social protection, other in-kind, other in-cash Outflows: taxes and social contributions	Saving and asset income	Saving and asset income

Source: United Nations, *National Transfer Accounts Manual: Measuring and Analysing the Generational Economy*, New York, 2013.

Another methodological innovation of NTAs was to adjust the age profile of flows to macrocontrols calculated from the System of National Accounts (SNA) and other national statistics (e.g., taxes and detailed public expenditures) available in each country. Therefore, age-specific NTA measures, when aggregated for the whole population, are consistent with the SNA, which is the official source of information about the macroeconomy.

Over the years, the NTA Project has made many significant contributions to the literature on economic demography and to the debate about the implications of population ageing in the world. Although it is almost impossible to summarize the results achieved by every NTA country team in a few paragraphs, some of the global findings are noteworthy and relate directly to the objective of this paper. First, no other project has ever measured and described the economic life cycle in such a systematic and comprehensive way as NTAs. With results for more than 40 countries from all continents, it has become clear that the three-stage pattern of the life cycle (two phases of life cycle deficits intercalated by one phase of surplus) is the norm in today's world. However, there are variations across countries in the ages at which individuals become net producers (transition to adulthood) and the ages at which they return to the position of net consumers (after retirement). During the first stage of life, the life cycle deficit tends to be more pronounced in wealthier countries, where children usually stay at school for more years.

Accordingly, investments in human capital (consumption of education and health at younger ages) are more substantial in countries at the most advanced stages of the demographic transition, where the number of children per woman is lower than in poorer countries, which is in agreement with the quantity-quality trade-off theory (Lee and Mason, 2011b).

On the opposite tail of the life cycle, the stage of dependency at older ages also tends to be longer and marked by a larger life cycle deficit in wealthier countries. Higher per capita consumption of health and other goods and services and better provision of non-labour income to older people through more developed pension systems (public transfers or asset-based reallocations) help to explain some of the differences. Funding sources for persons aged 65 and older also vary. Public transfers are proportionally more significant in European and Latin American countries, whereas asset income represents a larger share of the life cycle deficit at older ages in Mexico, the United States and some Asian countries. Private transfers are close to zero or negative at older ages for most countries, the exceptions being some in Asia.

NTA researchers have identified various applications of the generational economy framework. The list is long but includes, for example, the study of the economic motivations (e.g., altruism, exchange, insurance) for individuals to receive and make intergenerational public and private transfers, particularly in the form of investments in children and old-age support. There have also been studies on the historical relations between private and public intergenerational flows and their impact on generational equity (Bommier and others, 2010; Araujo, Turra and Queiroz, 2011). More importantly, Mason and Lee, followed by other NTA researchers, have increased the knowledge available on the effects of changes in the age structure on economic growth, the so-called demographic dividend (Mason, 2007). Additionally, some groups have looked at the fiscal implications of the demographic transition (Miller, 2011; Miller and Cruz, 2013). More recently, NTAs have expanded their scope to include analysis of intra-age transfers, particularly studies by gender,⁴ socioeconomic status (Turra and Queiroz, 2005) and race (Oosthuizen, 2019).

In Latin America and the Caribbean, Brazil and Chile were the first countries to develop NTAs. Later, Argentina, Colombia, Costa Rica, El Salvador, Jamaica, Mexico, Peru, the Plurinational State of Bolivia and Uruguay joined the group. Thanks to the coordination and support of the Economic Commission for Latin America and the Caribbean (ECLAC) over the years, research in Latin America and the Caribbean has made significant advances in the study of the generational economy.⁵ In addition to estimating NTAs (in many cases for more than one year), country teams have looked at many themes, including (i) the role of the public sector in promoting the well-being of children and older people, (ii) the fiscal implications of population ageing, (iii) the magnitude and duration of the demographic, gender and education dividends and (iv) intra-age (inter-group) differences, particularly by gender and socioeconomic status. Several of the findings to be presented in the next parts of this section have been discussed to a certain extent in earlier studies, thanks to the efforts of ECLAC and the local teams. In a new stage of the ECLAC NTA project in 2018/2019, the country teams of Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico, Peru and the Plurinational State of Bolivia⁶ produced fresh estimates of transfer accounts by age and socioeconomic status. They also identified and addressed specific research and policy questions for each country. Table 3 summarizes some of the results from the national studies prepared during the project. Three of the main conclusions are worth noting: (i) the existence of gender inequality in both market and household production, (ii) the presence of profound socioeconomic disparities in the economic life cycle and (iii) the increasing fiscal pressures from population ageing.

⁴ Counting Women's Work project, led by Gretchen Donehower. See [online] <https://www.countingwomenswork.org/>.

⁵ For more information, see "Latin America and Caribbean Region National Transfer Accounts" [online] <http://latin-america.ntaccounts.org/web/nta/show>.

⁶ Latin American and Caribbean Demographic Centre (CELADE)-Population Division of ECLAC: Paulo Saad, Zulma Sosa and Marta Duda-Nyczak; Argentina: Pablo Comelatto; Brazil: Cassio M. Turra, Eduardo Rios-Neto, Simone Wajnman, Fernando Fernandes, Jordana Jesus, Bruno Guimarães and Rene Lazzano; Chile: Mauricio Holz; Costa Rica: Pamela Jiménez and Luis Rosero Bixby; Colombia: Piedad Urdinola and Jorge Tovar; El Salvador: Maria Elena Rivera and Werner Peña; Mexico: Ivan Mejía; Peru: Javier Olivera; Plurinational State of Bolivia: Rolando Pardo and Roland Pardo.

Table 3
National Transfer Accounts (NTAs) in Latin America and the Caribbean: key thematic areas
and main conclusions from the national studies, 2018–2019

Key thematic areas	Countries	Main conclusions
Gender	Brazil, Colombia, Costa Rica, El Salvador, Mexico	Per capita and aggregate production in the labour market is higher for men than women, resulting in inter-gender transfers over the life cycle. On the other hand, time production is more significant among women who transfer household services to men. When market and non-market production are added up, the net balance by gender tends to be close to zero or small and positive for men (slightly higher transfers from men to women).
Demographic dividends	Brazil, El Salvador	The first dividend is ending in many countries of the region. Education and labour market improvements can make the first dividend larger and longer-lasting.
Education	Brazil	The demographic transition is beneficial to education: there is a negative relationship between the school-age dependency ratio and public investment in education per child.
Socioeconomic inequalities in NTAs and National Time Transfer Accounts (NTTAs)	Brazil, Colombia, Chile	There are considerable differences in the life cycle deficit by socioeconomic status. Life cycle surpluses arise only at adult ages in the highest socioeconomic groups. Among the lowest socioeconomic groups, there is no surplus stage, but deficits are still larger at younger and older ages. Thus, there are both substantial intergenerational transfers (from adults to children and older people) and intragenerational transfers (from higher to lower socioeconomic status groups) in the Latin America and Caribbean region.
Fiscal issues and other projections	Brazil, Chile, El Salvador, Mexico	Population ageing will give rise to restrictions and challenges in Latin America and the Caribbean, mostly because of its impact on public transfers. However, population ageing can also increase investment in children, which may help the economy to grow faster and minimize some of the ageing challenges.

Source: Project 1617 AO, "Demographic transition: opportunities and challenges to achieve the Sustainable Development Goals in Latin America and the Caribbean", coordinated by CELADE Population Division of ECLAC.

1. NTA estimates: materials

Many measures can be estimated from NTA data. Most of them have already been examined in earlier studies. Here, the methodological choices are limited to elements of the generational economy that can be connected to the demographic transition and the SDGs in a comprehensible and coherent scheme. The most obvious selection criterion is age, since this is the variable that structures the NTA framework. Because it was only recently that intra-age transfers (by gender, socioeconomic status and race) also become a focus of the project, they will not be considered in this section. Thus, children and older people, groups who cannot produce enough in the labour market to fund consumption, comprise the most vulnerable individuals in the economic life cycle. If there were no sharing and saving over the life cycle, the well-being of young and older age-dependent groups would be at risk. Political agreements in each society usually define the roles of the public sector, families and the market in funding consumption for these groups, with potential consequences for some of the SDG indicators, particularly those that focus on outcomes related to human capital, health and poverty. At the same time, changes in the age structure caused by the demographic transition directly affect the absolute and relative size of the two dependent age groups over time, bringing opportunities but also new challenges for societies, as already described in the previous section.

After all these aspects had been considered, NTA countries were classified by three dimensions for this paper. The first dimension is the magnitude and composition of investments in the early stage of the life cycle. It compares the proportion of consumption at younger ages (ages 0–19) that is publicly funded with the magnitude of the life cycle deficit at the same ages. The second dimension looks at consumption levels and composition among older people by comparing the proportion of consumption that is publicly funded and the magnitude of the life cycle deficit at ages older than 65. The third dimension provides a picture of intergenerational relations by associating net private and public transfers to children and older people. Unbalanced intergenerational relations may affect social, health and economic outcomes for one age-dependent group to the detriment of the other.

Data for 43 countries⁷ were drawn from the NTA Project,⁸ including the new estimates from the ECLAC 2018–2019 project for Latin America and the Caribbean covering nine countries⁹ in the region. Six different indicators were estimated to measure each of the proposed dimensions:

1. Magnitude and composition of investments in children and youth:

- CG_{0-19}/CF_{0-19}
- LCD_{0-19}/YL_{30-49}

2. Magnitude and composition of consumption by older people:

- CG_{65+}/CF_{65+}
- LCD_{65+}/YL_{30-49}

3. Intergenerational relations:

- TF_{65+}/TF_{0-19}
- TG_{65+}/TG_{0-19}

Where CG is public consumption, CF is private consumption, LCD is the life cycle deficit, YL is labour income, TF is private transfers and TG is public transfers. The indicators represent mean per capita values in the corresponding age groups. The life cycle deficit is always measured as a proportion of mean per capita labour income at the prime ages, 30 to 49. Table 4 summarizes the data available for each country. Not all countries have the required data for all years. Where countries have data for more than one year, the final indicators were calculated as the simple average of the indicators available for all years.

Figures 15 to 17 show the descriptive statistics (box plots) for the six indicators in six regions of the world. Results by subregion are presented in annex 2. Relative to labour income, the life cycle deficit at ages 0–19 is highest on average in countries situated in Northern America, Latin America and the Caribbean, Oceania and Europe (an average of 0.45 to 0.50). The average ratio is lower in Asian countries (about 0.45), followed by African countries (approximately 0.35). For the composition of consumption at younger ages, the public sector plays a more critical role in Europe, where the ratio between public and private consumption is higher than 1 on average. The ratios are about half that size in Asia and in Latin America and the Caribbean, and even lower in African countries.

⁷ Argentina, Australia, Austria, Brazil, Cambodia, Canada, Chile, China, Colombia, Costa Rica, El Salvador, Ethiopia, Finland, France, Germany, Ghana, Hungary, India, Indonesia, Italy, Jamaica, Japan, Kenya, Mexico, Moldova, Mozambique, Nigeria, Peru, Philippines, Senegal, Singapore, Slovenia, Republic of Korea, South Africa, Spain, Sweden, Taiwan, Thailand, Turkey, United Kingdom, United States, Uruguay, Vietnam.

⁸ See [online] <http://www.ntaccounts.org/web/nta/show/Browse%20database>.

⁹ Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico, Peru and the Plurinational State of Bolivia.

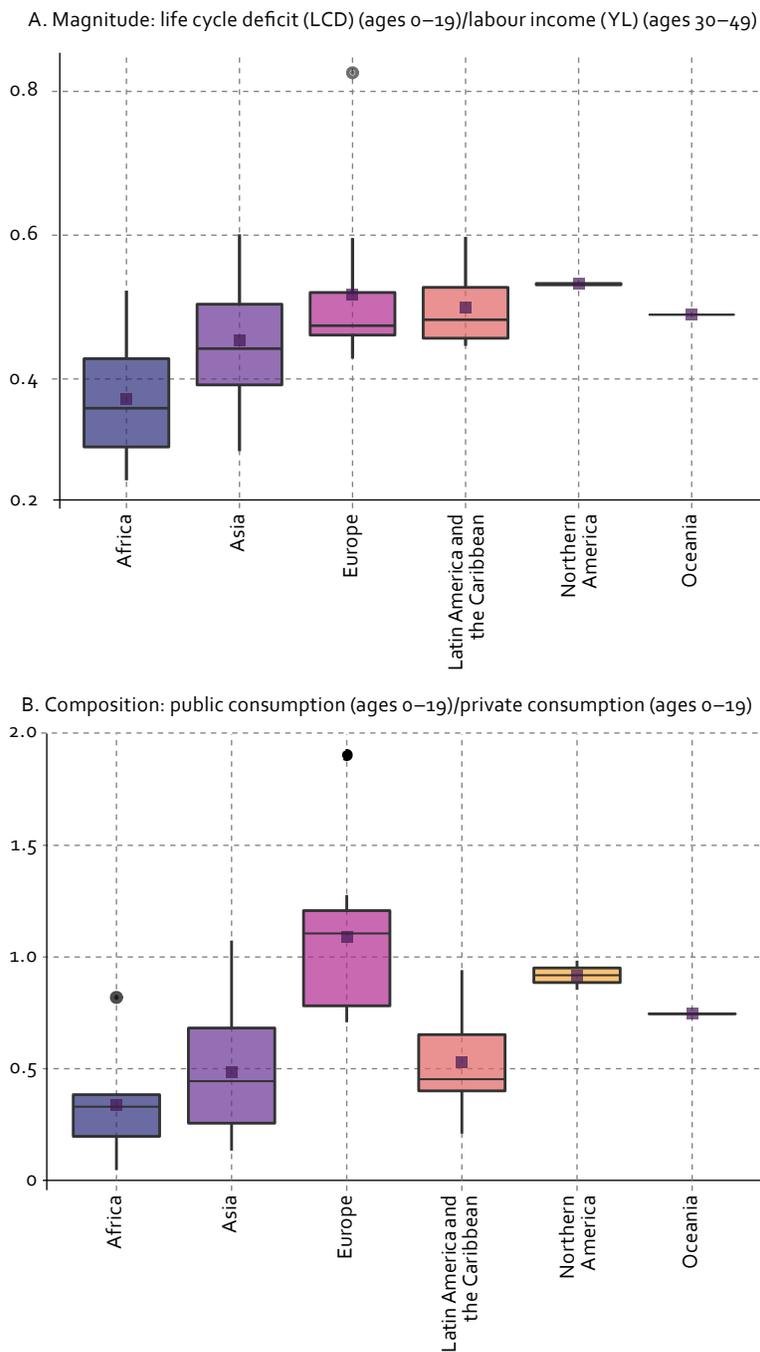
Table 4
National Transfer Account (NTA) data available online from the NTA Project and the new ECLAC Project

Pais	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
Argentina					N																					E	
Australia												N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E
Austria			N				N																				E
Bolivia (Plurinational State of)										N/E					E												E
Brazil				N																							
Cambodia																N											
Canada																											E
Chile										N																	
China																											
Colombia																											E
Costa Rica																											E
El Salvador																											N/E
Ethiopia																											
Finland																											
France										N																	N
Germany																											
Ghana																											N
Hungary																											N
India																											N
Indonesia																											N
Italy																											N
Jamaica																											N
Japan																											N
Kenya																											N
Mexico																											E
Republic of Moldova																											N
Mozambique																											N
Nigeria																											N
Peru																											N
Philippines																											E
Republic of Korea																											N
Senegal																											N
Singapore																											N
Slovenia																											N
South Africa																											N
Spain																											N
Sweden																											N
Taiwan (Province of China)																											N
Thailand																											N
Turkey																											N
United Kingdom																											N
United States																											N
Uruguay																											N
Viet Nam																											N

Source: R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; and Project 1617 AO, "Demographic transition: opportunities and challenges to achieve the Sustainable Development Goals in Latin America and the Caribbean", coordinated by CELADE Population Division of ECLAC.

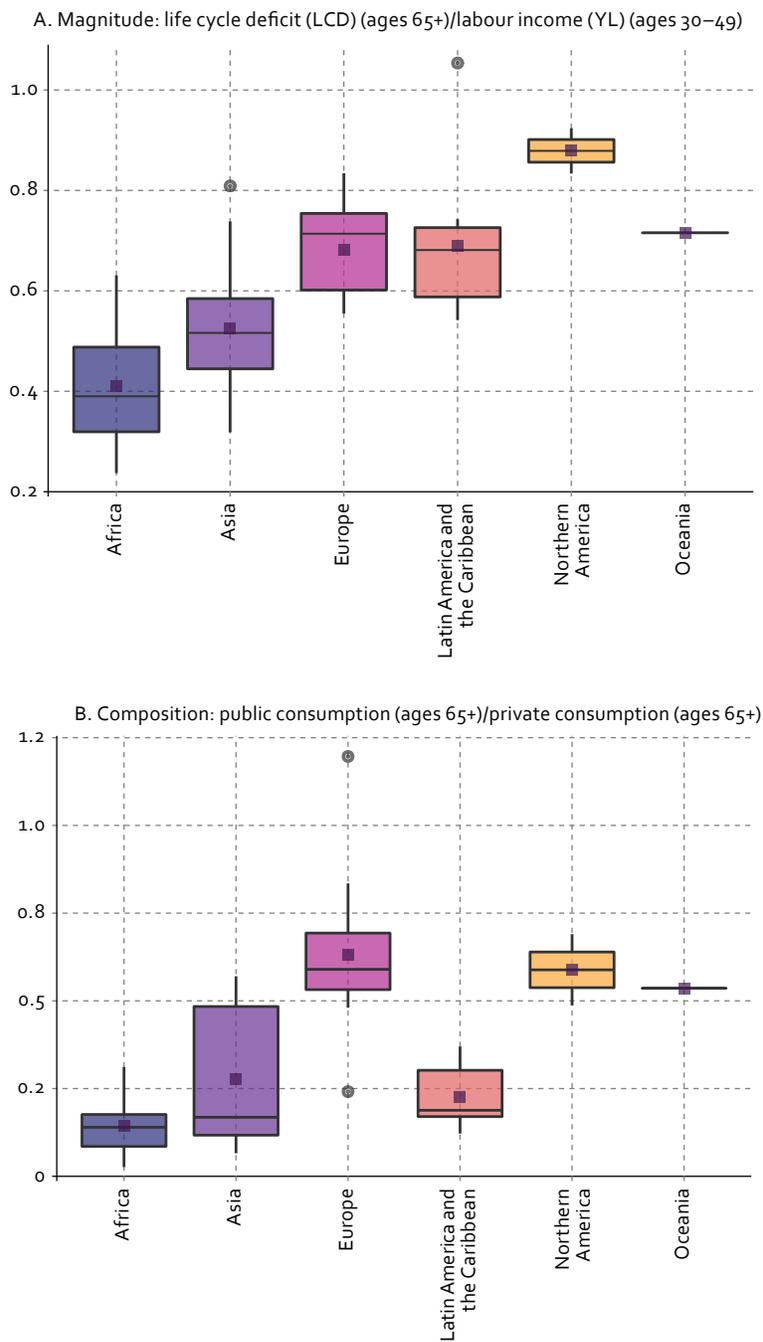
Note: N = National Transfer Accounts Project, E = ECLAC Project 2019.

Figure 15
National Transfer Accounts (NTAs), world regions: magnitude and composition of consumption at younger ages



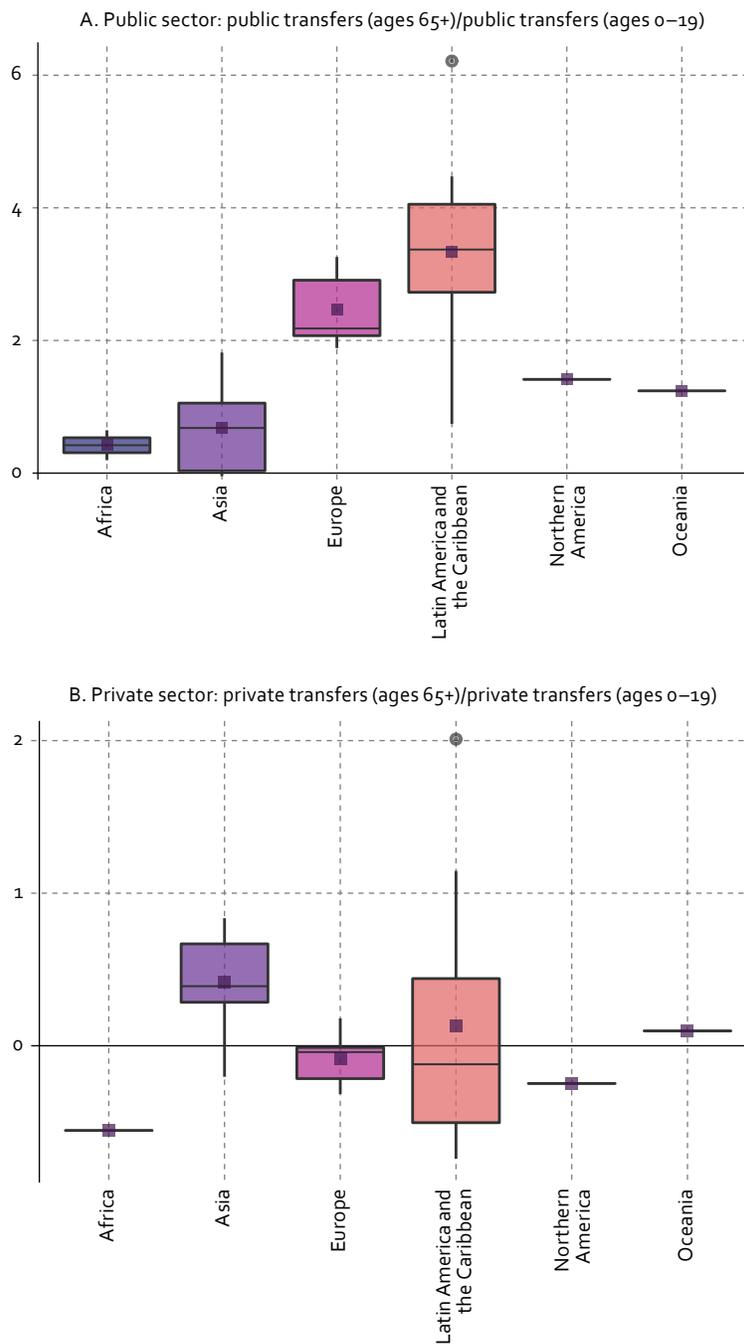
Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Figure 16
National Transfer Accounts (NTAs), world regions: magnitude and composition of consumption at older ages



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Figure 17
National Transfer Accounts (NTAs), world regions: intergenerational relations



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

The relative magnitude of the life cycle deficit at older ages (ages 65+) follows a somewhat similar pattern to that at younger ages in the region. On average, it is higher in countries situated in Northern America, Europe, Latin America and the Caribbean and Oceania. In these regions, however, the life cycle deficit at older ages represents a more significant fraction of labour income than the deficit at younger ages: about 70%, rising to more than 80% in Northern America. The average ratio is lower for countries in Asia (about 0.50) and Africa (about 0.40), being more comparable to the relative magnitude of the life cycle deficit of children in these regions. As for the components of consumption, the differences are similar at older and younger ages in the region. However, public consumption represents a smaller fraction of private consumption for older people than for children because of public education transfers to this first stage of the life cycle.

Intergenerational relations also differ by region. In Europe and Latin America and the Caribbean, public transfers to older people are about twice as large on average as those to children. The ratio is closer to 1 in Asia, Northern America and Oceania, meaning that the public sector plays a more balanced role in providing resources for the two dependent age groups in these regions. In African countries, meanwhile, the public sector primarily channels resources to children, with an average ratio of less than 0.5.

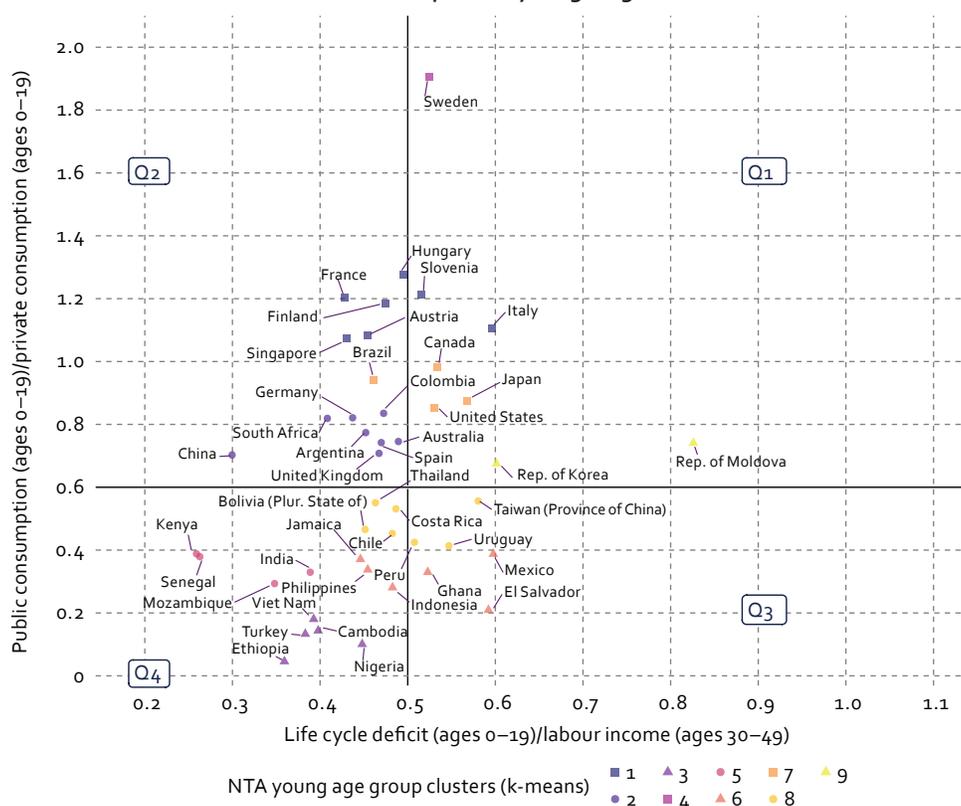
Private transfers ($TF(65+)/TF(0-19)$) play a minor role in supporting older people in most regions: ratios are close to zero or slightly negative in many countries, indicating that older people get only a small portion of family resources or even make net private transfers to adults and children. In Asia, ratios are positive but still lower than one, meaning that older people receive support from younger members of their families, but net family transfers to children are still more substantial.

B. Clustering countries by NTA dimensions

One of the objectives of this section is to group Latin American, Caribbean and other NTA countries by the proposed measures for future comparison with the demographic transition stages and the SDG indicators. This section follows the same methodology as the previous one, providing two complementary analyses: the classification of countries by some arbitrary and more straightforward criteria, and the application of a statistical method. Once more, k-means clustering is used to partition the data into a specific number of clusters and allocate countries to the groups with the nearest mean. Country grouping was carried out for each of the three dimensions referred to: consumption (investments) at younger ages, consumption at older ages and intergenerational relations.

Figure 18 shows the distribution of NTA countries according to the magnitude and composition of consumption (investments) at younger ages, plotting the ratio of public and private consumption (CG/CF) at ages 0–19 against the relative magnitude of the life cycle deficit (as a proportion of YL) at the same ages. The k-means clustering analysis yields nine possible groups of countries. On one side, there are countries where the relative magnitude of consumption at younger ages is low (below 40% of YL) and the public sector plays a minor role in the composition of investments in childhood, with CG/CF ratios below 0.40 (clusters 5 and 3: Cambodia, Ethiopia, India, Kenya, Mozambique, Senegal, Turkey and Vietnam). On the opposite side, there are countries where per capita consumption is around 50% of per capita labour income and public consumption is more significant than private consumption at younger ages, with CG/CF ratios above 1.2 (cluster 1: France, Finland, Hungary, Italy, Slovenia and Singapore). Countries in Latin America and the Caribbean are divided into four k-means groups: Brazil is in cluster 7 with Canada, Japan and the United States, with a magnitude of about 0.5 and composition of about 1.0, while Argentina and Colombia are in group 2 with Australia, Germany, South Africa, Spain and the United Kingdom, characterized by a slightly lower contribution from the public sector, with a CG/CF ratio of around 0.8. Costa Rica is in cluster 8 with Chile, Peru, the Plurinational State of Bolivia and Uruguay, in addition to China and Thailand. El Salvador, Jamaica and Mexico are in cluster 9 with Indonesia and the Philippines. CG/CF ratios are lower in both groups, ranging from 0.55 to 0.20.

Figure 18
National Transfer Accounts (NTAs), selected countries and groupings: magnitude and composition of consumption at younger ages



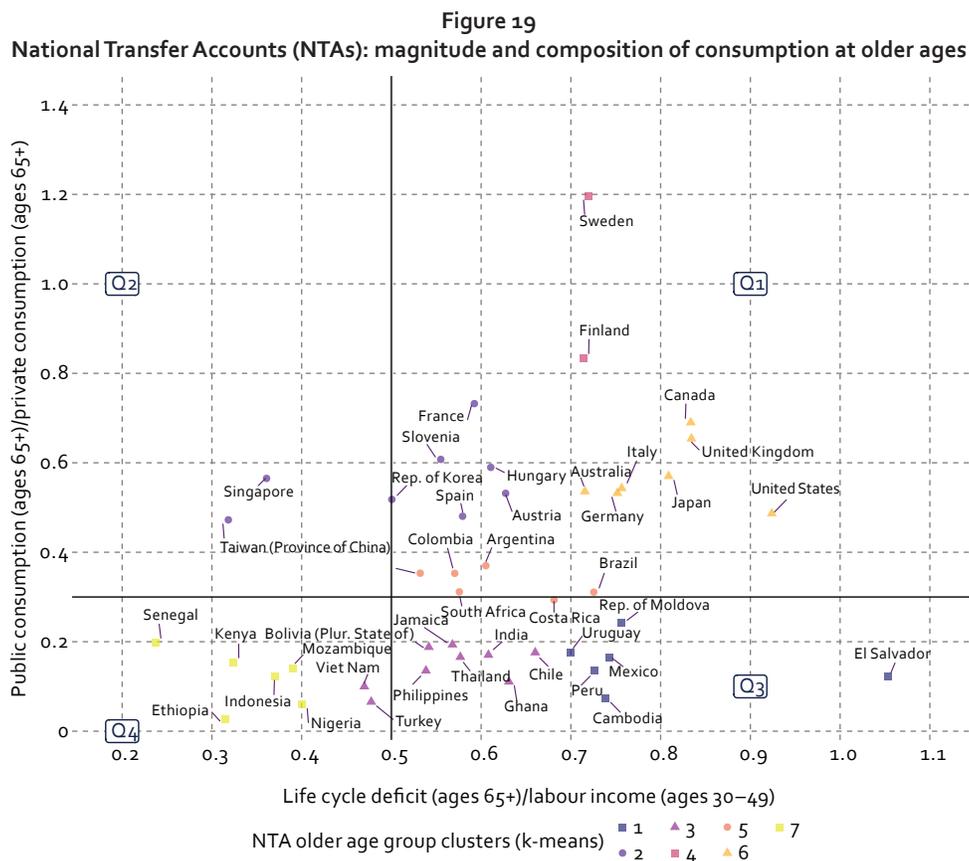
Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

A more straightforward way to look at the distribution of countries is to divide them into four quadrants. In the upper right quadrant of figure 18, the relative magnitude of the life cycle deficit is greatest (above 50% of YL) and CG represents at least 60% of CF. This quadrant was identified as quadrant 1 and labelled “high and public”. The upper left quadrant of figure 18 was labelled quadrant 2, “low and public”. In quadrant 2, the life cycle deficit at ages 0–19 represents less than 50% of YL, but CG is at least 60% of CF. Quadrant 1 and quadrant 2 include countries where the public sector plays a significant role in providing in-kind transfers to children. Argentina, Brazil and Colombia are in quadrant 2 together with Austria, Australia, China, Finland, France, Germany, Singapore and South Africa.

In the two lower quadrants, public consumption represents less than 60% of private consumption at younger ages. The lower right quadrant, which was labelled quadrant 3, “high and private”, includes El Salvador, Mexico, Peru and Uruguay. The children’s life cycle deficit represents more than 50% of adults’ labour income, but CG/CF ratios are lower, ranging from 0.21 (El Salvador) to 0.41 (Uruguay). In the lower left quadrant, which was labelled quadrant 4, “low and private”, the life cycle deficit at ages 0–19 represents less than 50% of YL, and CF/CF is below the 0.6 cut-off level. Quadrant 4 includes Chile, Costa Rica (0.5), Jamaica and the Plurinational State of Bolivia.

K-means clusters suggest there are significant variations within each of the quadrants, which group countries only crudely. For example, Costa Rica is in quadrant 4 but resembles countries in quadrant 1 and quadrant 2 such as Spain and the United Kingdom. Overall, the results show that, for children in Latin American and Caribbean countries, public consumption is at least a third of private consumption (except for El Salvador), and the life cycle deficit represents at least 45% of adults’ labour income, these levels being higher than in many African and some Asian countries.

Figure 19 shows the distribution of NTA countries by the magnitude and composition of consumption at older ages, plotting the ratio of public to private consumption (CG/CF) at ages 65 and over against the relative magnitude of the life cycle deficit (as a proportion of YL) at the same ages. Seven k-means clusters were identified. The quadrant methodology follows the same rationale as for consumption at younger ages, but with a lower cut-off point for composition: 0.30 instead of 0.60. Quadrant 1, in the upper right corner, was labelled “high and public” and represents countries where the CG/CF ratio is above 0.30 and the life cycle deficit is highest (over 50% of YL); quadrant 2, in the upper left corner, was labelled “low and public” and includes countries for which the CG/CF ratio is also above 0.30 but the life cycle deficit is below 50% of YL. On the lower part of the graph, quadrant 3 (“high and private”) and quadrant 4 (“low and private”) include countries where the CG/CF ratio is lower than 0.30 and LCD/YL can be either high (>0.5) or low (<0.5).

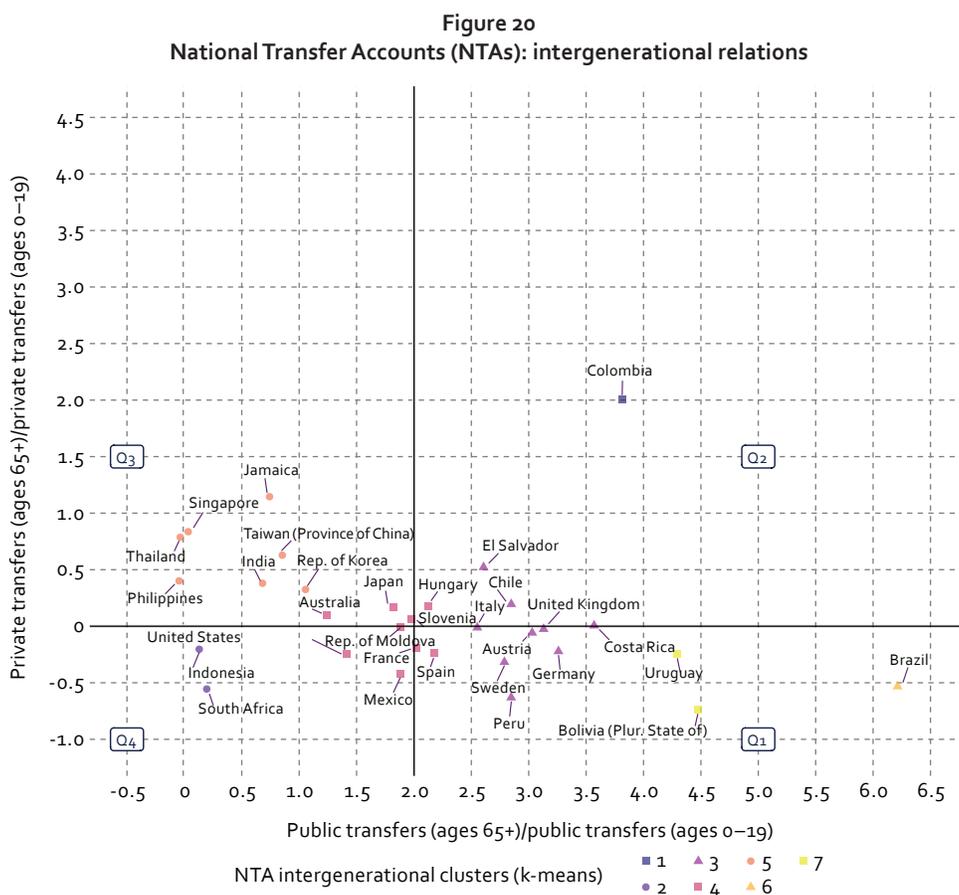


Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Once again, European and Northern American countries are characterized by strong consumption and a large share for public in-kind transfers at older ages (k-means clusters 2, 4 and 6; Q1). In most African and some Asian countries, on the other hand, public in-kind transfers represent less than 20% of private consumption (k-means cluster 7; Q4). Most Latin American and Caribbean countries are clustered in two intermediate groups. Argentina, Brazil, Colombia and Costa Rica are all in k-means cluster 5, in the lowest area of the upper right quadrant (Q1). Between 30% and 40% of consumption by older people in these countries comes from public services. South Africa and Taiwan show similar patterns. Chile, El Salvador, Jamaica, Mexico, Peru, the Plurinational State of Bolivia and Uruguay are

in the lower right quadrant (Q2), divided between k-means clusters 3 and 1, which are characterized by lower ratios of public to private consumption (ranging from 10% to 20%) than other Latin American and Caribbean countries. Cambodia, India, the Philippines and Thailand are in the same group.

Lastly, figure 20 shows the distribution of NTA countries by intergenerational relations, plotting the ratio of net private transfers to older people (ages 65+) and children (ages 0–19) against the ratio of net public transfers to the same dependent age groups. In addition to seven k-means clusters, the four quadrants are classified according to the roles of the public sector and families in supporting children and older people. For many wealthy countries, TG (65+)/TG (0–19) is about 2, meaning that the public sector transfers twice as much in the way of per capita resources to older people as to children. The areas of the graph with relatively large public transfers to older people are, first of all, quadrant 1, the lower right quadrant, which was labelled “(most) public transfers to older people, (all) private transfers to children”. In the upper right corner is quadrant 2, labelled “(most) public transfers to older people, (most) private transfers to children” and characterized by a TF (65+)/TF (0–19) ratio higher than zero, which implies that some private transfers go to older people. Quadrant 3, at the upper left of the chart, was labelled “(some) public transfers to older people, (most) private transfers to children”, there being a more harmonious relationship between public and private transfers to older people. Quadrant 4, in the lower left panel, was labelled “(some) public transfers to older people, (all) private transfers to children” and includes only three countries for which the measures more closely resemble those for countries in the other quadrants.



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Brazil and Colombia are outliers among the NTA countries. In Brazil, which is situated in quadrant 1, public transfers favour older people to the detriment of children more than in any other country ($TG(65+)/TG(0-19)$ is higher than 6.0), whereas private transfers are mostly to children, older people being net donors. In Colombia, both private (2.01) and public (3.81) net transfers to older people are higher than those to children. Net public transfers to older people are also particularly high in all other countries of Latin America and the Caribbean except Jamaica and Mexico. In Chile, Costa Rica, El Salvador, Peru, the Plurinational State of Bolivia and Uruguay, the $TG(65+)/TG(0-19)$ ratio is higher than 2.5, putting all these countries in quadrants 1 and 2 alongside countries with well-developed welfare programmes such as Austria, Italy, Slovenia and Sweden. Mexico, like France, Japan and the United States, follows a more balanced pattern, but net public transfers to older people are still almost twice as large as those to children. Most countries' $TF(65+)/TF(0-19)$ ratios are close to zero or slightly negative, meaning that private transfers to children dominate. An exception is the group of countries in the upper left quadrant of the chart, characterized by $TF(65+)/TF(0-19)$ ratios higher than 0.25 and a low contribution by the public sector to supporting older people. Jamaica is there together with India, the Philippines, the Republic of Korea, Singapore, Taiwan and Thailand.

C. Associations between NTAs and demographic dimensions

Table 5 characterizes the Latin American and Caribbean countries by each of the demographic and NTA dimensions. As discussed in the previous section, all 11 countries are currently in intermediate to advanced stages of the demographic transition, clustering in three different groups according to the CADR and the OADR. Concerning the NTA dimensions, the clustering analysis suggests that: (i) the contribution of the public sector to consumption by children and older people is more salient in Argentina, Brazil and Colombia, these countries being followed by Chile, Costa Rica and Uruguay, where families and the public sector play similar roles, and then by El Salvador, Jamaica, Mexico, Peru and the Plurinational State of Bolivia, where the public sector plays a less significant role; (ii) in all Latin American and Caribbean countries, particularly when compared to African and Asian countries, the public sector is a crucial channel for allocating resources over the life cycle, mainly through intergenerational (in-cash) transfers to older people.

Is there any statistical association between the demographic and NTA dimensions? Figures 21 to 23 plot each of the NTA dimensions (measured by quadrants) together with the demographic clusters, confirming some of the patterns discussed earlier. They also display correlation coefficients in each plot. The analysis includes all NTA countries in the world. There is a strong and statistically significant correlation between the magnitude and composition of consumption by children and older people and the stages of the demographic transition (coefficients are negative and significant). In general, countries in the most advanced stages of the demographic transition are characterized by a larger life cycle deficit at the dependent ages and higher participation by the public sector. At the same time, NTA countries have similar patterns of consumption magnitude and composition at both young and older ages (the correlation between the young and old groups is 0.85). However, there is no statistically significant correlation between intergenerational relations and the demographic transition. This finding probably reflects two factors. First, the analysis includes only intergenerational transfers. Countries at similar stages of the demographic transition may adopt asset-based reallocations (between age groups) instead of (or together with) public transfers (between generations) to support older people (e.g., Mexico versus Brazil, the United States versus Sweden). Also, countries with comparable age distributions (e.g., Asian and Latin American countries) may differ in the roles played by families and the public sector in supporting older people. In other words, the composition of resources allocated to older people may be more strongly associated with political and historical contexts than with demographic changes. Figures 21 to 23 confirm the main findings.

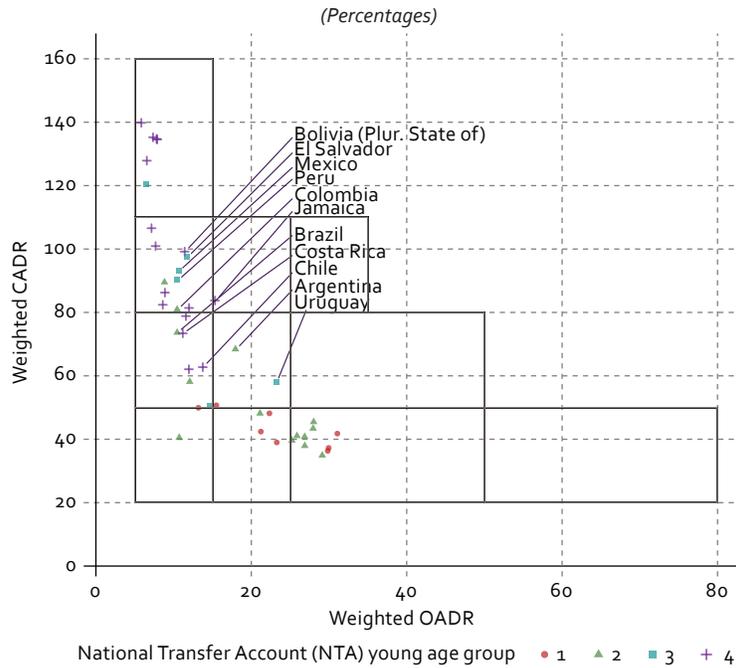
Table 5
Latin American and Caribbean countries classified by demographic and generational economy
dimensions derived from National Transfer Accounts (NTAs)

Country	Demographic transition		Generational economy		
	Child-age dependency ratio	Old-age dependency ratio	Consumption at younger ages (life cycle deficit/labour income, public consumption/private consumption)	Consumption at older ages (life cycle deficit/labour income, public consumption/private consumption)	Intergenerational relations (Public transfers 65+/0-49; private transfers 65+/0-19)
El Salvador	80-110 pHigh	05-15 Very low	(0.59; 0.21) Q3: high and private	(1.05; 0.12) Q3: high and private	(2.61; 0.52) Q2: (most) public transfers to older people, (most) private transfers to children
Peru	80-110 pHigh	05-15 Very low	(0.51; 0.42) Q3: high and private	(0.73; 0.13) Q3: high and private	(2.85; -0.63) Q1: (most) public transfers to older people, (all) private transfers to children
Bolivia (Plurinational State of)	80-110 pHigh	05-15 Very low	(0.45; 0.46) Q4: low and private	(0.54; 0.19) Q3: high and private	(4.47; -0.74) Q1: (most) public transfers to older people, (all) private transfers to children
Colombia	80-110 pHigh	05-15 Very low	(0.47; 0.83) Q2: low and public	(0.57; 0.35) Q1: high and public	(3.81; 2.01) Q2: (most) public transfers to older people, (most) private transfers to children
Mexico	80-110 pHigh	05-15 Very low	(0.60; 0.39) Q3: high and private	(0.74; 0.16) Q3: high and private	(1.88; -0.42) Q4: (some) public transfers to older people, (all) private transfers to children
Jamaica	80-110 pHigh	15-25 Low	(0.45; 0.37) Q4: low and private	0.57; 0.19 Q3: high and private	(0.74; 1.14) Q3: (some) public transfers to older people, (most) private transfers to children
Brazil	50-80 Intermediate	05-15 Very low	(0.46; 0.94) Q2: low and public	(0.72; 0.31) Q1: high and public	(6.21; -0.53) Q1: (most) public transfers to older people, (all) private transfers to children
Chile	50-80 Intermediate	05-15 Very low	(0.48; 0.45) Q4: low and private	(0.66; 0.17) Q3: high and private	(2.85; 0.19) Q2: (most) public transfers to older people, (most) private transfers to children
Costa Rica	50-80 Intermediate	05-15 Very low	(0.49; 0.53) Q4: low and private	(0.68; 0.29) Q2: high and public (borderline)	(3.57; 0.01) Q2: (most) public transfers to older people, (most) private transfers to children
Uruguay	50-80 Intermediate	15-25 Low	(0.55; 0.41) Q3: high and private	(0.70; 0.18) Q3: high and private	(4.29; -0.25) Q1: (most) public transfers to older people, (all) private transfers to children
Argentina	50-80 Intermediate	15-25 Low	(0.45; 0.77) Q2: low and public	(0.60; 0.37) Q2: high and public	(3.37; N/A) Q1 or Q2

Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

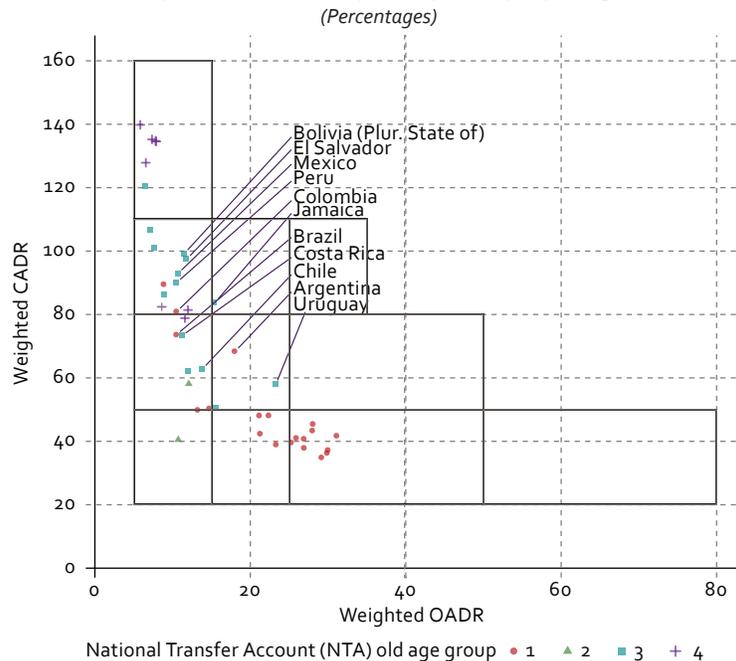
Note: Private transfer estimates are not available for Argentina.

Figure 21
Association between child-age and old-age dependency ratios (CADR and OADR) and the magnitude and composition of consumption by children (ages 0–19)



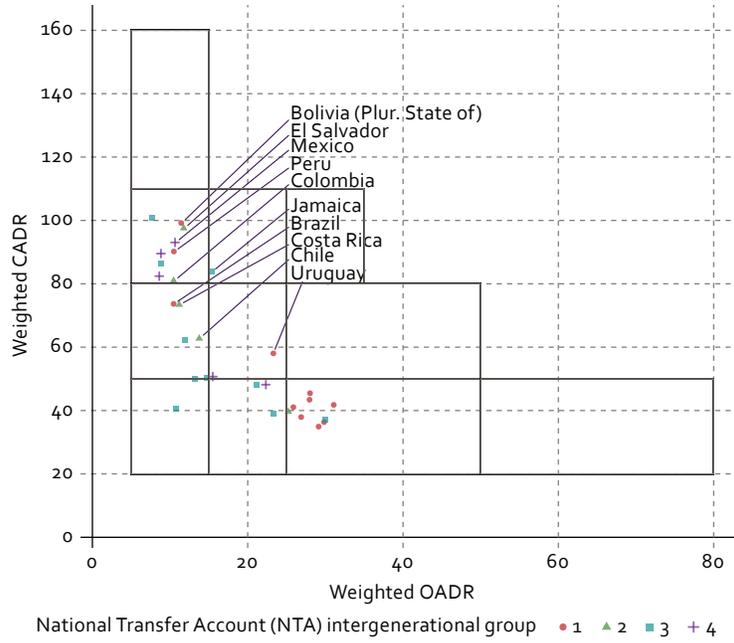
Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.
 Note: Correlation coefficient = -0.77 (p<0.001).

Figure 22
Association between child-age and old-age dependency ratios (CADR and OADR) and the magnitude and composition of consumption by older people (ages 65+)



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.
 Note: Correlation coefficient = -0.79 (p<0.001).

Figure 23
Association between child-age and old-age dependency ratios (CADR and OADR)
and intergenerational relations
(Percentages)



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Note: Correlation coefficient = -0.33 (p<0.1).

IV. The Sustainable Development Goals: associations with demographic and National Transfer Account measures

The objectives of this section are to discuss the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, select goals, targets and indicators that could be associated with both the demographic transition and the generational economy, and measure any correlations that may exist between them.

A. A brief review of the United Nations 2030 Agenda for Sustainable Development

The multilateral 2030 Agenda for Sustainable Development was approved in September 2015 by the United Nations General Assembly after a broad participatory consultation process that involved governments, civil society, the private sector and academia.¹⁰ The main objective of the Agenda is to build a more egalitarian society. Its aims are to eradicate extreme poverty, combat all forms of inequality and promote inclusive economic growth, sustainable cities, peace, justice and stronger institutions. The policy improvements proposed to achieve the Agenda goals are based on global, regional and national strategies. The Agenda also seeks to strengthen partnerships between developed and developing countries.

The 2030 Agenda comprises 17 Sustainable Development Goals (SDGs), 169 targets and 231 indicators and represents a comprehensive approach to attaining an equitable future for all people. It is built on responsibilities and partnerships for development in which all countries participate. According to the United Nations, the SDGs are universal, since the agenda applies to all countries and involves individual responsibilities and common tasks. They are also transformative, since the plan proposes an innovative development model that integrates human rights with economic, social and environmental dimensions. The SDGs are also civilizatory, since they envisage “a world of universal respect for equality and

¹⁰ See United Nations, Sustainable Development Goals Knowledge Platform [online] <https://sustainabledevelopment.un.org/>.

non-discrimination”.¹¹ Lastly, the SDGs constitute a planning and monitoring tool for national governments and international organizations to implement the necessary actions and assess the outcomes.

The United Nations elected to have the regional commissions carry forward regional and local discussions on the implementation of the 2030 Agenda and monitoring of the SDGs. For countries in Latin America and the Caribbean, the 2030 Agenda is vital to the promotion of sustainable, more equitable development. Although they have achieved higher levels of economic development than many countries in other parts of the world, Africa and Asia for example, inequalities within the region remain a critical issue that requires a solution. In this context, in May 2016, within the framework of the thirty-sixth session of the Economic Commission for Latin America and the Caribbean (ECLAC), Latin American and Caribbean countries created the Forum of the Countries of Latin America and the Caribbean on Sustainable Development, a “regional mechanism for the implementation and monitoring of the 2030 Agenda for Sustainable Development, the SDGs, their targets and means of implementation”.¹²

The Forum has been held by ECLAC every year since 2017. It includes national and regional representatives of governments, civil society, academia, development banks, United Nations agencies and the private sector. At Forum meetings, participants can exchange good practices, discuss common goals and promote regional cooperation. One of its chief contributions has been the Montevideo Consensus on Population and Development, which is a tool for planning, promoting and monitoring sustainable development in the Latin America and Caribbean region (ECLAC, 2019). The Montevideo Consensus is a progressive instrument organized into nine thematic sections that identify regional priorities in the area of population and development. In addition, in line with the resolution creating the Forum of the Countries of Latin America and the Caribbean on Sustainable Development, it makes a great many contributions of its own by incorporating the demographic dimension and proposing indicators that are specific to the region and were not originally part of the 2030 Agenda.

B. SDG estimates: materials

As mentioned above, the 2030 Agenda for Sustainable Development includes a comprehensive set of goals, targets and indicators. One of the challenges for the present work was to select indicators that could be coherently connected to the demographic and generational economy (NTA) dimensions. Since this paper offers only an exploratory and descriptive analysis of potential associations between the demographic, NTA and SDG dimensions, it was necessary to avoid including SDG indicators that a priori seemed to have only a distant bearing on the demographic and economic life cycle patterns discussed in the previous sections. The inclusion of too many indicators in the absence of more sophisticated statistical models (which it is not the objective of this study to employ) would make the analysis less parsimonious than is advisable. The selection process thus had to follow some methodological steps before the final selection of indicators was made.

First, the list of targets and indicators compiled by the United Nations was obtained for every SDG, from 1 to 17. Because both the demographic transition and the NTA measures centre on the two dependent age groups, children and older people, the priority was to include indicators that target these groups. The pre-selection of indicators was carried out in three phases, after many rounds of discussions between the researchers and the project coordinator. Two datasets were used as the sources of information: the Global SDG Indicators Database (United Nations, 2020) and the Organization for Economic Cooperation and Development database (OECD, 2020).

¹¹ See Economic Commission for Latin America and the Caribbean (ECLAC), “The Sustainable Development Goals (SDGs)” [online] <https://www.cepal.org/en/topics/2030-agenda-sustainable-development/sustainable-development-goals-sdgs>.

¹² See Economic Commission for Latin America and the Caribbean (ECLAC), “The Forum of the Countries of Latin America and the Caribbean on Sustainable Development and the Regional Follow-up to the 2030 Agenda” [online] <https://www.cepal.org/en/topics/2030-agenda-sustainable-development/forum-countries-latin-america-and-caribbean-sustainable-development-and-regional-follow-2030-agenda>.

The first phase included the following indicators:¹³

- 1.1.1 Proportion of the population living below the international poverty line by sex, age, employment status and geographical location (urban/rural);
- 1.2.1 Proportion of population living below the national poverty line, by sex and age;
- 1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable;
- 1.a.2 Proportion of total government spending on essential services (education, health and social protection);
- 3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population);
- 3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income;
- 4.1.1 Proportion of children and young people (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex;
- 4.2.1 Proportion of children aged 25-59 months who are developmentally on track in health, learning and psychosocial well-being, by sex;
- 5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location.

The second phase added the following indicators:

- 2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age;
- 2.2.2 Prevalence of malnutrition (weight for height $>+2$ or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight);
- 3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older;
- 4.6.1 Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex;
- 5.6.1 Proportion of women aged 15–49 years who make their own informed decisions regarding sexual relations, contraceptive use and reproductive health care;
- 6.1.1 Proportion of population using safely managed drinking water services;
- 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water;
- 7.1.1 Proportion of population with access to electricity;
- 7.1.2 Proportion of population with primary reliance on clean fuels and technology;
- 8.5.2 Unemployment rate, by sex, age and persons with disabilities;

¹³ The numbers in each indicator of the Global SDG Indicators Database represent the related goals and targets. For example, indicator 1.1.1 measures progress towards target 1.1 ("By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day") of SDG 1 ("End poverty in all its forms everywhere").

- 8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training;
- 9.5.1 Research and development expenditure as a proportion of GDP;
- 10.4.1 Labour share of GDP, comprising wages and social protection transfers;
- 16.9.1 Proportion of children under 5 years of age whose births have been registered with a civil authority, by age;
- 17.1.1 Total government revenue as a proportion of GDP, by source;
- 17.1.2 Proportion of domestic budget funded by domestic taxes.

Lastly, the third phase added another eight indicators:

- 3.7.1 Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods;
- 3.7.2 Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group;
- 3.b.1 Proportion of the target population covered by all vaccines included in their national programme;
- 5.5.1 Proportion of seats held by women in (a) national parliaments and (b) local governments;
- 5.5.2 Proportion of women in managerial positions;
- 16.2.3 Proportion of young women and men aged 18–29 years who experienced sexual violence by age 18;
- OECD poverty ratio (66 year-olds or more);
- OECD poverty ratio (ages 0–17 years old).

After preparing the list of pre-selected indicators, it was necessary to check for data availability. The list retained only indicators with data available for numerous countries, to avoid selection bias. Gender-related indicators were dropped because of the lack of a complete set of intra-age NTA measures that could be used to correlate with them. Indicators related to public spending and other aggregate economic and social measures were likewise excluded, since they are redundant with NTAs, which provide a better measure of the role of the public sector in providing in-kind and in-cash transfers for children and older persons. Once these criteria had been applied, the final list of indicators included:

Older people:

- 1.1.1 Proportion of the population living below the international poverty line by sex, age, employment status and geographic location (urban/rural);
- 3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population);
- OECD poverty ratio (66 year-olds or more).

Children and youth:

- 1.1.1 Proportion of the population living below the international poverty line by sex, age, employment status and geographic location (urban/rural);
- 2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age;

- 3.b.1 Proportion of the target population covered by all vaccines included in their national programme;
- 3.7.2 Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group;
- 3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population);
- 4.1.1 Proportion of children and young people at the end of primary achieving at least a minimum proficiency level in **reading**;
- 4.1.1 Proportion of children and young people at the end of primary achieving at least a minimum proficiency level in **mathematics**;
- 8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training; only female;
- OECD poverty ratio (ages 0–17 years old).

The association of each of the SDG indicators with the demographic and NTA measures was examined graphically. Additionally, pairwise correlation coefficients were estimated for each of the measures from the three dimensions: (i) SDG indicators, (ii) the 11 weighted demographic groups based on the CADR and OADR and (iii) NTA dimensions measured both in terms of single ratios (CG (0–19)/CF (0–19), CG (65+)/CF (65+) and TG (65+)/TG (0–19)) and by quadrants as discussed in the previous section. A summary of the main results is presented in table 6 at the end of the section.

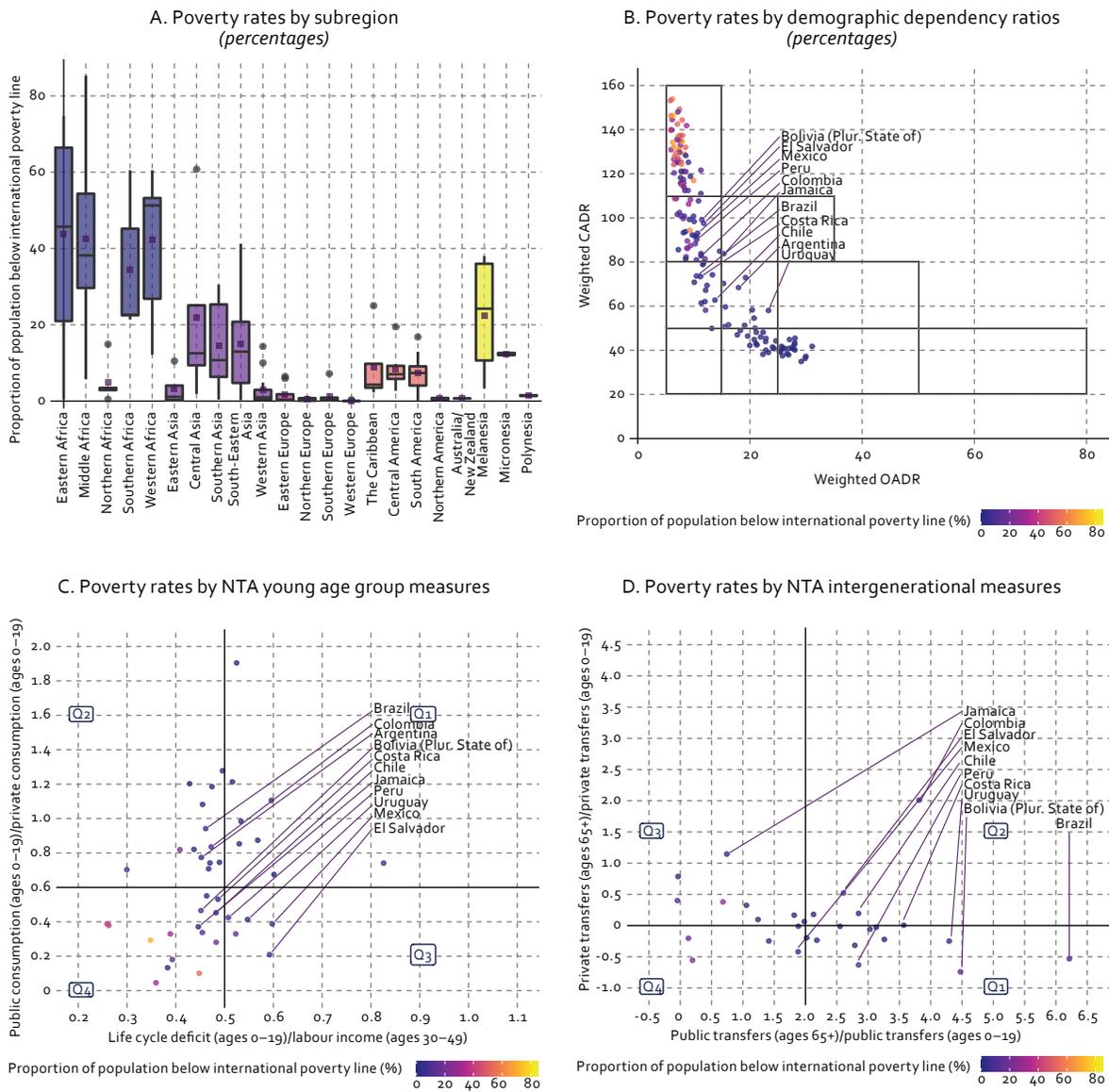
C. Associations between demographic, NTA and SDG indicators

All SDG indicators are multidimensional measures of living conditions. They are affected by and affect the main demographic variables (mortality, fertility and migration) as well as public policies, individual decisions, the formation of families and the development of markets, which will ultimately determine the characteristics of the economic life cycle (NTA). The results of this section must therefore be analysed with caution, since they represent simple associations between the indicators that may be strengthened by feedback effects.

Poverty rates are probably among the SDG indicators that connect most strongly with the size and patterns of economic flows in the life cycle. Since poverty is generally more prevalent among children and older people than adults, one should expect higher levels of consumption among these age groups to be associated with lower poverty rates. At the same time, fertility declines at the more advanced stages of the demographic transition, as does the dependency ratio within households, particularly among lower-income groups, making individuals less likely to be poor. Furthermore, rising income levels reduce mortality and fertility levels, changing the population age structure. Thus, it is not surprising that, as figure 24 shows, the proportion of the population living below the international poverty line is significantly higher in the subregions of Africa and Asia, followed by Latin America and the Caribbean, than in Europe, Northern America and Oceania. Poverty tends to be lower in countries with a lower CADR and a stronger role for the public sector in children's consumption. Since most Latin American and Caribbean countries are already in the intermediate stages of the demographic transition, poverty rates are lower there than in African and Asian countries. The correlation measures confirm statistically significant negative correlations between poverty and the demographic dimension (-0.59), as well as between poverty and NTA dimensions (CG/CF (0–19) = -0.51; CG/CF (65+) = -0.50), but not with intergenerational measures. In the comparisons using NTA quadrants, the correlation is positive, which is consistent since quadrant 1 has the highest ratio of public flows and quadrant 4 the lowest.

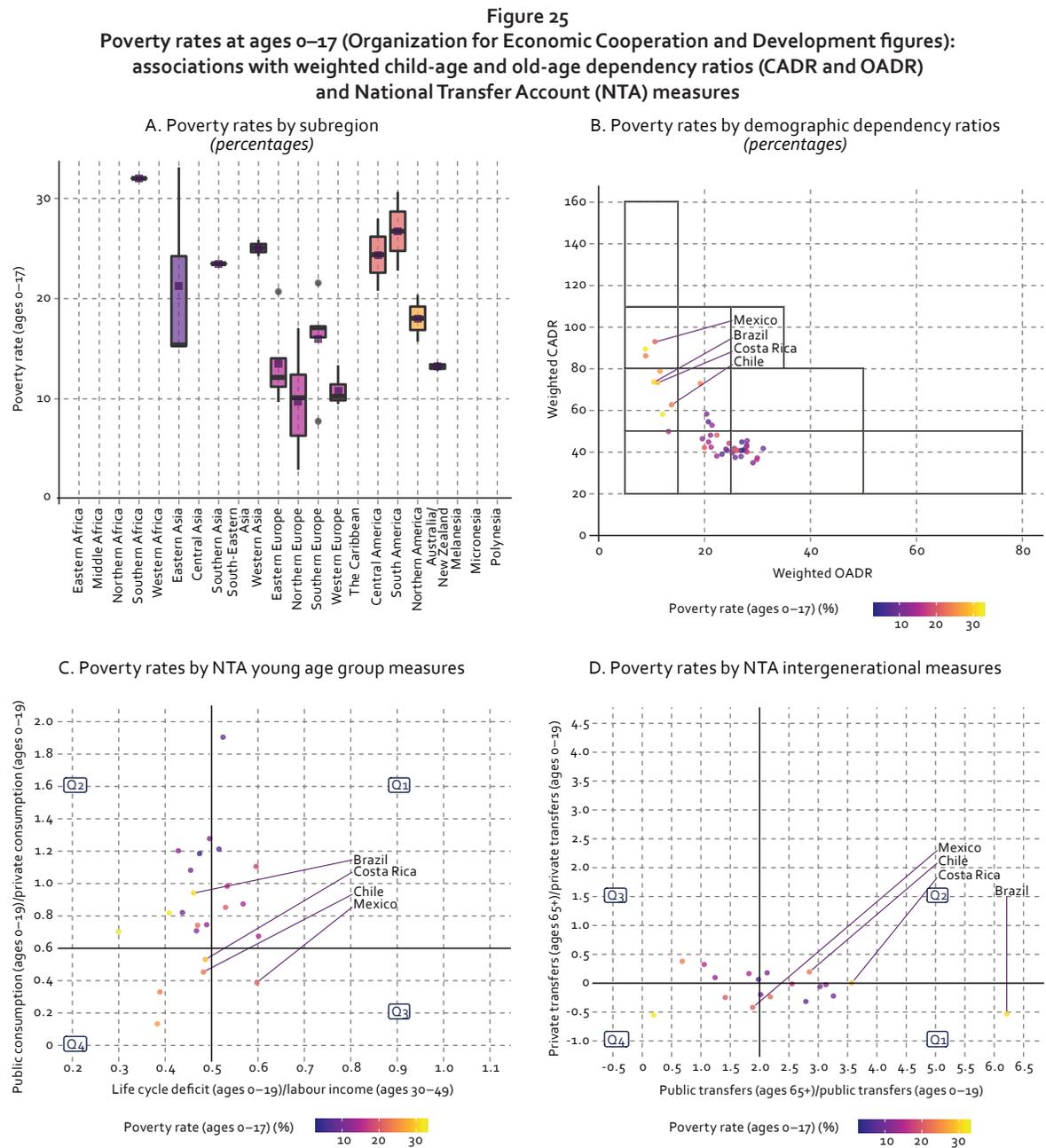
Figure 24

Poverty rates (1.1.1. international line): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

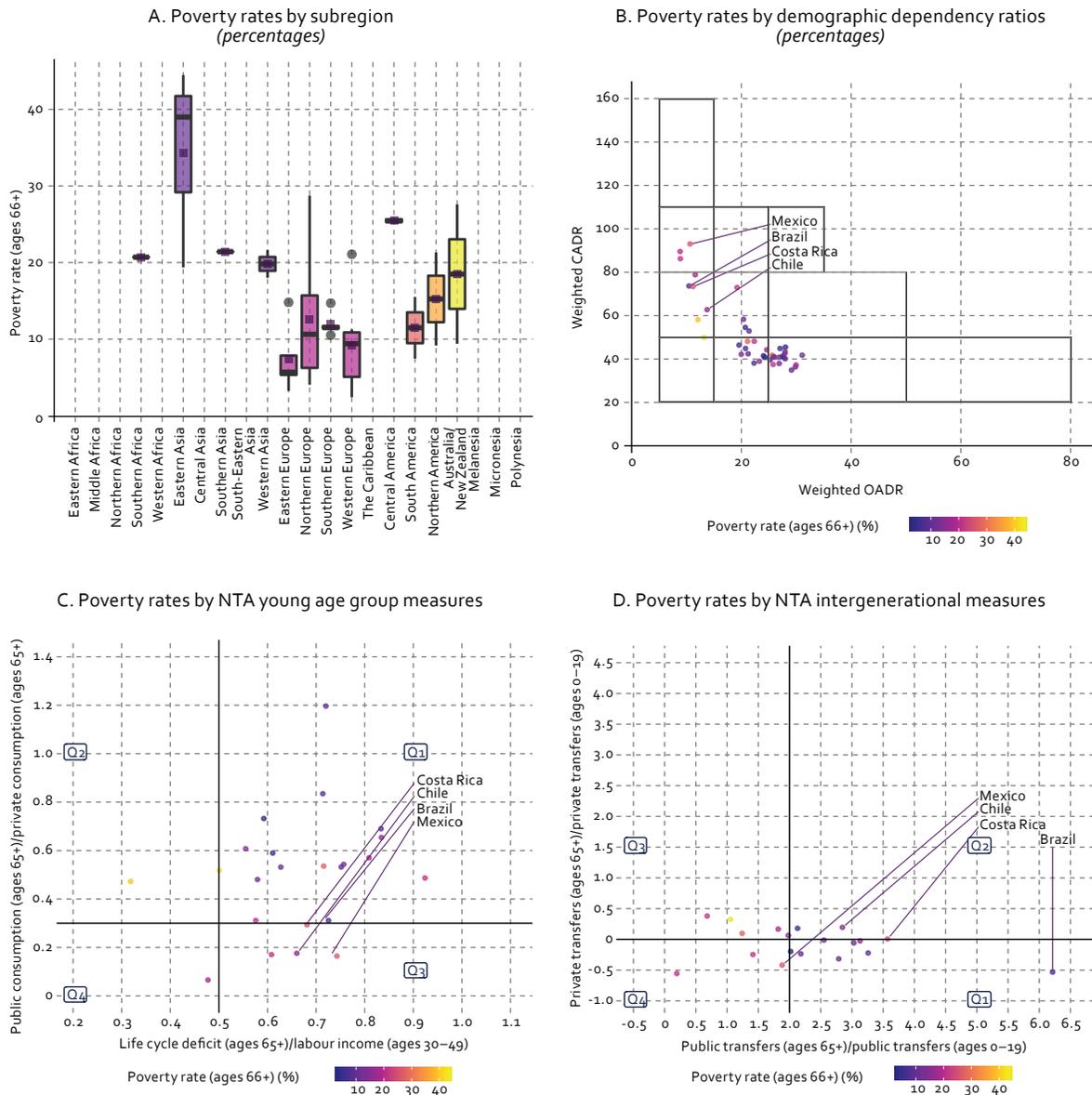
As mentioned earlier, poverty rates are highest among children and older people. Thus, differences in the age structure can affect crude measures of poverty, such as the one used in figure 24. To mitigate compositional effects, figures 25 and 26 show estimates of poverty rates for the young (ages 0–17) and old (ages 66+) age groups. The data are from OECD and therefore include fewer countries. The way poverty rates at younger ages vary with demographic and NTA measures becomes even more evident (figure 25) than before: ratios are lower for countries where the CADR is lower (correlation = -0.67; p-value < 0.01) and the public share of children’s consumption higher (correlation = -0.58; p-value < 0.01). The association between poverty at younger ages and NTA measures looks much weaker where intergenerational relations are concerned (correlation = 0.04; not significant).



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; Organization for Economic Cooperation and Development (OECD), "Poverty rate", 2019 [online] https://www.oecd-ilibrary.org/social-issues-migration-health/poverty-rate/indicator/english_ofe1315d-en; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

The associations with demographic and consumption measures (ratio of public consumption) appear to be less strong among older people (figure 26) than among children (below -0.35). Where intergenerational relations are concerned, though, higher public transfers to older people than to children are more significantly associated with lower poverty rates (correlation = -0.46; p-value < 0.05), probably reflecting the existence and coverage of pension systems in each country.

Figure 26
Poverty rates for ages 66+ (Organization for Economic Cooperation and Development figures):
associations with weighted child-age and old-age dependency ratios (CADR and OADR)
and National Transfer Account (NTA) measures

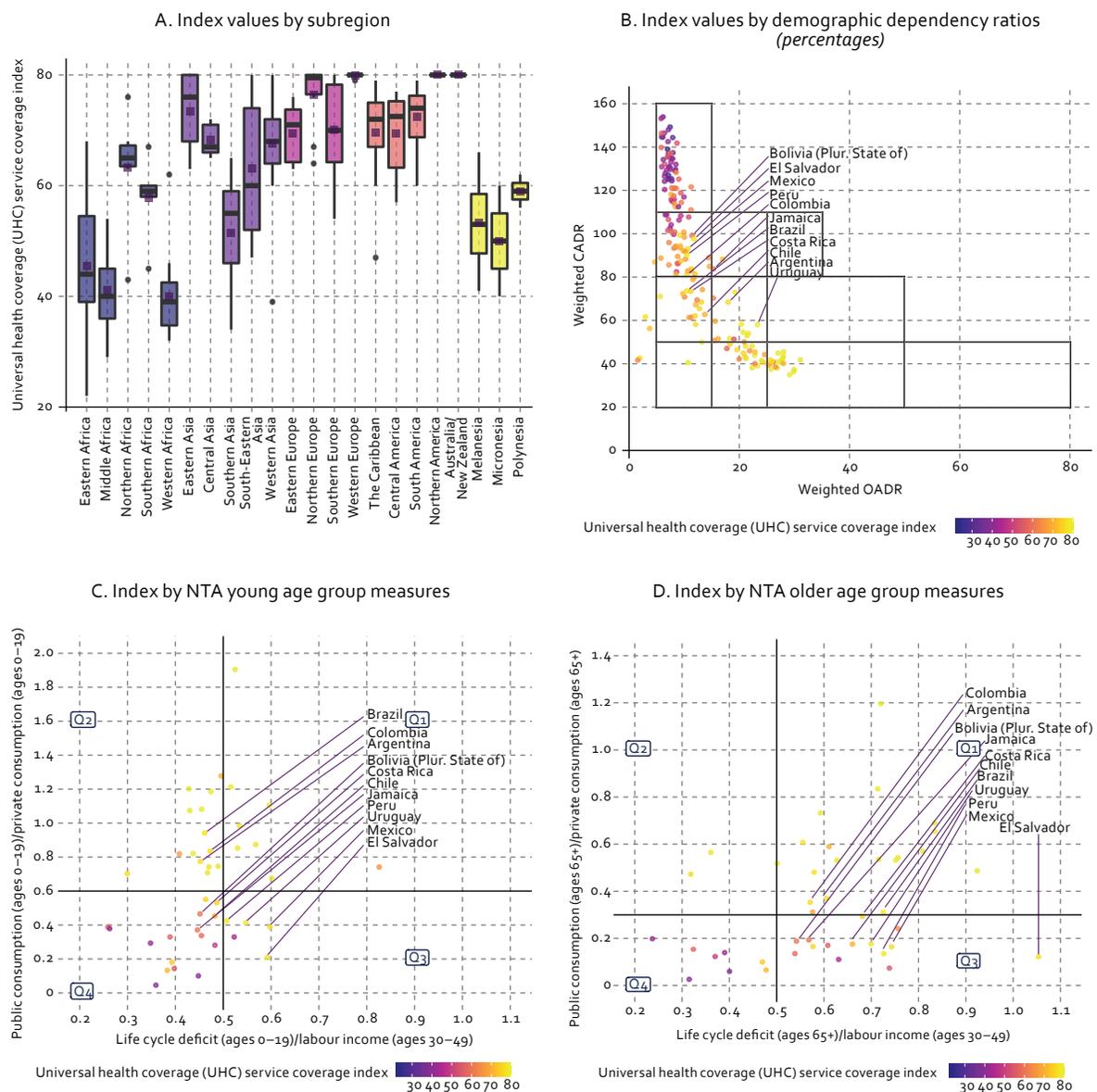


Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; Organization for Economic Cooperation and Development (OECD), "Poverty rate", 2019 [online] https://www.oecd-ilibrary.org/social-issues-migration-health/poverty-rate/indicator/english_ofe1315d-en; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Health is a critical measure of living conditions. Although health outcomes and the demand for health services are variables typically related to age, most SDG indicators are not available by age. At very young and older ages, health indicators tend to be worse and the demand for health services greater. The universal health coverage (UHC) service coverage index is the only SDG indicator that can be examined from the perspective of both children and older people. Like total poverty rates, however, it is a crude measure and thus susceptible to age structure composition effects, so that correlations need to be treated with caution.

Figure 27 shows that the coverage index is lowest for countries in Africa and Asia and varies positively with the stages of the demographic transition (correlation = 0.67; $p < 0.01$). The index is above 70% in all NTA Latin American and Caribbean countries except Jamaica and the Plurinational State of Bolivia. Figure 27 also shows that higher consumption (measured by life cycle deficit/labour income ratios) and higher ratios of public consumption, among both individuals aged 0–19 and older than 65+, are positively associated with higher health service coverage (correlation = 0.62). The matrices of correlation confirm the patterns shown in the graphs and suggest that intergenerational relations are not strongly associated with health coverage, although coefficients are also positive.

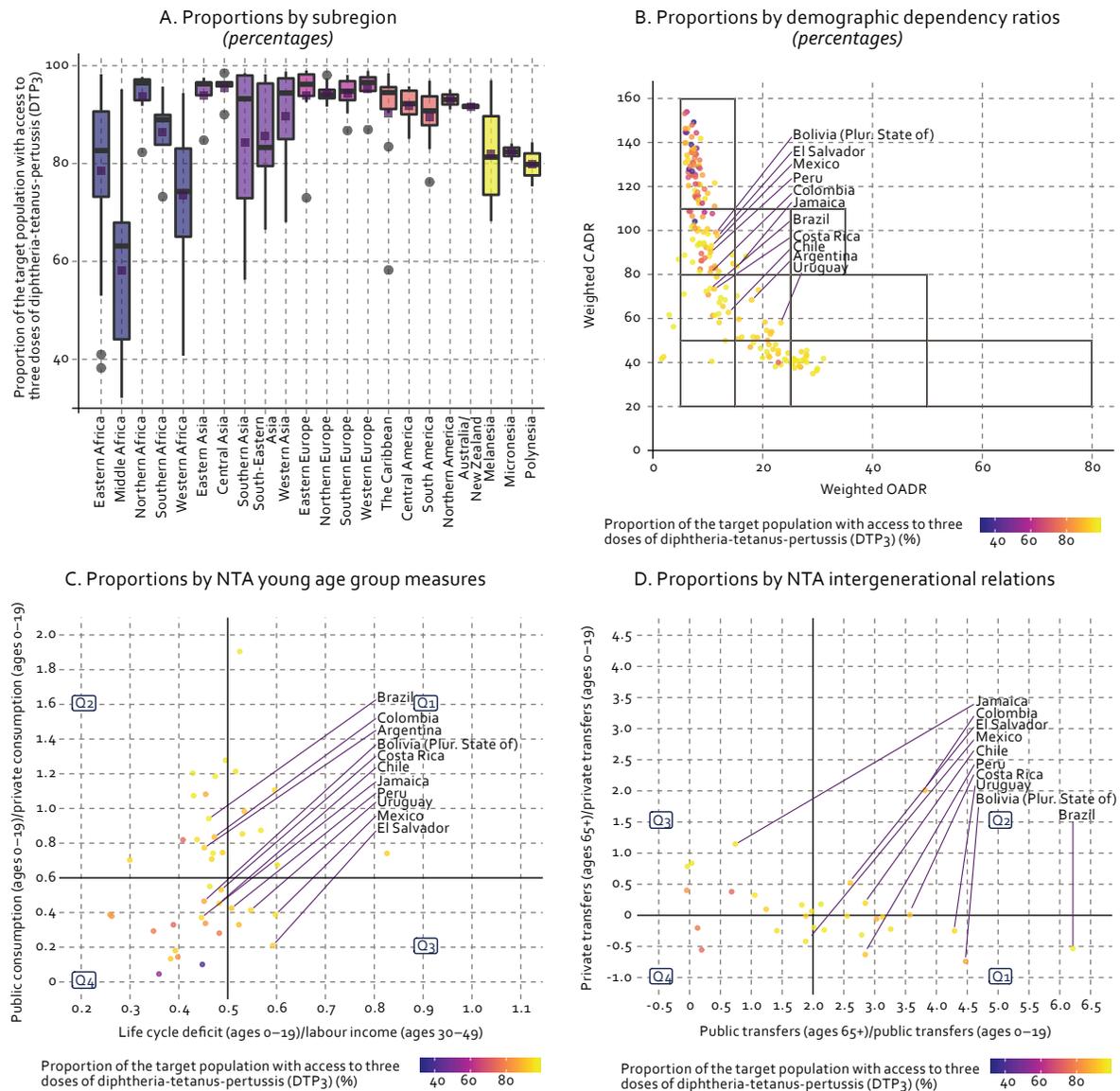
Figure 27
Universal health coverage (UHC) service coverage index (3.8.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

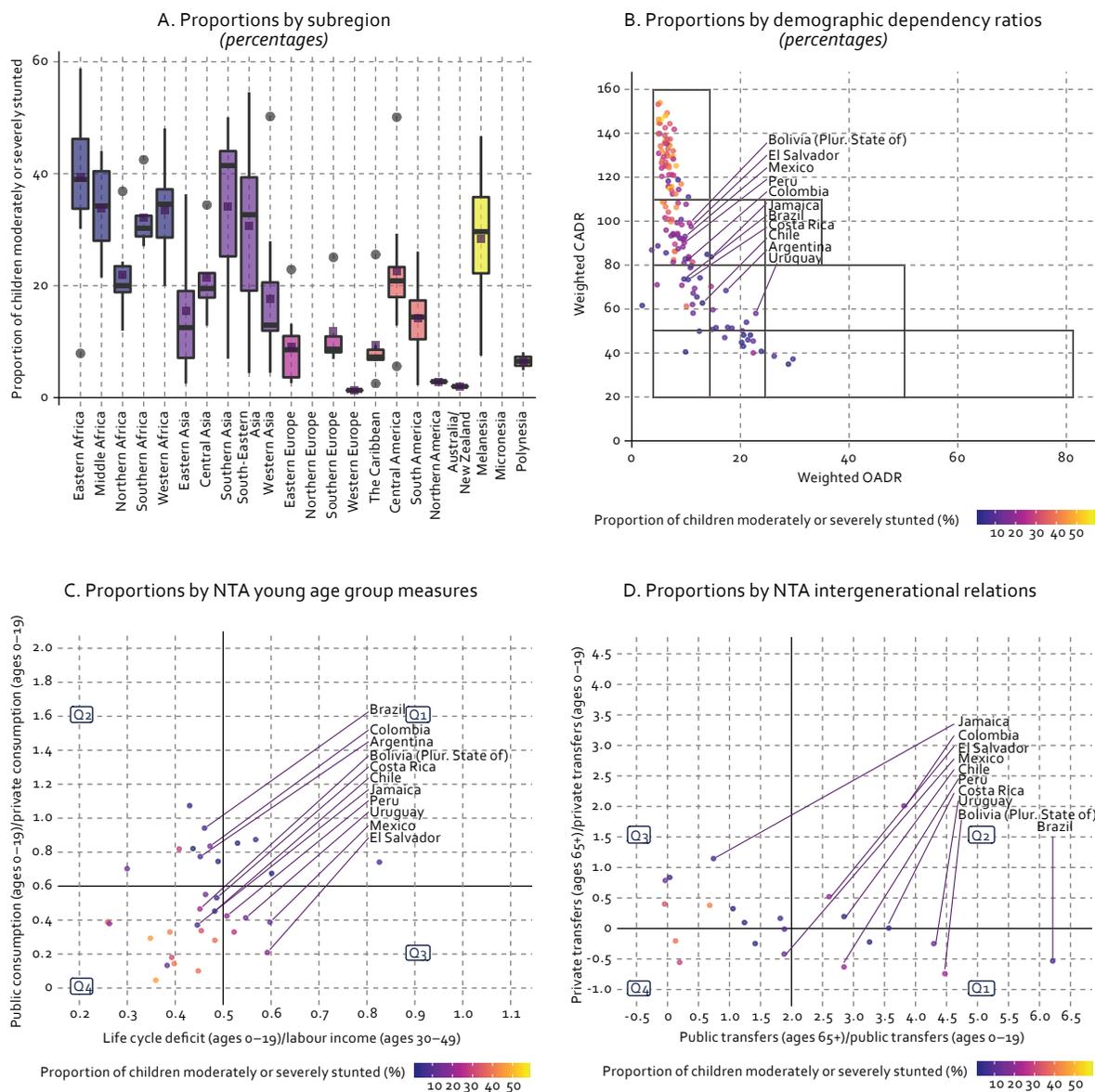
Although there are no health indicators specific to older people, some SDG indicators are closely associated with children's health. Two of them are presented in figures 28 and 29: immunization, measured by the proportion of the target population with access to three doses of diphtheria, tetanus and pertussis, and the proportion of children suffering from moderate or severe stunting. Not surprisingly, in both cases, the outcomes are significantly worse for countries in Africa and some Asian countries. These are countries that are in the first stages of the demographic transition and in which consumption at younger ages is relatively low in relation to labour income. In addition, the public sector plays only a minor role in funding goods and services for children in these countries. Since stunting and immunization are measures of the initial stages of social and economic development, for the other NTA countries in the world, including those of Latin America and the Caribbean, there is not much variation in the values of the two indicators. However, the correlation with public consumption at younger ages is significantly positive for immunization (0.53) and negative for stunting (-0.69).

Figure 28
Immunization (3.b.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://intaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

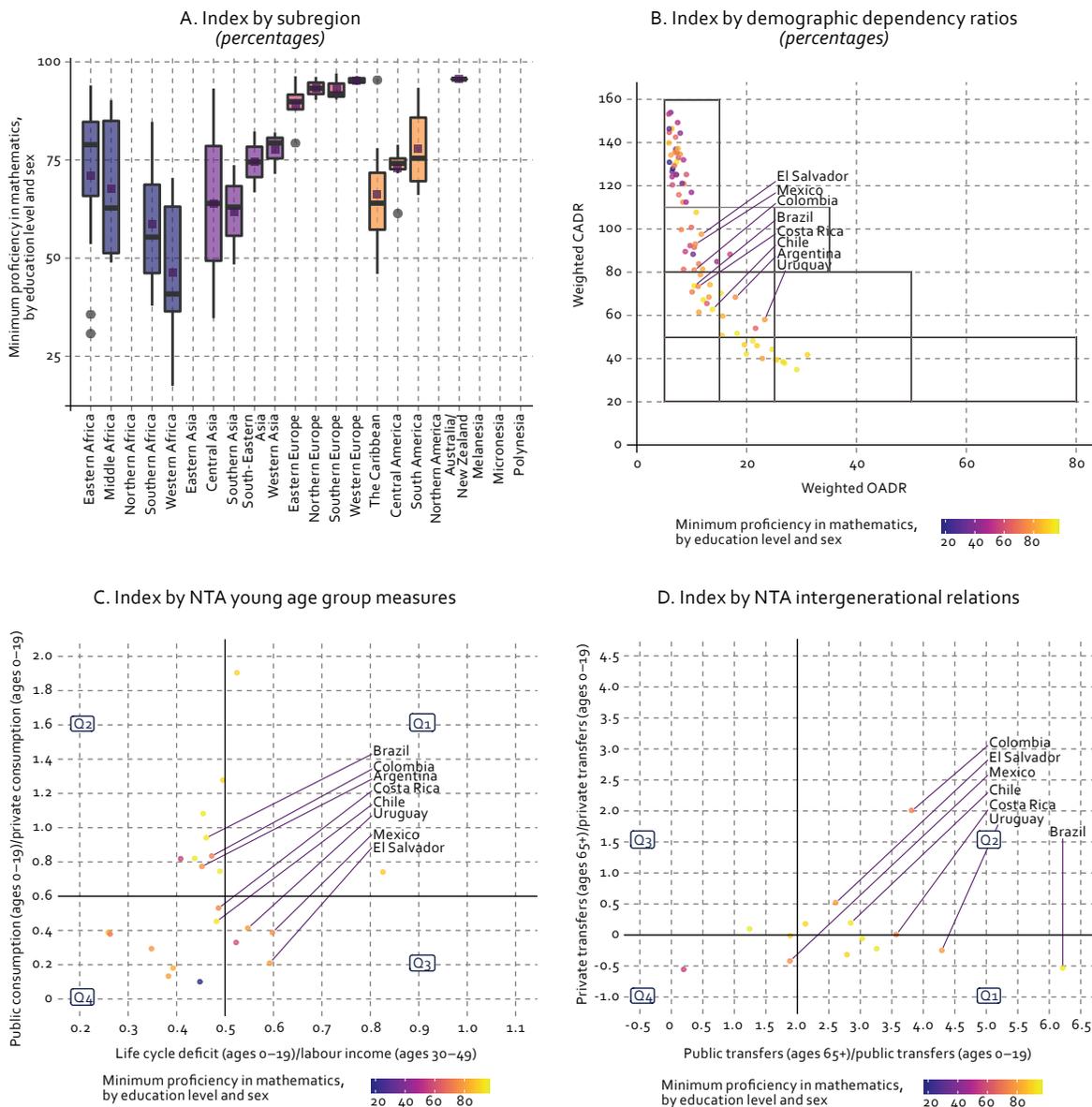
Figure 29
Stunting (2.2.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

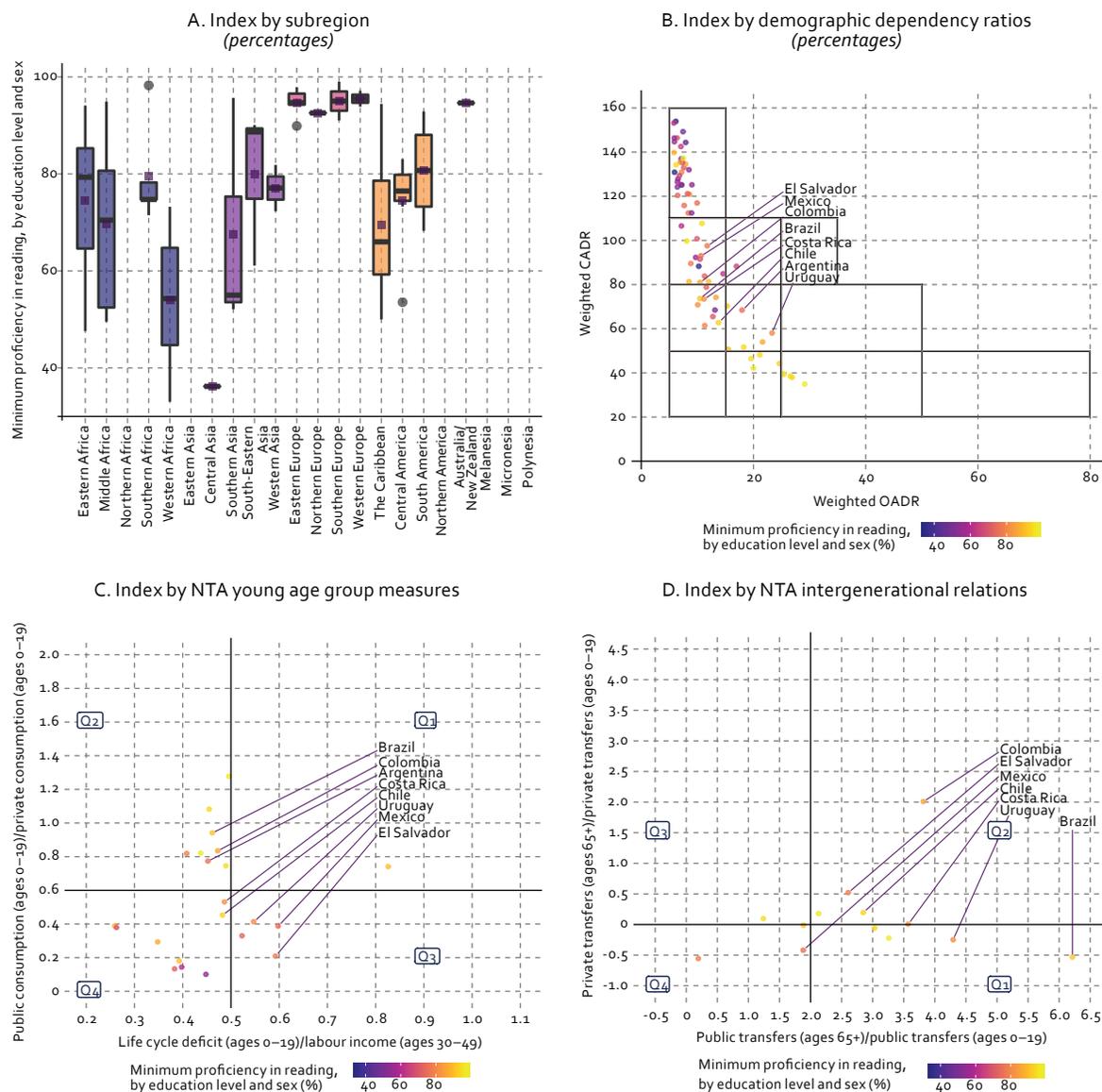
Another critical dimension of social and economic development is education. Two SDG indicators that measure the quality of education were selected: proficiency in mathematics and reading (figures 30 and 31). Although there is a positive and statistically significant correlation between proficiency in mathematics and reading with both the stage of the demographic transition (0.63) and the role of the public sector in providing goods and services to children (0.44), the regional patterns for education are different to those for the health indicators. One explanation is the nature of each set of indicators: the selected education indicators are measures of quality rather than just quantity. Proficiency in mathematics and reading is negatively impacted in countries where inequality is high, which includes most of the Latin America and Caribbean region.

Figure 30
Proficiency in mathematics (4.1.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

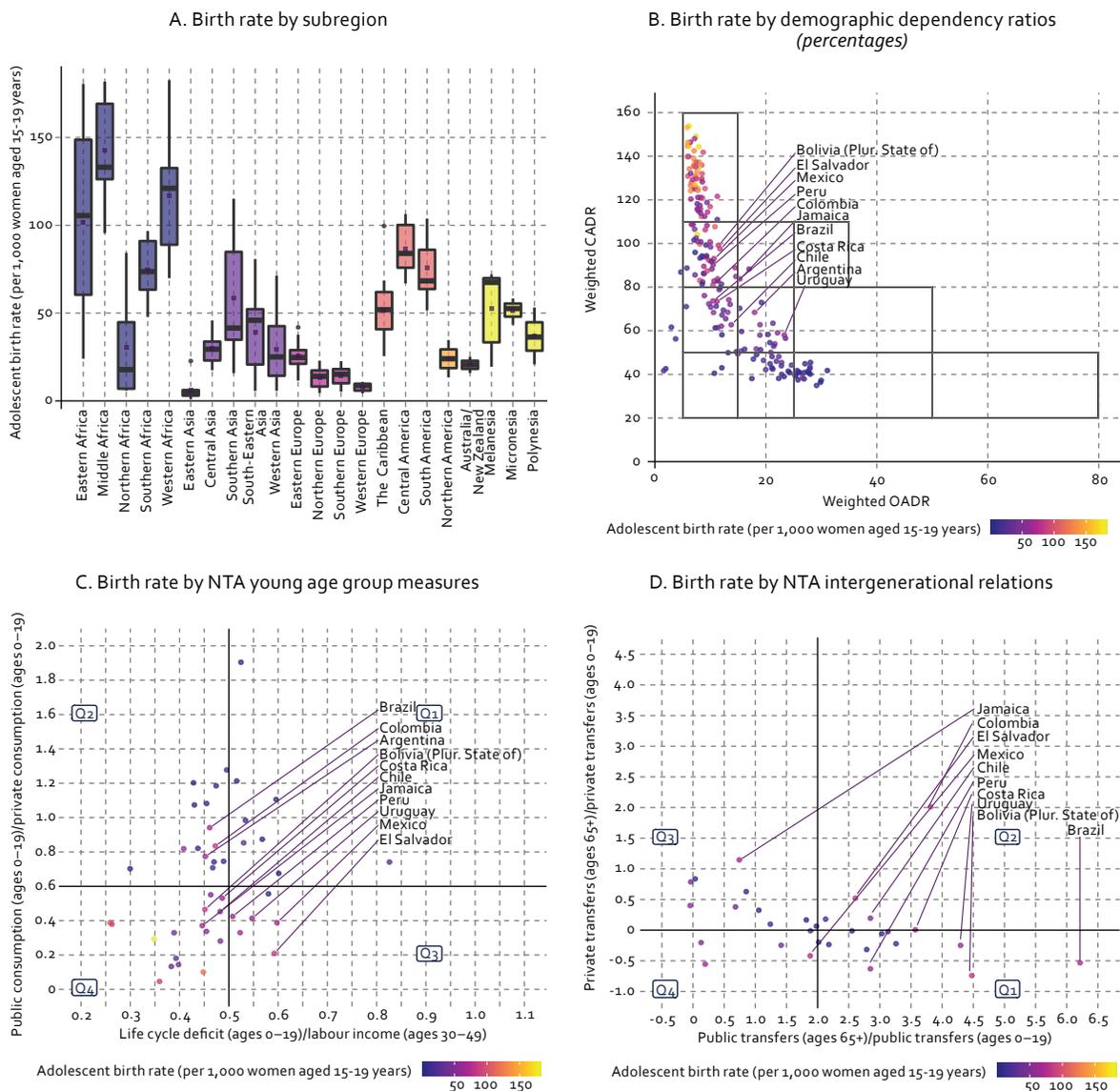
Figure 31
Proficiency in reading (4.1.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

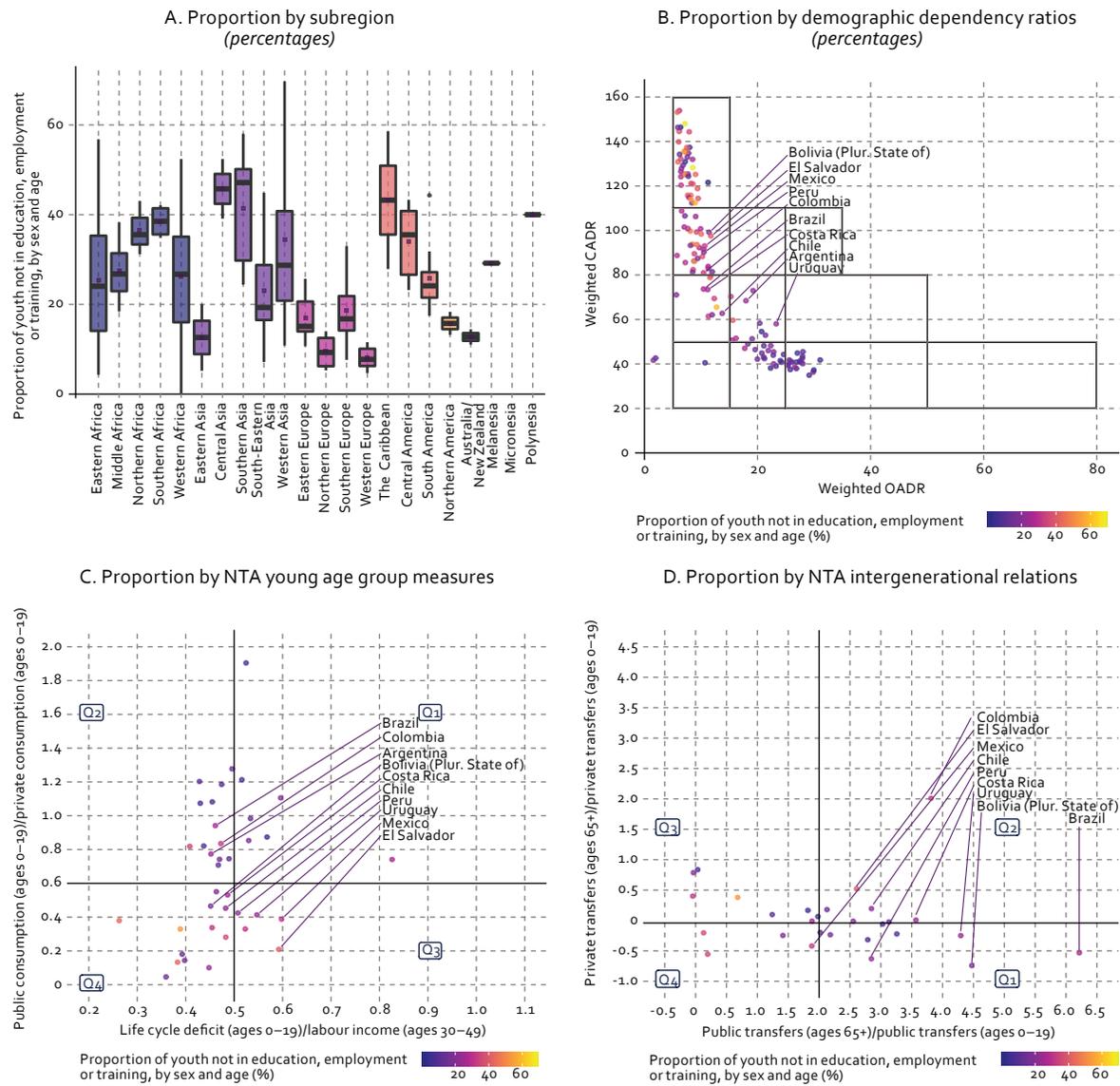
Two other measures of well-being at younger ages, namely adolescent birth rates and the proportion of youth not in education, employment or training, are presented in figures 32 and 33. Although these indicators are negatively associated with both the demographic transition and the role of the public sector in funding youth consumption, they take lower values in Latin American and Caribbean countries than in nations with similar demographic and NTA patterns. There is a vast literature exploring the social and economic problems affecting the young in Latin America. Historically high levels of inequality (of income, gender, and race/ethnicity), chronic urban violence and political issues are behind the relatively poor performance of Latin American and Caribbean countries on these indicators, which appear to be inelastic to fertility and mortality declines and the enlargement of the public sector.

Figure 32
Adolescent birth rate (3.7.2): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

Figure 33
Proportion of youth not in education, employment or training, female only (8.6.1): associations with weighted child-age and old-age dependency ratios (CADR and OADR) and National Transfer Account (NTA) measures



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

Table 6
Summary of Sustainable Development Goal (SDG) indicators and associations with demographic and National Transfer Account (NTA) measures

SDG indicator	Prevalence rates (median)					Associations			
	Latin America and the Caribbean	Africa	Asia	Europe	Northern America	Oceania	Stages of the demographic transition	Public/private consumption (ages 0–19 or 65+)	Intergenerational relations (ages 65+/0–19)
1.1.1 Poverty rate	6.8	42.0	5.5	0.3	0.6	11.8	Negative	Negative	Not significant
OECD: Poverty rate (ages 0–17)	25.4	32.0	23.9	11.3	18.0	13.2	Negative	Negative	Not significant
OECD: Poverty rate (ages 65+)	20.3	20.7	21.5	10.5	15.2	18.5	Negative	Not significant	Negative
3.8.1 Universal health coverage (UHC) service coverage index	73.0	44.0	66.0	76.0	80.0	58.0	Positive	Positive	Positive
3.b.1 Immunization	92.0	79.8	94.3	94.9	93.1	84.2	Positive	Positive	Not significant
2.2.1 Prevalence of stunting	13.2	34.4	19.7	8.5	2.9	8.1	Negative	Negative	Not significant
4.1.1 Proficiency in mathematics	73.7	62.8	72.6	91.9	N/A	95.6	Positive	Positive	Not significant
4.1.1 Proficiency in reading	75.7	70.3	72.3	94.5	N/A	94.6	Positive	Positive	Not significant
3.7.2 Adolescent birth rate	64.7	103.3	26.1	14.8	24.0	43.3	Negative	Negative	Not significant
8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training; female only	27.2	31.2	27.3	12.5	15.8	29.0	Negative	Negative	Not significant

Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>; Organization for Economic Cooperation and Development (OECD), "Poverty rate", 2019 [online] https://www.oecd-ilibrary.org/social-issues-migration-health/poverty-rate/indicator/english_ofe1315d-en; United Nations, *World Population Prospects 2019. Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/> and Global SDG Indicators Database, 2020 [online] <https://unstats.un.org/sdgs/indicators/database/>.

V. Overview, challenges and recommendations

This section presents an overview of the main results of the paper and discusses potential challenges and recommendations that arise from the associations between the demographic transition, the generational economy and the SDGs.

A. Overview

Latin America and the Caribbean has witnessed rapid demographic, social, economic and political transformations, but inequalities remain high in the region. The main goal of the present paper was to connect demographic changes with generational measures and the SDGs to cast light on potential mechanisms behind sustainable development. It is well known that the demographic transition, a global phenomenon that results from declining birth rates and improving survival levels, has outstripped the ability of nations in Latin America and the Caribbean to achieve sustainable development for all. One of the main consequences of the demographic transition is population ageing. Changes in the age structure modify the share of economically dependent age groups in the population (usually children and older people), affecting the allocation of resources over the life cycle and the ability of societies to improve well-being.

Accordingly, section II re-examined the demographic transition in the light of the age transition. Drawing on synthetic demographic measures, namely the child-age (ages 0–19) and old-age (65+) dependency ratios (CADR and OADR), and data from the medium-fertility variant of the 2019 Revision of the United Nations population estimates and projections for 201 countries, the analysis yielded at least four main findings.

First, it was shown that the CADR and the OADR are negatively associated, but not in a linear way. In the early stages of the demographic transition, there is a high proportion of children and young age groups owing to the combination of numerous births and high mortality rates. The CADR can be as high as 150 per 100 working-age adults, while the OADR is lower than 7.5 older people per 100. By comparison, at the most advanced stages of the demographic transition, the CADR falls to less than 30 children per 100 adults and the OADR increases to levels above 65 per 100. Between the initial and final stages of the demographic transition, the total number of dependents (children and older people) declines relative to adults, a temporary phase that may help societies to improve people's lives. By the end, there has been a significant change in the composition of dependents: older people have replaced some of the children and youth, and the population has become significantly older.

Second, the duration and intensity of changes in the age structure vary across countries. The maximum and minimum levels of the CADR and the OADR differ, as may the time taken for the CADR to decline without a significant increase in the OADR. Thus, countries group into different clusters over the demographic transition.

Third, estimates for 1980–2020 suggest that the European and Northern American countries have been at the forefront of the demographic transition, followed by Latin American, Caribbean and Asian countries. African countries, particularly in sub-Saharan Africa, have had the highest CADR and the lowest OADR values, showing them to be at much earlier stages of the demographic transition. The projections available for the next 80 years indicate a substantial reduction in the proportion of younger age groups (CADR) and an increase in the relative participation of working-age adults in sub-Saharan Africa and a few countries of Asia and Latin America and the Caribbean, with potentially positive economic and social effects for these nations.

Lastly, Latin American and Caribbean countries started the demographic transition at different times during the nineteenth and twentieth centuries. Countries that began the fertility transition in the first decades of the second half of the twentieth century experienced rapid and intensive population ageing. This group includes, for example, Brazil and Colombia. Other countries in the region such as El Salvador, Mexico, Peru and the Plurinational State of Bolivia, have followed similar patterns but been characterized by a less dramatic reduction in the total dependency ratio. At the same time, countries such as Argentina and Uruguay that led the demographic transition in the region have gone through a more prolonged and less intense process of population ageing. In 1980–2020, the CADR was 80–110 and the OADR was in the range of 5–15 for most Latin American and Caribbean countries. Between 2025 and 2100, the CADR is projected to decline by more than half to 20–50, whereas the OADR will increase fivefold to 25–50 older people per 100 working-age adults. By the end of the century, the proportion of people aged 65 and older in many Latin American and Caribbean countries, including Brazil, Chile, Colombia and Costa Rica, will be comparable to the proportions estimated for countries in Europe, Northern America and Oceania. Unfortunately, many of the opportunities that come with the demographic transition will soon be over in Latin America and the Caribbean.

It is not only demographic changes that dictate the ability of countries to reach high levels of sustainable development. The structure of the generational economy, i.e., how societies decide to allocate resources from the most productive ages (adults) to the most vulnerable ages and other subgroups, is also critical, and this was accordingly the focus of section III. Recent methodological developments in the study of the economic life cycle have yielded improved, more comprehensive and comparable estimates of the generational economy throughout the world. Since 2004, the National Transfer Accounts (NTA) Project has provided estimates of intergenerational and inter-age transfer accounts for a growing number of countries, based on a coherent theoretical framework. In addition to estimating NTAs, country teams in Latin America and the Caribbean have examined many research questions, including the existence of gender inequality in both market and household production, the presence of profound socioeconomic disparities in the economic life cycle, and the increasing fiscal pressures from population ageing.

Many measures can be estimated from the NTA data. In the present paper, the methodological choices were limited to elements of the generational economy that could be connected to the demographic transition and the SDGs in a comprehensible and coherent scheme. The most obvious selection criterion was age, since it is the variable that structures the NTA framework: children and older people, groups who cannot produce enough in the labour market to fund consumption, are the most vulnerable individuals in the economic life cycle. NTA countries were classified by three dimensions: (i) the amount and composition of consumption in the first stage of the life cycle (ages 0–19), (ii) the amount and composition of consumption among older people (ages 65+) and (iii) intergenerational relations, ascertained by associating net private and public transfers to children and older people. Data for 43 countries were drawn from the NTA Project, including the new estimates from the ECLAC 2018–2019 Latin America and Caribbean project covering nine countries in the region. The findings are based on the combination of the six different NTA indicators, and some of them deserve consideration.

First, it was shown that, relative to labour income, consumption at younger ages is greater in countries situated in Northern America, Latin America and the Caribbean, Oceania and Europe. The average ratio is lowest in Asian countries, followed by African countries. As regards the composition of consumption at younger ages, the public sector plays a more critical role in Europe, where the ratio between public and private consumption is, on average, higher than 1. The public/private ratio is about half that in Asia and Latin America and the Caribbean, and even lower in African countries. In relative terms, Argentina, Brazil and Colombia resemble Austria, France, Germany and South Africa, where the public sector plays a significant role in providing in-kind transfers to children. Other Latin American and Caribbean countries allocate proportionally fewer resources to children through the public sector (less than 60% of private consumption), but children's consumption tends to be higher there than in some African and Asian countries.

Regional differences in consumption are comparable at older and younger ages. European and Northern American countries are characterized by high consumption and a large share for public in-kind transfers at older ages. In most African and some Asian countries, on the other hand, public in-kind transfers represent less than 20% of private consumption and no more than 50% of labour income. Latin American and Caribbean countries are clustered in two intermediate groups, both characterized by large fractions of consumption relative to income (above 60%) but having different compositions. In Argentina, Brazil, Colombia and Costa Rica, between 30% and 40% of older people's consumption comes from public services. Chile, El Salvador, Jamaica, Mexico, Peru and Uruguay are characterized by a lower ratio of public to private consumption, ranging from 10% to 20%.

Intergenerational relations also differ by region. In most wealthier countries of Europe, public transfers to older people are more than twice as large on average as those to children. The ratio is closer to 1 in Asia, Northern America and Oceania, whereas in Africa the public sector is primarily a channel that allocates resources to children. In the Latin America and Caribbean region, Brazil and Colombia are outliers. In Brazil, public transfers favour older people to the detriment of children more than in any other country, with a ratio of over 6.0. In Colombia, both private (2.0) and public (3.75) net transfers to older people are higher than those to children. Net public transfers to older people are also particularly high in all the other countries of Latin America and the Caribbean except Jamaica and Mexico.

Lastly, there was found to be a statistically significant negative correlation between the magnitude and composition of consumption by children and older people and the stages of the demographic transition: countries in the most advanced stages of the demographic transition are characterized by higher consumption at the dependent ages and higher public sector participation. On the other hand, there was not found to be a statistically significant correlation between intergenerational relations and the demographic transition: countries with comparable age distributions (e.g., Asian and Latin American countries) may differ in the roles played by families, the public sector and the financial market (assets) in supporting older people. The composition of resources allocated to older people may be more strongly associated with political and historical contexts than with demographic changes.

To what extent are demographic changes and strategies of resource allocation over the life cycle associated with measures of well-being? The 2030 Agenda for Sustainable Development set out a global framework for ending extreme poverty and fighting inequality and injustice. It is undoubtedly susceptible to both demographic changes and the way families, governments and the market distribute resources and time within and between age groups. For example, population ageing may require intergenerational systems to adjust, with consequences for the well-being of some subgroups. Conversely, transfers over the life cycle may influence fertility and mortality levels. Section IV provided an exploratory analysis, based on graphs and simple correlations, to describe how some SDGs are associated with the demographic and NTA indicators discussed in the previous sections. It was not the intention to measure feedback effects or control for covariates in multiple regression models. Hopefully, future research will develop methodological approaches that deal with these issues.

One of the contributions of the paper was to preselect the SDG indicators that have the strongest potential to affect and be affected by demographic and NTA indicators. For that, the list of targets and

indicators established by the United Nations for every SDG was obtained. The priority was to include indicators measuring the well-being of children and older people, who were the focus of the demographic and NTA analyses. The final list kept 11 indicators with data for as many countries as possible to avoid selection bias. It did not include gender-related indicators because of the lack of a complete set of intra-age NTA measures that could be used to correlate with them. Indicators related to public spending and other aggregate economic and social measures were likewise excluded, since they are redundant with NTAs.

The exploratory analysis suggested that well-being indicators tend to improve at the most advanced stages of the demographic transition. There are different hypotheses regarding this finding. On the one hand, the reduction in the CADR during the demographic transition allows countries to invest in human capital and promote economic growth and well-being before population ageing imposes new challenges. On the other hand, lower poverty rates and better education and health accelerate the demographic transition. Demographic changes and SDG indicators may also be connected through different dimensions not included in the analysis, such as the quality of institutions, gender equity, urbanization and democracy.

Concerning the NTA measures, improved SDG indicators were found for countries where consumption at young and old ages is greater relative to adults' labour income, and the public sector plays a more significant role in providing services (e.g., health and education) to the two dependent age groups. Once more, the associations may work both ways, reinforcing the correlations. In addition, other dimensions not included in the analysis may explain the relationships found. For example, a preliminary analysis suggested that the correlations between NTA and SDG indicators lost significance when demographic transition stages were controlled for.

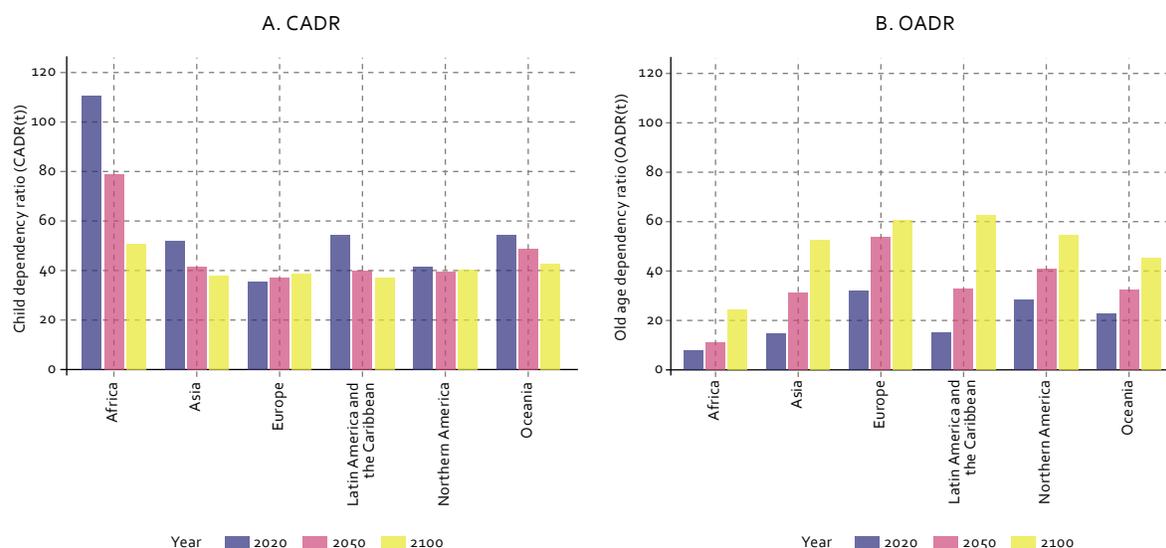
Overall, intergenerational relations – the balance between resources transferred to children and older people through families and the public sector – did not seem to affect the SDG indicators. As mentioned, countries at similar development levels may opt for different channels for allocating resources by age, including asset-based reallocations, without worsening levels of well-being. Besides, there might be an optimal level of intergenerational transfers for children and older people after which the consequences for the SDG indicators included in the current analysis are negligible.

B. Some additional challenges

The analysis conducted in this paper has ignored several of the problems that countries in Latin America and the Caribbean have faced in seeking to secure development and well-being for all population subgroups. There is a myriad of theoretical and empirical models that offer explanations for development success and failure in the region, but to review them and add them to the present analysis was beyond the scope of this paper. Nevertheless, a few considerations related to the demographic transition and NTAs may cast some light on why Latin American and Caribbean countries are moving quickly into the last stages of the demographic transition but may not be able to catch up with high-income countries' levels of well-being.

As mentioned in section II, the demographic transition has been particularly rapid in Latin America and the Caribbean compared to Northern America and Europe. Population ageing is already a reality in the region. The consequences of such profound changes are not trivial and have outstripped the ability of countries to take advantage of the opportunities they offer. As figure 34 shows, the United Nations projects that the CADR will still decline to some extent until 2050 in the region, but will vary little after that until 2100. On the other hand, the OADR will more than triple between 2020 and 2100, exceeding the levels in Asia, Europe, Northern America and Oceania. The temporary relative increase in the working-age population is almost over for several countries in the region, such as Argentina, Brazil, Chile, Colombia, Mexico and Uruguay. It remains uncertain whether the necessary social and economic improvements will occur during a period of rapid population ageing, considering how little success has been achieved during the (more favourable) demographic phase in which the working-age population has increased.

Figure 34
Child-age and old-age dependency ratios (CADR and OADR), world regions, 2020–2100
 (Percentages)



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

The economic challenges ahead are visible in table 7. It shows total consumption tending to increase relative to total labour income in selected NTA countries of Latin America and the Caribbean between 2020 and 2100 as the population ages and higher proportions reach ages above 65. The additional effort required to maintain current levels of consumption in the next 30 years (if all other economic variables remain constant) will range from 0.37% to 1.66% per year because of an increasing OADR, despite a lower CADR. Several factors can mitigate the effects of population ageing in the economy, including higher capital income, more progressive tax systems, higher labour force participation rates through the promotion of gender equity and international migration, or the postponement of retirement.

Table 7
Effects of demographic changes on the life cycle deficit, selected Latin American and Caribbean countries, 2020–2050

Country	Change in the life cycle deficit		Change in the life cycle deficit assuming that aggregate consumption by children aged 0–19 is inelastic		
	Ratio 2050/2020	Annual change (percentages)	Ratio 2050/2020	Annual change (percentages)	Total increase in children's per capita consumption, 2020–2050 (percentages)
Argentina	1.23	0.69	1.25	0.75	3.35
Brazil	1.36	1.03	1.55	1.45	33.22
Chile	1.65	1.66	1.91	2.16	25.78
Colombia	1.17	0.52	1.36	1.03	34.94
Costa Rica	1.41	1.16	1.59	1.54	26.83
El Salvador	1.12	0.37	1.24	0.71	38.08
Jamaica	1.27	0.80	1.63	1.62	36.83
Mexico	1.20	0.62	1.30	0.87	19.43
Uruguay	1.41	1.15	1.47	1.27	17.18

Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org/>; and United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Labour income may also increase faster if investments in human capital increase and become more equal across and within nations. Thus, one source of hope is the growing quantity and quality of education in the context of a declining CADR. Although investments in human capital have varied across population subgroups in the region, keeping inequality high and productivity low, some windows of opportunity will remain open for a while. For example, as table 7 shows, per capita consumption at ages 0 to 19 could increase by about a third for most NTA countries in Latin America and the Caribbean if children's total consumption remained constant as the CADR declined. Although this strategy would require a more significant effort to fund the additional old-age consumption (between 0.71% and 2.16% per year), it could also improve productivity significantly, thereby promoting the necessary sustainable growth.

Inequality is undoubtedly one of the most critical obstacles to sustainable growth in Latin America and the Caribbean. Public policies should therefore target the most vulnerable groups and seek to overcome the differentials that persist in the region. Consistently, table 8 shows that NTA measures vary significantly by gender and socioeconomic status. These estimates are just a glimpse of the new methodological developments under way in the Latin American and Caribbean NTA project coordinated by ECLAC. As mentioned earlier, the results are still preliminary and were thus not included in the earlier sections. However, they have uncovered substantial differences in labour income between men and women (a factor of about 2) and in the life cycle deficits of high and low socioeconomic status groups (a factor of between 1.10 and 3.32). These estimates reveal that there are many different stories within the Latin America and Caribbean region in terms of levels, trajectories and associations between demographic, NTA and SDG measures, and these merit attention from scholars and public policies. Some population subgroups in Latin America and the Caribbean (e.g., men of high socioeconomic status) can be expected to follow the patterns estimated for high-income countries in Europe and Northern America, whereas in other cases (particularly women of low socioeconomic status), relationships are more likely to resemble those found for lower-income countries in Africa and Asia.

Table 8
Effects of demographic changes on the life cycle deficit, selected Latin American and Caribbean countries, 2020–2050

Country	Gender	Socioeconomic status	
	Labour income (ages 30–49)	Life cycle deficit (ages 0–19)	Life cycle deficit (ages 65+)
	Men/women	High/low socioeconomic status	High/low socioeconomic status
Argentina	N.A.	1.45	1.10
Brazil	2.00	1.64	2.07
Chile	N.A.	3.32	2.64
El Salvador	1.69	2.34	1.93
Mexico	1.96	3.25	2.96
Uruguay	1.71	N.A.	N.A.

Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

VI. Final recommendations

The analysis presented in this paper has suggested that as the demographic transition proceeds, NTA and SDG indicators shift towards higher consumption, greater public provision of services to children and older people and improved indicators of well-being (lower poverty rates, better education and health). However, there is no guarantee that after becoming older, countries in the first stages of the demographic transition will also become wealthier, more developed and less unequal. Although the demographic data used cover 150 years and represent a substantial portion of the demographic transition in the world, estimates are left- and right-censored. In addition, the period of observation is considerably narrower for the NTA and SDG indicators. In some cases, accordingly, the early and more advanced stages are represented by different countries and regions, and the associations in the present study should not be taken as automatic in the trajectory of any society. In this context, some recommendations follow:

- The stages characterized by a declining CADR and an increasing share for working-age groups are critical, since they are a time when human capital investments can thrive and measures can be implemented to alleviate poverty at younger and older ages, boosting sustainable growth. This phase is coming to an end in the Latin America and Caribbean region, but it can still be beneficial in several African countries.
- Institutional reforms are crucial, since the duration of the period marked by a lower CADR may be too short for countries to overcome the social and economic constraints that limit the ability of societies to take full advantage of the demographic changes and move quickly towards the SDGs before populations age. The provision of high-quality education to all children is one (relevant) example of how countries in Latin America and the Caribbean have been unsuccessful in transforming the demographic transition into more sustainable development.
- Investments in children and youth must increase to improve productivity but also reduce inequalities as demographic changes translate into larger proportions of the population at adult and older ages. Investments in children and youth enhance well-being at more advanced ages by promoting economic growth and asset accumulation, and by improving health over the life cycle with positive consequences for income and wealth during the last stage of life.

- Public transfers are critical for enhancing children's well-being, since in most countries they are the only way for young members of low-income families to accumulate an adequate amount of human capital and overcome inequalities that are perpetuated through the generations. At older ages, the dependence of well-being measures on government transfers is lower. Different combinations of asset-based reallocations and public and private transfers may work well as long as the mix of strategies does not lead to higher inequality, smaller savings or fiscal issues that put welfare systems and families at economic and financial risk.
- It is imperative to increase productivity in middle-income countries (including those of Latin America and the Caribbean) where populations are ageing fast but inequalities, low economic growth and institutional issues persist. With a slow-growing labour force, redistribution policies that improve gender equity, close racial gaps, reduce regional and income inequality and promote better fiscal policies can help buffer the consequences of a rapidly ageing population and avoid jeopardizing human rights, social advances and health gains.

Many methodological issues hinder examination of the association between demographic changes, the generational economy and sustainable growth. Scholars, international agencies and governments should pay attention to some of them:

- As mentioned earlier, cross-sectional data cannot be used to trace the real trajectories of the demographic transition, NTAs and SDGs. Studies for selected countries may give a more precise picture of how these factors are associated in specific contexts.
- The NTA Project has made significant contributions to the study of the associations between economic and demographic variables. However, it is crucial to move beyond inter-age relations to intra-age analyses, or do so more quickly, and to incorporate more aspects of the generational economy into the discussion about sustainable development. Initial research has shown very different patterns of inter-age transfers for groups living within the same countries, as discussed earlier. Differences by socioeconomic status, gender and race may be more significant than those between countries, and thus social mobility may interact with population ageing to affect sustainable development.
- The SDG list of indicators is incomplete. There are no data by age and socioeconomic status for most measures. Although there are some gender indicators, there is still a lot to be done before estimates by subgroups become available for a large set of countries. In addition, many of the indicators are not appropriate for measuring development in middle- and high-income countries, which reduces the scope for examining the association between demographic changes, the economic life cycle and sustainable development. One critical step is to define regional SDG indicators, such as the ones proposed by the Montevideo Consensus on Population and Development. However, the data still need to be produced. Lastly, datasets from different institutions need to be harmonized to enlarge the list of indicators and improve between- and within-country comparisons.

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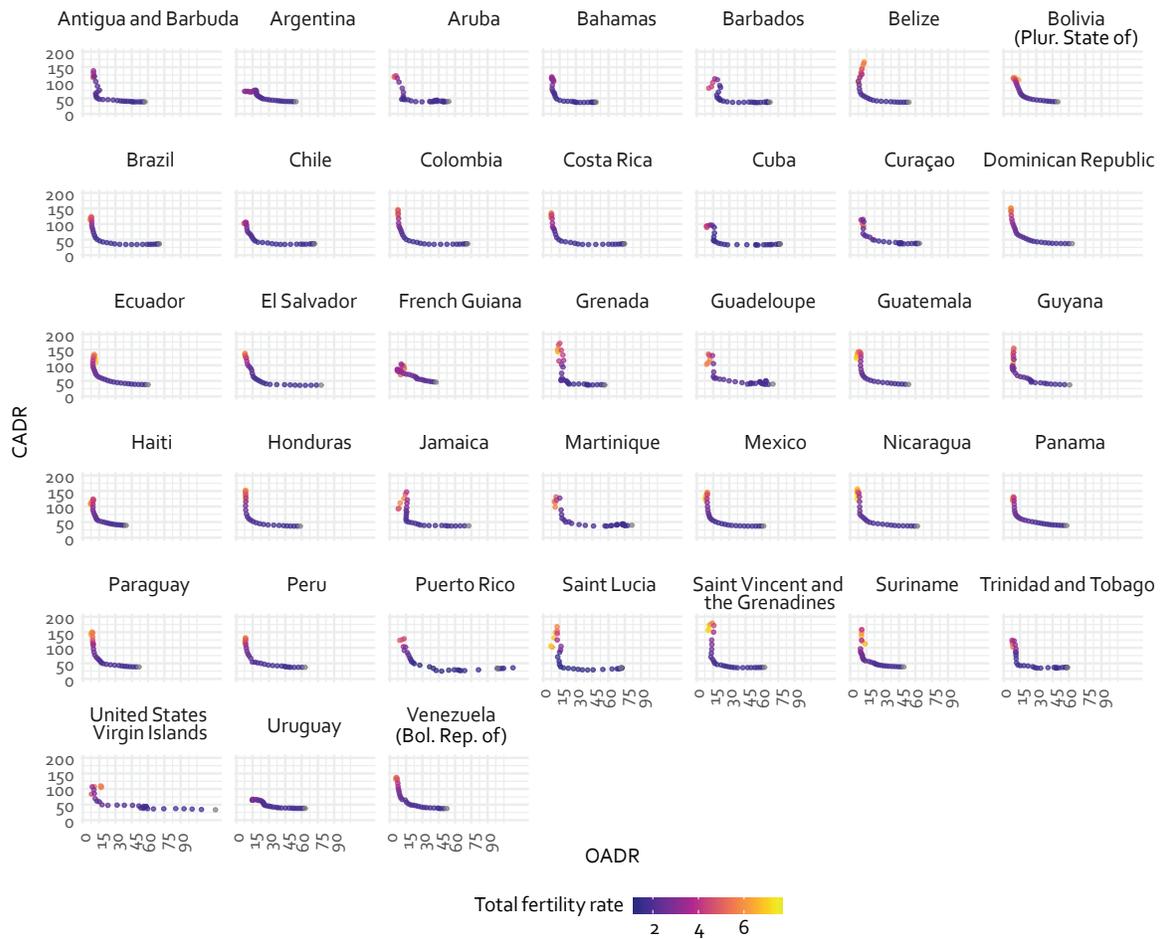
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Annexes

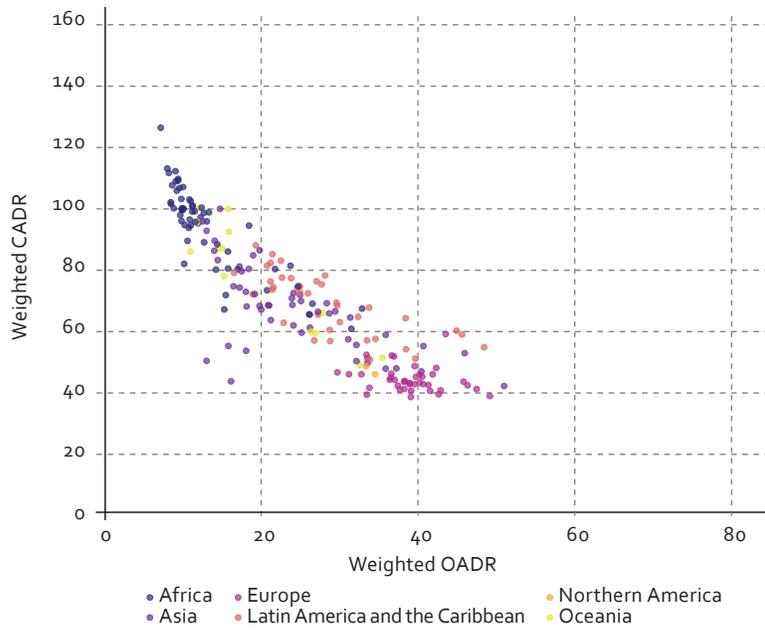
Annex 1

Figure A1.1
Child-age and old-age dependency ratios (CADR and OADR), by total fertility rates,
selected countries of Latin America and the Caribbean, 1950–2100
(Percentages)



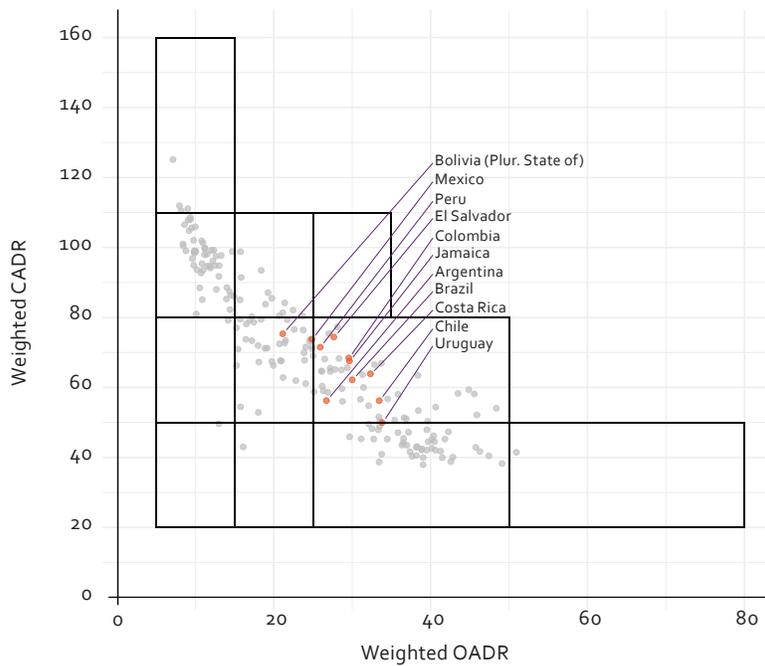
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.2
Weighted child-age and old-age dependency ratios (CADR and OADR), world regions, 1950–2100
 (Percentages)



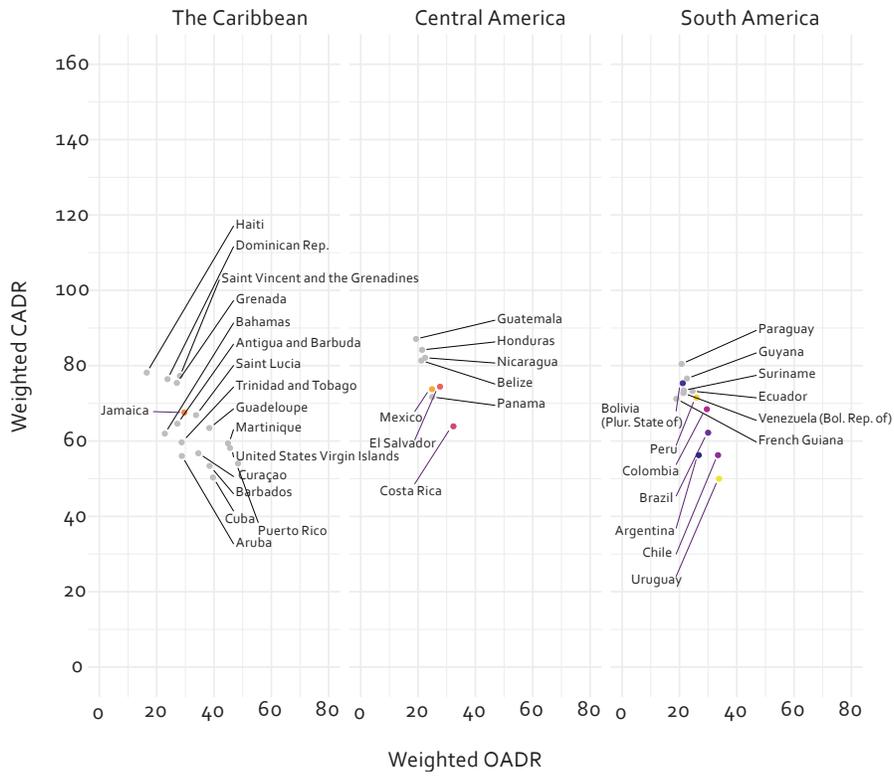
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.3
Weighted child-age and old-age dependency ratios (CADR and OADR) for National Transfer Account (NTA) countries in Latin America and the Caribbean, 1950–2100
 (Percentages)



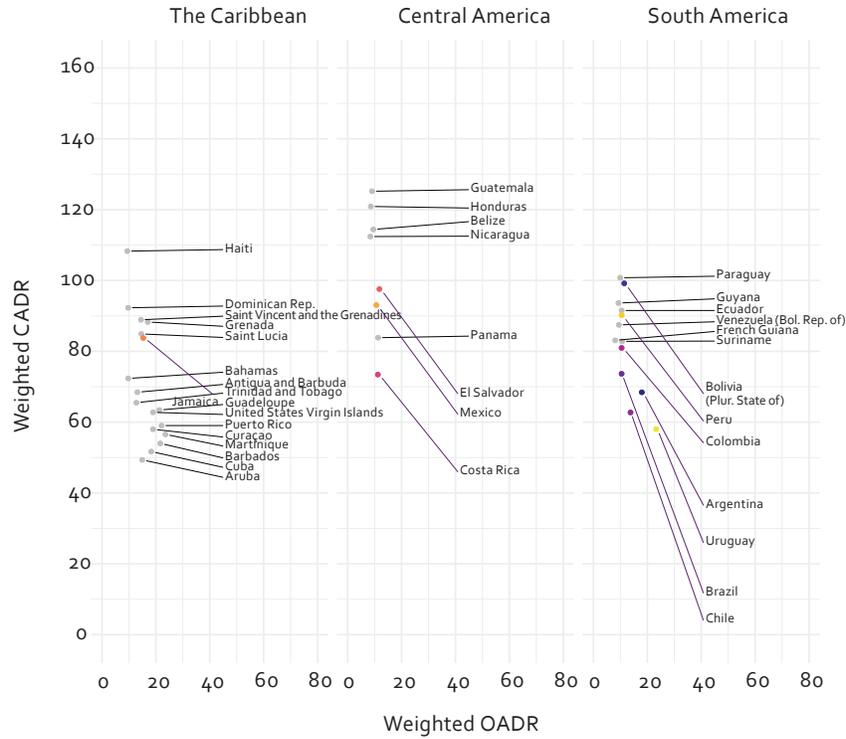
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.4
Weighted child-age and old-age dependency ratios (CADR and OADR) for subregions
in Latin America and the Caribbean, 1950–2100
(Percentages)



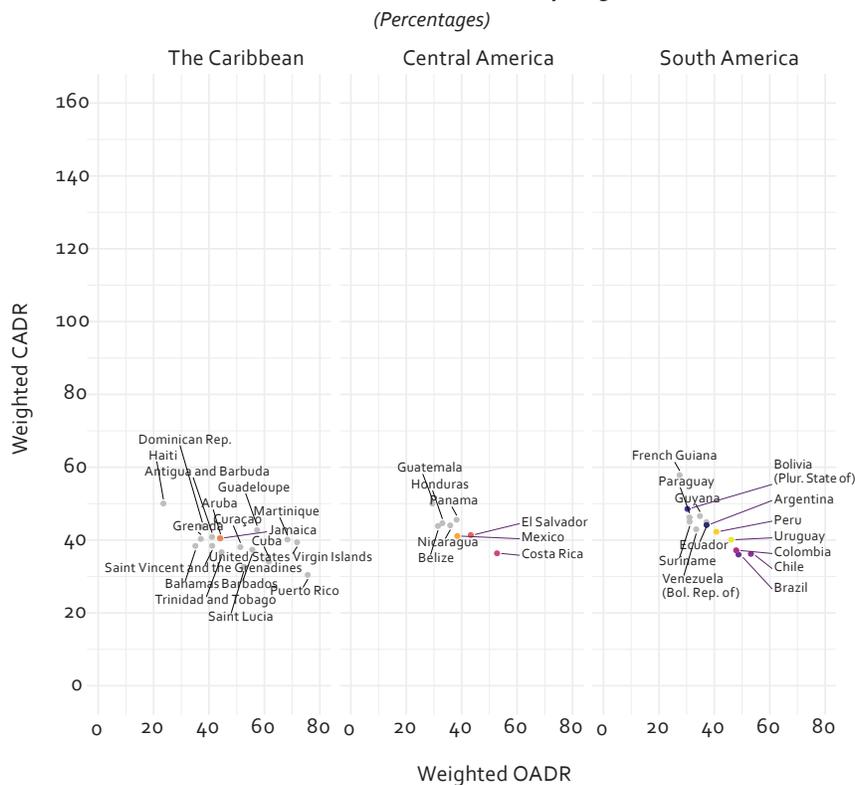
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.5
Weighted child-age and old-age dependency ratios (CADR and OADR) for subregions
in Latin America and the Caribbean, 1980–2020
(Percentages)



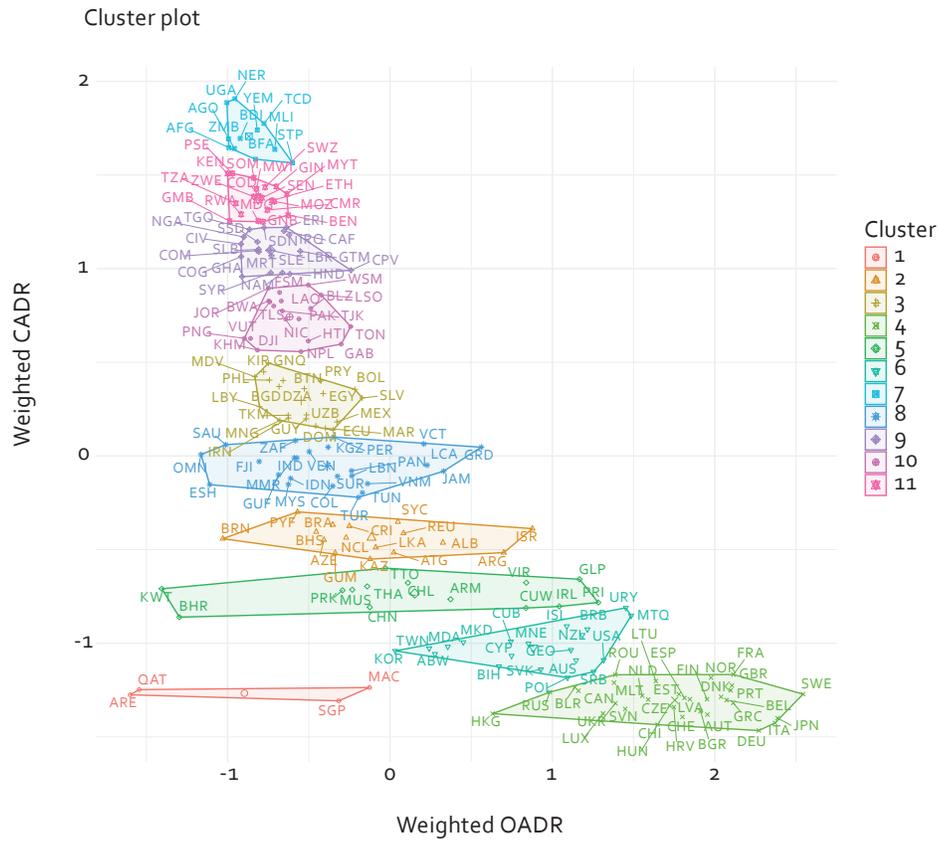
Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.6
Weighted child-age and old-age dependency ratios (CADR and OADR) for subregions
in Latin America and the Caribbean, 2025–2100



Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

Figure A1.7
Weighted child-age and old-age dependency ratios (CADR and OADR), k-means clusters, 1980–2020

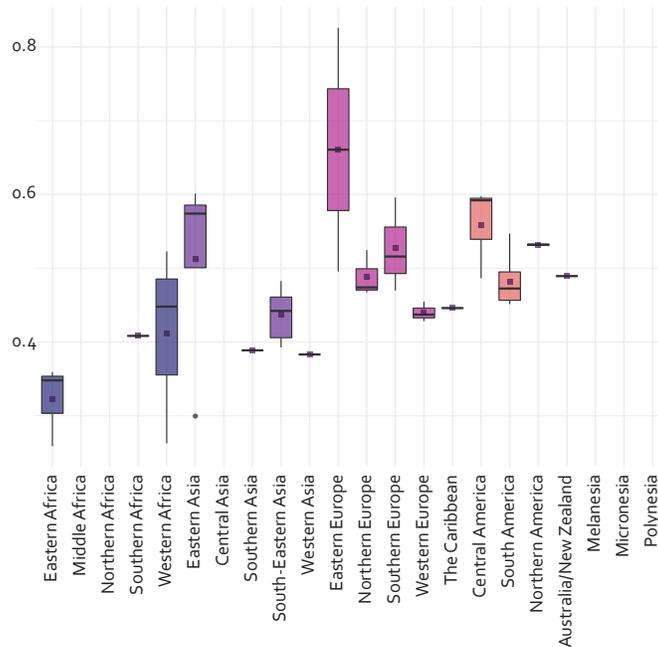


Source: Prepared by the authors, on the basis of United Nations, *World Population Prospects 2019: Online Edition*, New York, 2019 [online] <https://population.un.org/wpp/>.

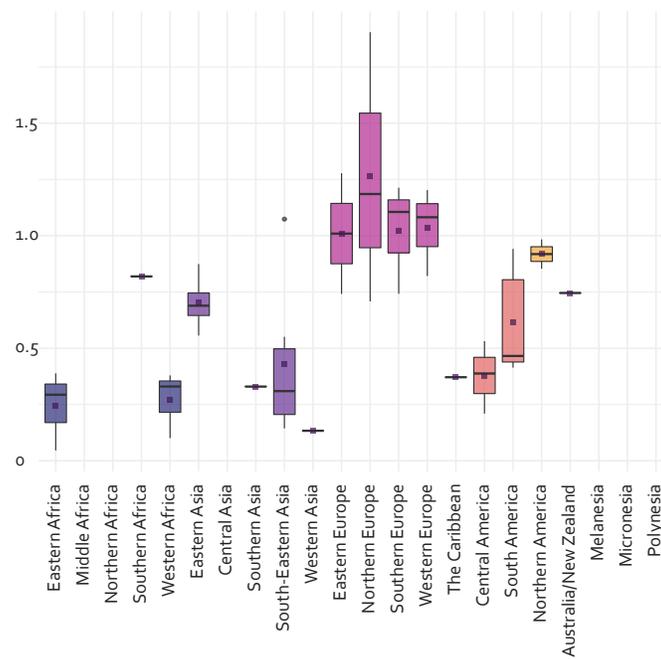
Annex 2

Figure A2.1
National Transfer Accounts (NTAs): magnitude and composition of consumption at younger ages

A. Magnitude: life cycle deficit (ages 0–19)/labour income (ages 30–49)



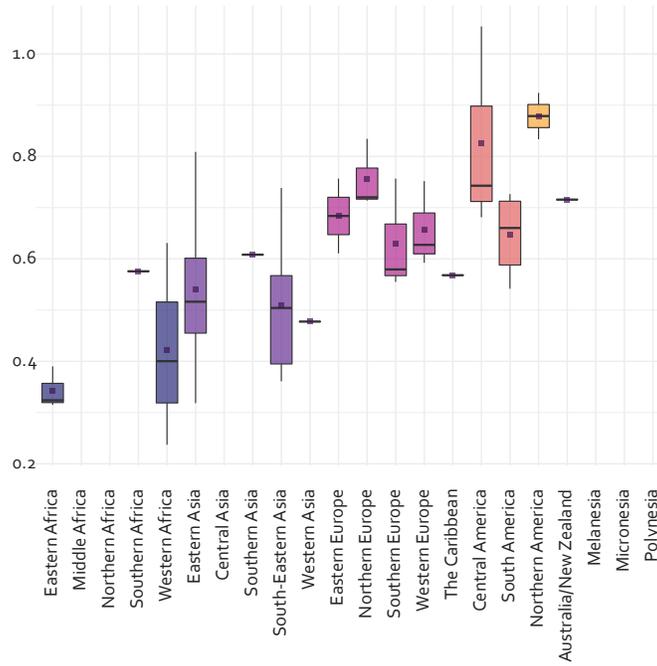
B. Composition: public consumption (ages 0–19)/private consumption (ages 0–19)



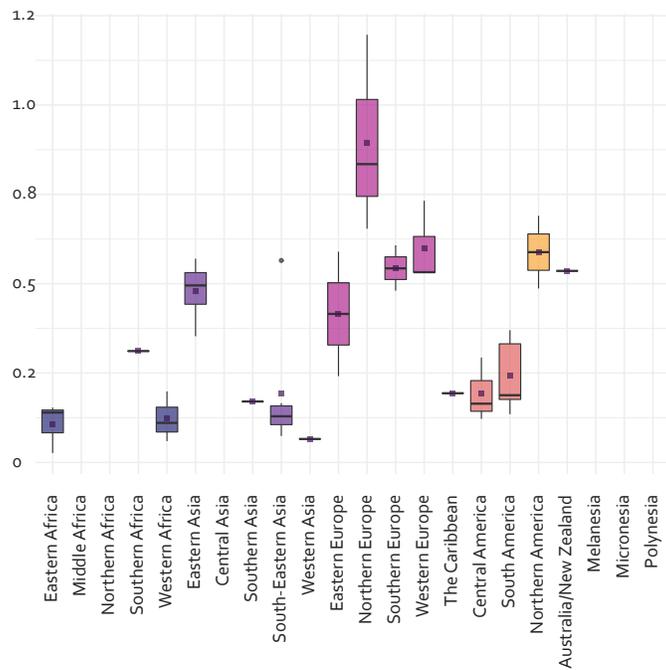
Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Figure A2.2
National Transfer Accounts (NTAs): magnitude and composition of consumption at older ages

A. Magnitude: life cycle deficit (ages 65+)/labour income (ages 30–49)

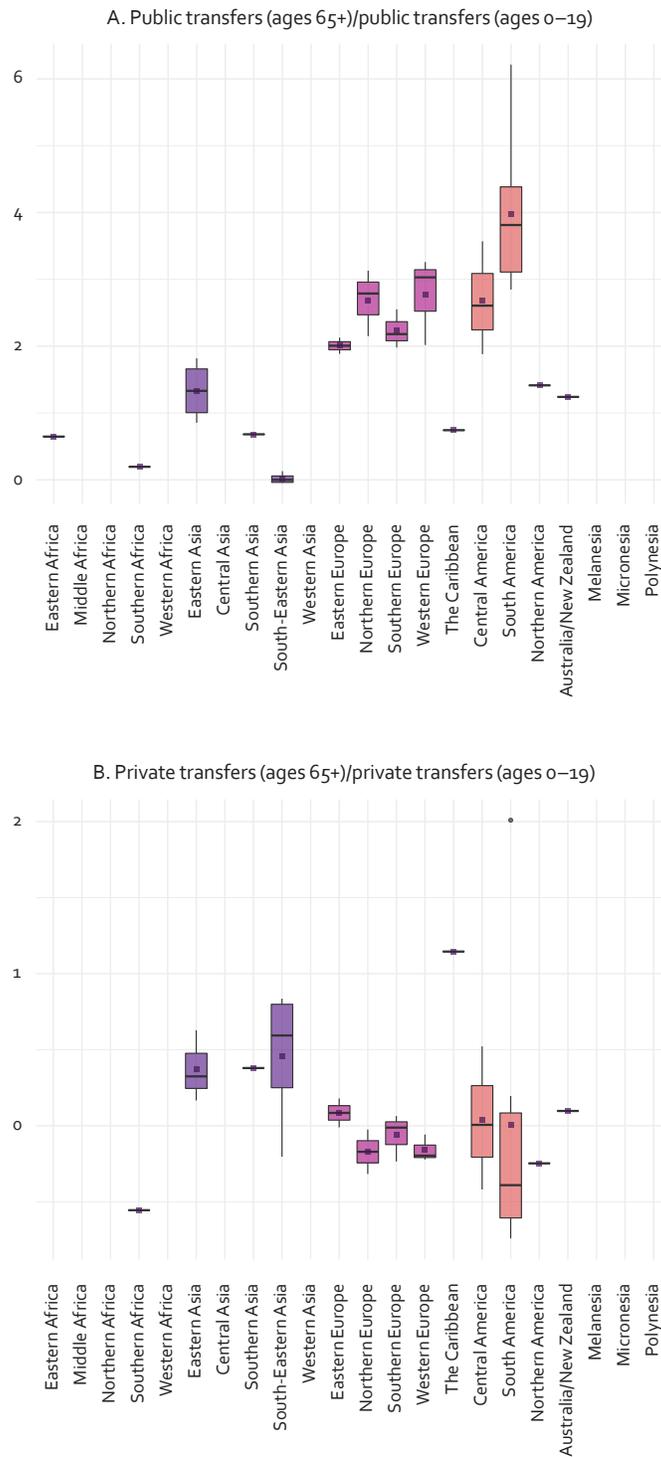


B. Composition: public consumption (ages 65+)/private consumption (ages 65+)



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

Figure A2.3
National Transfer Accounts (NTAs): intergenerational relations



Source: Prepared by the authors, on the basis of R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*, Cheltenham, Edward Elgar, 2011 [online] <https://ntaccounts.org>.

The region of Latin American and Caribbean has witnessed rapid demographic, social, economic and political transformations in the last 50 years. Despite the reduction in poverty, the progress made in the provision of essential services to the population and the improvements in education, health and gender equality, many problems remain. In particular, levels of both inter- and intragenerational inequality are high. Also, in most cases, the demographic transition has outpaced societies' ability to create conditions for sustainable development.

Well-being measures vary by age, gender and other demographic dimensions. Therefore, progress towards attainment of the Sustainable Development Goals (SDGs) is inextricably linked to population trends, hence societies should adopt policies that anticipate population dynamics if they want to make the most of the opportunities and respond to the new challenges presented by the demographic transition. Implementation of the 2030 Agenda for Sustainable Development is also susceptible to how families, governments and the market distribute resources within and between age groups. In the light of these far-reaching demographic changes, adjustments may need to be made to programmes to allocate resource over the life cycle, in order to ultimately address inequality levels and ensure the successful implementation of sustainable development.

This study was prepared within the framework of the development account project 1617 AO, entitled "Demographic transition: opportunities and challenges to achieve the SDGs in Latin America and the Caribbean", implemented by the Latin American and Caribbean Demographic Centre (CELADE)-Population Division of the Economic Commission for Latin America and the Caribbean (ECLAC), between January 2017 and December 2019. By incorporating National Transfer Accounts data into the analysis, this study seeks to enhance knowledge regarding sustainable development in ageing societies. It also presents policy recommendations for Latin American and Caribbean governments to attain the SDGs in the context of rapid demographic transition, taking into account different demographic, political and socioeconomic backgrounds.