

The challenges of the ageing for the old age social protection. Reflecting from Latin America

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Abstract

Adequate and rigorous methodological tools to describe, quantify and understand ageing population is essential for knowing its challenges and being able to recommend relevant policies. That is why we propose to evaluate the rigor and robustness of the evidence with which we analyse the material impact of the age structure transformation, critically reviewing the indicator of demographic dependence (counterpart of the support ratio) and, especially, the economic dependence ratio. Next, we try to contribute to the design of suitable instruments to empirically address the problem of study. The work of analysis is based on the case of six countries, which are the six Latin American countries already present in the base of National Transfer Account (NTA): Argentina, Uruguay, Chile, Brazil, Mexico and Costa Rica.

Key words: Ageing, sustainability, social security, support ratio.

Resumen

Retos del envejecimiento para la protección social de la vejez. Reflexiones desde Latinoamérica

Conocer los retos propios del envejecimiento de las poblaciones y ser capaces de recomendar políticas pertinentes, requiere contar con herramientas metodológicas adecuadas y rigurosas para describir, cuantificar y comprender el problema. Con este documento nos proponemos evaluar la rigurosidad y solidez de la evidencia con la que analizamos el impacto material de la transformación de la estructura de edades, revisando críticamente el indicador de dependencia demográfica y, especialmente, la relación de dependencia económica. A continuación, intentamos contribuir con el diseño de instrumentos idóneos para abordar empíricamente el problema de estudio. El trabajo de análisis se basa en el caso de seis países, que son los seis países latinoamericanos que se encuentran en la base de (Cuenta de Transferencia Nacional) NTA: Argentina, Uruguay, Chile, Brasil, México y Costa Rica.

Palabras clave: Envejecimiento, sostenibilidad, seguridad social, relación de dependencia.

INTRODUCTION

One of the consequences of the phenomenon described as "demographic transition" is the transformation of the age structure of the population. This produces the so-called "population ageing" process, which initially occurred in the developed countries, but is already under way, in an accelerated manner, in the countries of the Latin American region (Chackiel, 2004). Faced with this phenomenon, numerous alarms have sounded, particularly concerning its impact on the equilibrium of social security systems and on the evolution of expenditure in the health care systems. The changes in the age structure seem to imply that the set of transfers to the elderly will become an increasingly difficult burden to meet, with consequences for the sustainability of the old age protection systems, particularly of pensions, but also for the levels of welfare of the rest of the population (by affecting the levels of consumption per capita) and, perhaps, for the production systems (by affecting the levels of savings and the availability of people of working age).

To design strategies and policies that will enable us to confront these challenges requires that, in the first place, we are able to adequately quantify the material implications of ageing. It is also important that we understand the variables and significant analytical dimensions for this (whether productive, labour, demographic or distributive). That is, that we are able to distinguish those that are specific consequences of the change in the age structure from those that depend, at least partially, on the productive and distributive contexts in which this occurs. And that we are also able to differentiate new challenges from those which, as regards the social protection systems of old age, are prior to (and/or independent of) demographic ageing. In this context, the way we study, understand and measure the challenges of population ageing acquires a key relevance.

The main methodological tools for assessing the economic impact of ageing, both the demographic "dependency ratio" and the "economic support ratio", do so by ignoring the transformations that occur in production and labour contexts. However, both the National Transfer Account (NTA) project (United Nations, 2013) and the Reproductive Revolution theory (MacInnes and Pérez Díaz, 2008) provide conceptual tools for understanding that it is not possible to attribute a relationship between age and production in a transhistoric and linear form. The changes occurring in that relationship are thus crucial to establish the material significance attributed

to a particular age structure. These changes, moreover, are not alien to our object of study if we understand demographic phenomena as longitudinal processes, which interact throughout history with other transformations in social, cultural and economic institutions (Pérez Díaz, 2005). This is why it is distorting to evaluate the material consequences of demographic processes in abstraction from their productive and labour contexts. Our working hypothesis is, then, that neither the "demographic dependency ratio" nor the "economic support ratio" permit adequate quantification of the material challenge that ageing implies in each society, in function of its own production characteristics. This implies that their use carries the risk of estimating present and future material solvency problems that do not necessarily correspond with reality, and of confusing those that are consequences of the change in the age structure with those which may be related to other dimensions of analysis.

We are concerned about the rigorousness and solidity of the evidence with which we analyse the material impact of the transformation of age structures, and we therefore aim to contribute to the search for tools to make accurate diagnoses and to quantify the challenges facing societies in the process of ageing. Specifically, these would be tools that make it possible: (a) to recognize the relevance that the diversity of material realities, which are the context of the change in age structures in each country, have for the material impact of ageing; (b) to use a suitable measurement to separate the challenges inherent in the new circumstances from those that have to do with an old debt of the expansion of rights; and (c) to distinguish the material impact that is not related to demographic variables but to economic, distributive, social and cultural variables.

With this aim, we will critically review the indicator of demographic dependency and, especially, the economic dependency ratio, tools whose results are the main evidence used by studies about the material impact of ageing. We will break down the relationship between age structure and the two variables that make up the indicator: consumption and income. We will then reformulate the indicator by correcting the number of workers, weighted in terms of the changes occurring over the period in their income-generating capacity. Finally, we will explore the possibilities of enriching the approach using new methodologies, aimed at considering the total material production of populations and not just the wage income.

The analysis and reformulation will be based on the case of 6 countries, which are the six Latin American countries in the NTA database and for which, therefore, we have profiles of consumption and income. Argentina,

Uruguay, Chile, Brazil, Mexico and Costa Rica will allow us to understand the situation of countries with different ageing processes and productive development, and will provide a first approximation to the Latin American situation, still characterized by younger populations and by economic contexts and protection systems that are very different from those of the first world's ageing countries. Nevertheless, it is intended that the external validity of the results should touch the approach and methodology problems in the study of ageing in any population.

We start with a review of the main concerns and alarms about ageing and its material consequences. Then, we present the methodologies that underlie them, questioning them from the contributions of two conceptual frameworks fundamental to tackling the problem: on the one hand, Reproductive Revolution theory and, on the other, the contributions of the NTA project. Next, we empirically address the challenges of ageing, focusing on the Latin American case: first, from traditional measurements; then, reviewing the components of the economic dependency ratio; and finally, calculating the indicator in a reformulated version and quantifying the performance of each country on three indicators of sustainability, estimating their future challenges in production terms. Finally, in the conclusions, we will discuss the main implications of the new approach for understanding the challenges that ageing entails in societies with different labour and production contexts, as well as to guide the recommendations and the design of policies in the face of difficulties of the sustainability and quality of social protection of old age.

DISCUSSION

Ageing: Concerns and alarms

Ageing raises concerns and questions regarding its material consequences, its economic consequences, and the challenges these would entail for the financing of social security. On the one hand, some authors fear that it impacts negatively on the levels of material welfare of the population, affected by the increase of the burden of consumption of the group of elderly people (Jaspers-Faijfer, 2008; Lee et al., 2010). Others add that their consequences could even jeopardize the productive capacity of our societies, hogging for the consumption of the elderly resources that are fundamental for the operation or growth of the economy (Esping-Andersen, 2008; Bloom et al., 2011). Some also point out that consumption burdens of the elderly could, in fact, be unsustainable, threatening the future sustainability of the social

security systems (European Commission, 2010; Kotlikof and Burns, 2004, in Scherbov et al., 2014).

Bearing in mind that the main concerns and alarms about ageing are related to their presumed economic consequences, the weighting of these is a key issue in the conceptualization of the problem.

How do we calculate the impact of ageing today?

For many years, the problem of the material impact of ageing was tackled as a mainly demographic phenomenon, whose potential material consequences were weighted by indicators of support/dependency, and of old age support/dependency. The traditional indicator of demographic dependency relates the number of individuals at "inactive" or "dependent" ages (who would not generate economic income) with that of individuals at ages established as "active" (members of the workforce), as a way of measuring the effort that the potentially active population must make to meet the needs of the inactive population (Uthoff et al., 2006). The old age dependency index, in turn, counts only elderly dependents (Andrews, 2000). In this indicator, the ages considered as active (and therefore productive) and inactive (which correspond to dependent persons) are established in a fixed manner over time and between different countries. In turn, the people considered dependent all have an equivalent weight, regardless of their age.

Some authors have questioned the use of the demographic indicator because of the explanatory limitation implied by considering people as active or dependent based only on their age, without taking into account their effective relationship with work. Chackiel (2004) points out that, if people of productive age are unemployed, they will really be dependent people. Likewise, Uthof et al. (2006) point out that, assuming that every active-age person contributes in an equivalent way to the family budget ignores a variety of situations, as active-age persons may be inactive, unemployed or working, and the latter may, in turn, be formal or informal. To properly consider the real situation, Uthof et al. (2006) propose an indicator of formal dependency, "which seeks to capture, in addition to the traditional demographic dimension of dependency, this other facet that concerns the structural or cyclical problems of labour markets" (10). In this, people are dependent or active, not depending only on their age, but according to their effective working condition. Inactive or unemployed persons of working age, and even informal workers, will be considered dependent, while only formal workers will be included in the denominator of the indicator. But,

although now the "active persons" are not defined solely by their age but by their working condition, once defined as such, they are treated as if they all had an equivalent weight, without distinguishing between their different income levels or their different contributions to financing the State and in particular the various social protection systems (not to mention the omission of any estimate of the contribution that the productivity of each worker has to increasing the national product.) Just as in the traditional demographic dependency indicator, dependents are all counted with the same weight, without considering the possible differential burdens of consumption that each age group represents.

From the perspective of generational economy, a group of authors linked to the NTA project (United Nations, 2013) indicates that it is a limitation to arbitrarily define a range of ages as the "productive" or "dependent" age, as the dependency ratio does. They emphasize that the consumption and income patterns of different ages vary from one society to another and over time (United Nations, 2013), so that the material significance of ages is not "natural" but contingent, and socio-historically conditioned. Pérez Díaz (2005), one of the main referents of the Reproductive Revolution theory, argues similarly, emphasising that the significance of ages is not fixed in time. From that perspective, he questions the main studies on the impact of ageing, that are generally alarmist, built on the *priori* premise that "the characteristics and behaviours of each age are invariant and already known" (18), as reflected in the traditional indicator of dependency defining active and dependent ages in a fixed way. However, Pérez Díaz (2005) points out that, in "the real world ... a very substantial modification of the meaning and characteristics of each age" has occurred "as the population pyramid has changed its shape" (18) and that, in fact, "a good part of the former is due to the latter" (18). Therefore, when "one starts from the "operating" premise that everything stays the same in our forecasts except the respective weights of the ages" (25), a contradiction occurs from the methodological point of view: "We face the paradox that the consequences of a change in the age structures are analysed as if that change were not in itself a reason for change in the social significance of the ages"(25). For the author, the real consequences of demographic ageing can be analysed only by empirical study, not *a priori*, of the different ages as they are embodied by successive generations (Pérez Díaz, 2005).

Consistent with the recognised contingent character of the relation of ages with production and consumption, the NTA (2017) provides a database with the age patterns of consumption and labour income of different

countries, established from empirical information from national surveys. Thus, while the age patterns of consumption account for the variations in consumption levels by ages in each society (United Nations, 2013), the income patterns allow the material significance of each age group as a generator of labour income to be weighted, insofar as the average income per age reflects the activity rates, employment rates, hours worked, and productivity levels of the different age groups (United Nations, 2013).

Although age profiles are cross-sectional type data, being based on single-year surveys (Lee and Mason, 2011), the NTA (United Nations, 2013) proposes using them also in longitudinal series, to interpret how the change in the age structure of each society impacts over time. To this end, they suggest that, without losing sight of the fact that they are transversal data at the time of interpreting them, "repeated estimates of the NTA can be used to build pseudo-panel data and to analyse cohorts" (United Nations, 2013:8). Through a new indicator, called the economic support ratio, the NTA (2017) reformulates the demographic support ratio. This ratio recognises that all people, regardless of their role as resource-generators, are consumers to different extents, according to the age patterns of consumption, while labour income can be found in different age ranges with different weights according to the income patterns of each age. The economic support ratio then relates the number of workers and of consumers so that their different levels of income and consumption are considered according to an equivalent unit of measure in monetary terms. For that, the population of each age is weighted by its age pattern, which is the extent to which its consumption or income is equivalent to the monetary value of the income of one "effective" worker (calculated as the average labour income of workers from age 30 to 49). The economic dependency ratio thus corresponds to the number of effective consumers per 100 effective workers in a population, assuming as constant the age profiles of consumption and labour income (NTA, 2017).

The NTA methodology implies an analytical jump with respect to the traditional demographic approaches, by making it clear that the economic significance of an age structure depends, in fact, on changing age profiles according to the region and the historical time, in agreement with the explanations of Reproductive Revolution theory. However, by assessing the economic impact of age-structure change assuming the stability of age profiles throughout the time period observed, the indicators are insensitive to the actual transformations occurring in these profiles. These transformations are not only key to establishing the material significance of the

age structure throughout the series, but may also be interrelated with the demographic phenomena whose impact is to be analysed.

Obviously, it would be wrong to argue that demographic phenomena will have a negative effect on labour income levels if they also produce effects that counteract this. Thus, for example, if a decrease in fertility levels can be related with an increase in female activity rates (Lee, 2014; Bloom et al., 2011), the implications of this decrease could be misinterpreted when the change in number of potential income producers is observed in terms of static age patterns over time, insensitive to this increase in the activity rates. In the same way, it will be distorting to ignore the evolution of productivity when relationships have been found between the reduction of fertility rates and greater investment in human capital that can generate increases in economic productivity (Mason and Lee, 2011).

To assume as constant the relationship between the population at certain ages and the production of wealth implies taking on the Malthusian premise that there are rigid limits in the capacity of populations to maximize the production of resources. If history, since the first industrial revolution, has shown that the consequences of vegetative growth could not be known beforehand, but must be established in relation to the behaviour of the "production" variable, it is equally inadequate to assume, in long-term analysis, a production of growth linearly linked to the population and its age structure. And to the extent that we use as a base a production estimate that is disconnected from empirical reality, we will fail to establish the capacity or difficulties of the population to face the consumption expenditures of their populations as their age structures change.

Next, we will try to establish how and to what extent the results of this indicator can be distorting for establishing the material impact of ageing and the challenges that it implies in each population, as well as how we can improve our methodological tools to study long term periods for which data sources are often limited.

A LOOK AT LATIN AMERICA

Latin America from traditional measurements

To take into account the contexts and economic transformations that frame the transformation of the age structure, we must pay attention to the specificity of ageing in the Latin American region. Its demographic transition occurs under different conditions from those of populations such as the European or of other developed countries, only because ageing occurs (or

is anticipated) more rapidly (Chackiel, 2004), but because it also does so in material conditions very different from those of the First World (Peláez, 2004). Likewise, these differences in levels of wealth are framed in different distributive configurations, with regard to the distribution between capital and labour, between workers (between formal workers, between formal and informal, and between mercantile and non-mercantile), and in the characteristics of labour markets themselves (which can have very different levels of informality and unemployment, among other differences). These peculiarities of the region are no minor issue when it comes to elucidating the challenges of sustainability of social security in the framework of ageing since, as we will try to establish, the distributive dimension could play a more central role than is usually attributed to it in studies on the material consequences of ageing.

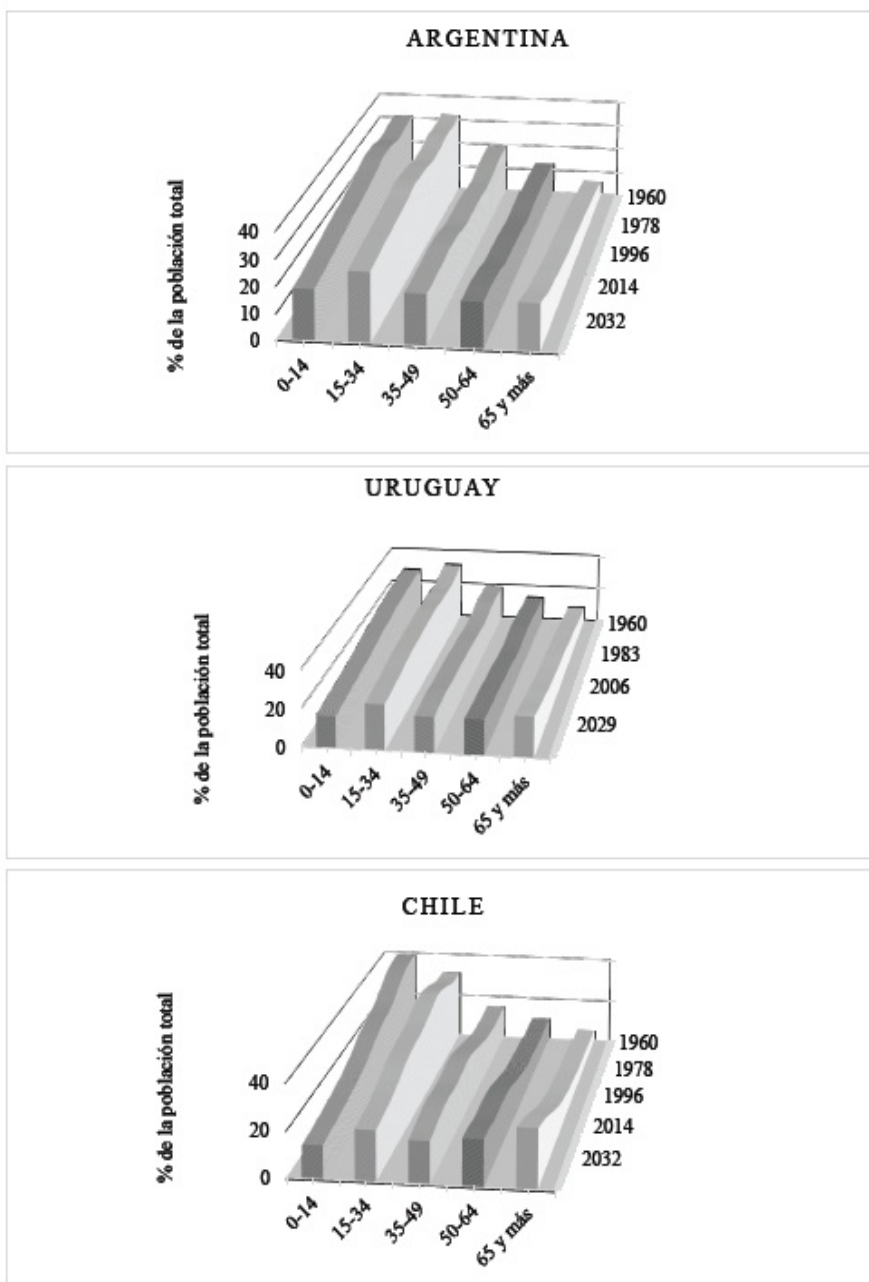
We propose to initiate a new approach to the analysis of the challenges of population ageing in the region, although we will have to limit ourselves for now to the observation of the 6 countries that are part of the NTA database, Argentina, Uruguay, Chile, Mexico, Brazil and Costa Rica, and in which it is thus possible to calculate the economic dependency ratio from their income and consumption patterns. It is, in any case, a broad selection that reflects very disparate performances in the decades analysed in terms of economic development and ageing processes.

Starting with population estimates and projections, we will begin by describing the transformation of the age structure that has occurred over the last few decades and that is projected to occur in the next few decades.

In Figure 1a and Figure 1b, in all the countries, we see a transformation of the age structure that runs from the typical pyramid form (with its base in the ages 0-14 and a gradual reduction of age groups in the population) towards a more even distribution between the age groups, but which in no case becomes a complete inversion of the pyramid. So we could say that, although populations age in relation to their structure in the past, up to 2050 no completely aged age structures are expected, in the sense that older age groups predominate.

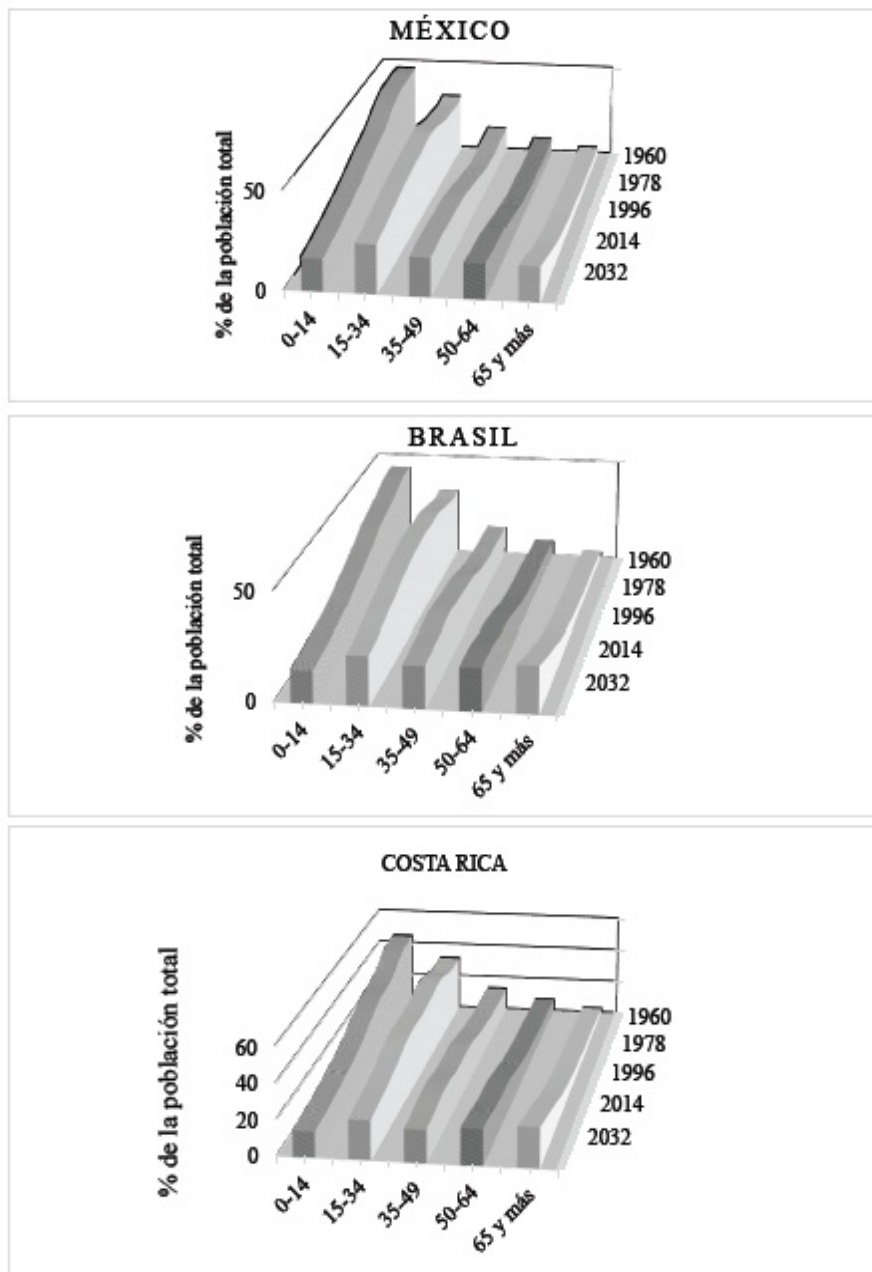
Next, we present the evolution of the index of ageing in each country, which establishes the number of older adults per 100 minors under 15 years.

Figure 1a: Age structure of the population (AGE GROUPS). 1960-2050



Source: Own work, based on data from United Nations (2017)

Figure 1b: Age structure of the population (AGE GROUPS). 1960-2050



Source: Own work, based on data from United Nations (2017)

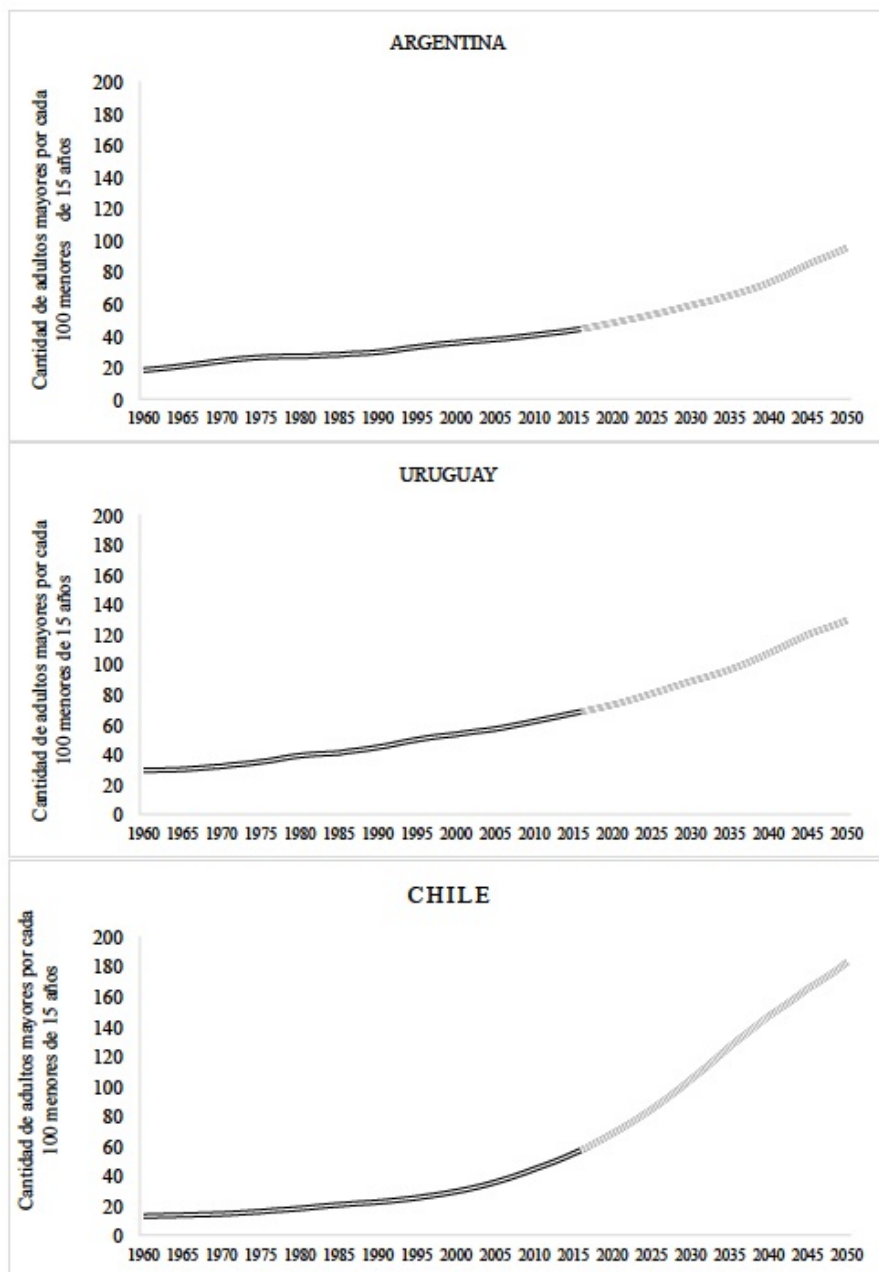
In Figure 2a and Figure 2b, we see that both Argentina and Uruguay currently have a high index of ageing, resulting from a process sustained over time and less accelerated than in other countries, in which its evolution (mainly projected) acquires an exponential form. Thus, if we assume the core scenarios of official projections, we can expect a change in the Latin American ageing map in the coming years, so that the more aged populations in the region will be reached or overtaken by populations that will be ageing in an accelerated manner. Thus, Chile, Brazil, and Costa Rica are expected to reach higher levels of ageing than Uruguay by 2050.

As we have explained, to assess the material impact that the change in age structure implies for populations, the (demographic) dependency ratio is frequently employed. However, due to the limitations mentioned, we will focus on the economic dependency ratio, considered as a better formulation for tackling the relationship between consumption and income in populations with different age structures. This is how the economic dependency ratio evolves in these countries.

In Figure 3a and Figure 3b, we can observe, with different intensity and year of onset, an evolution that tends initially to increase economic dependency, followed by a downward process that finally reverts again. The downward part of the curve, from the highest value of dependency to the lowest (Jaspers-Faijer, 2008), is the period that is generally interpreted as "demographic bonus" (or demographic dividend), representing the period of the demographic transition during which the relative size of the child and adolescent population drops faster than that of older people, causing a decrease in the overall dependency ratio.

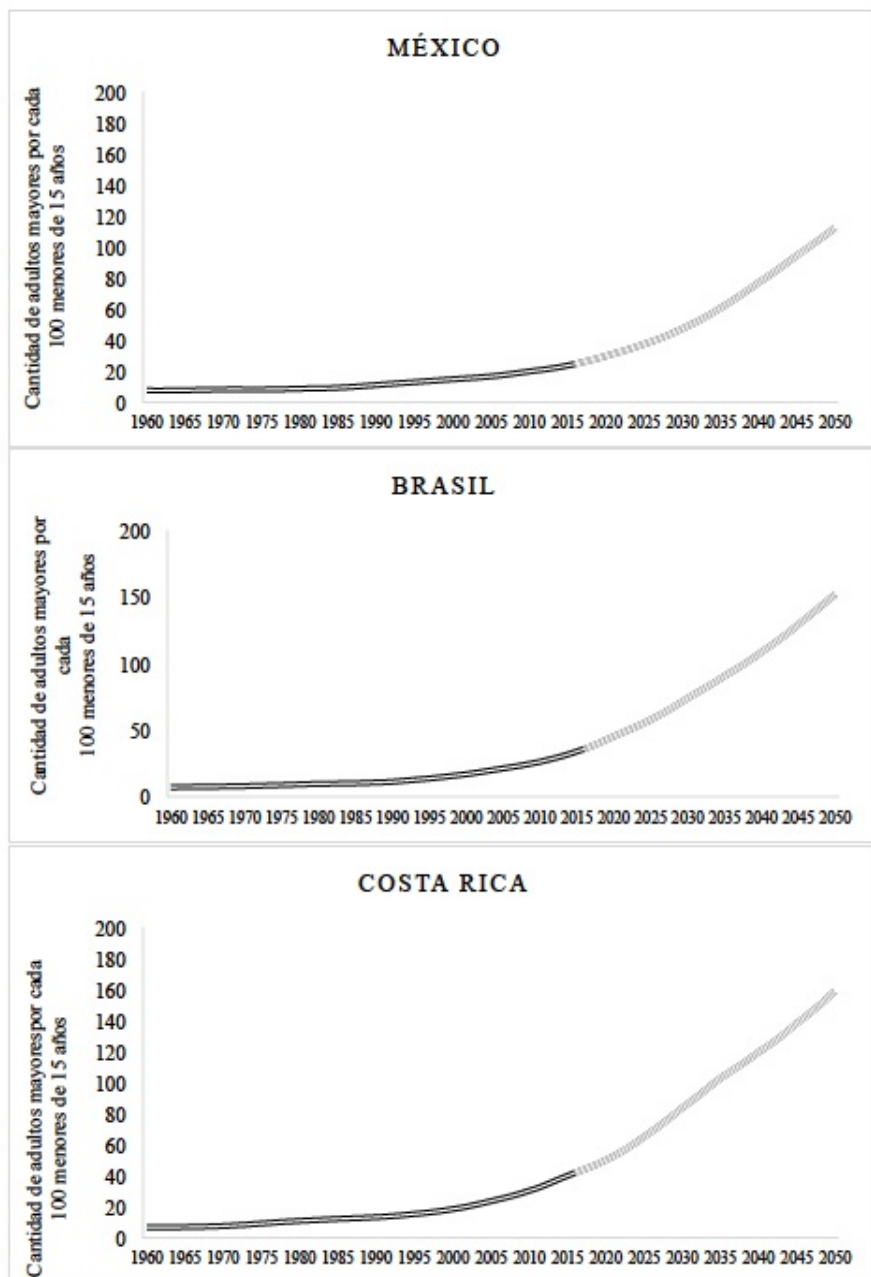
In Argentina and Uruguay, we see a bonus of very mild intensity, while in the other countries the bonus is much more pronounced. In Mexico, the projections are not enough to show the increase of dependency expected after the bonus. In the other countries, the process that seems to be starting today and up to 2050, if the core scenarios of the official projections are met, supposes a sustained increase in economic dependency from 2020 or 2035, according to the country (although after a significant reduction). Economic dependency is then expected in 2050 to return to levels similar to those of the mid-90s in Brazil and Costa Rica, those of 2010 in Argentina and Uruguay, and the levels of the 80s in the case of Chile.

Figure 2a: Index of ageing. 1960-2050



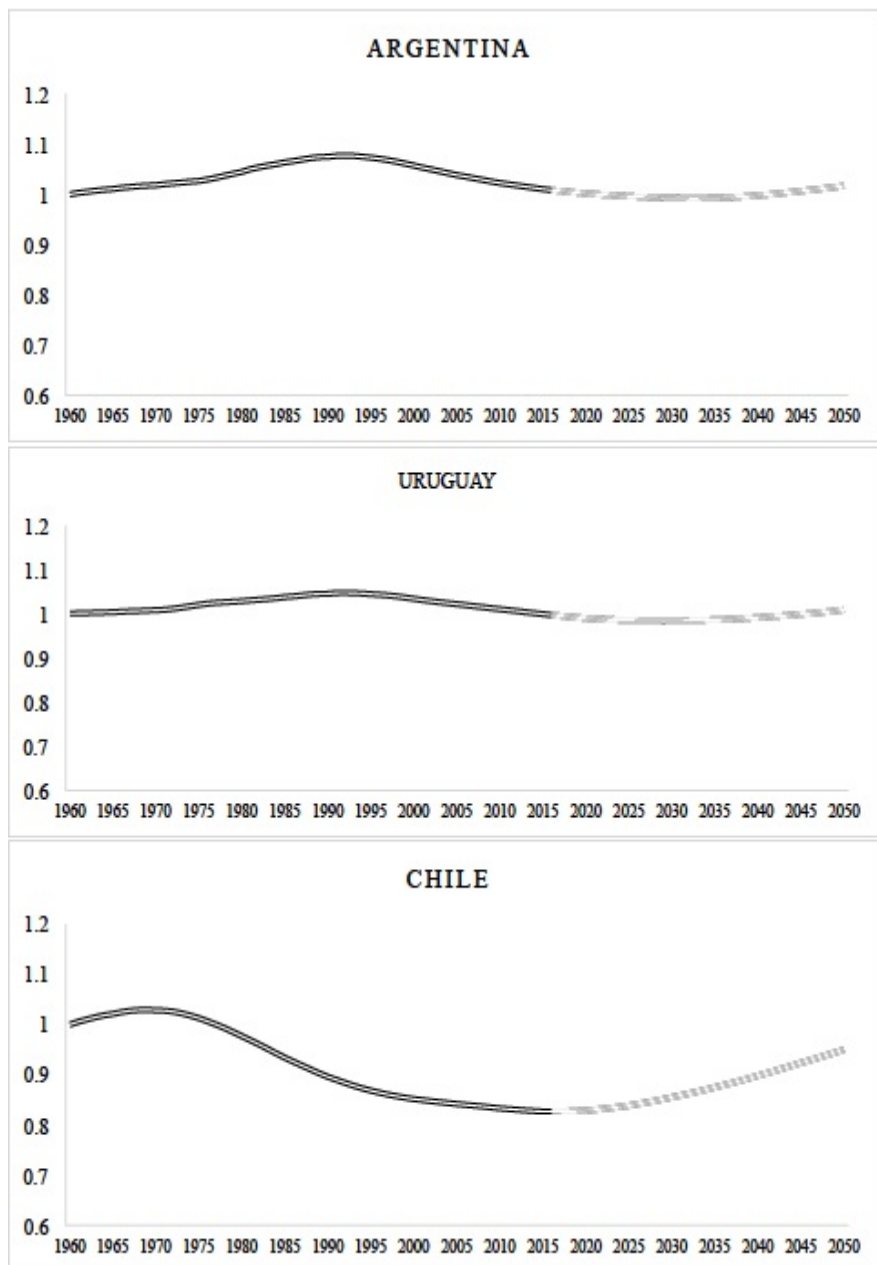
Source: Own work, based on data from United Nations (2017).

Figure 2b: Index of ageing. 1960-2050



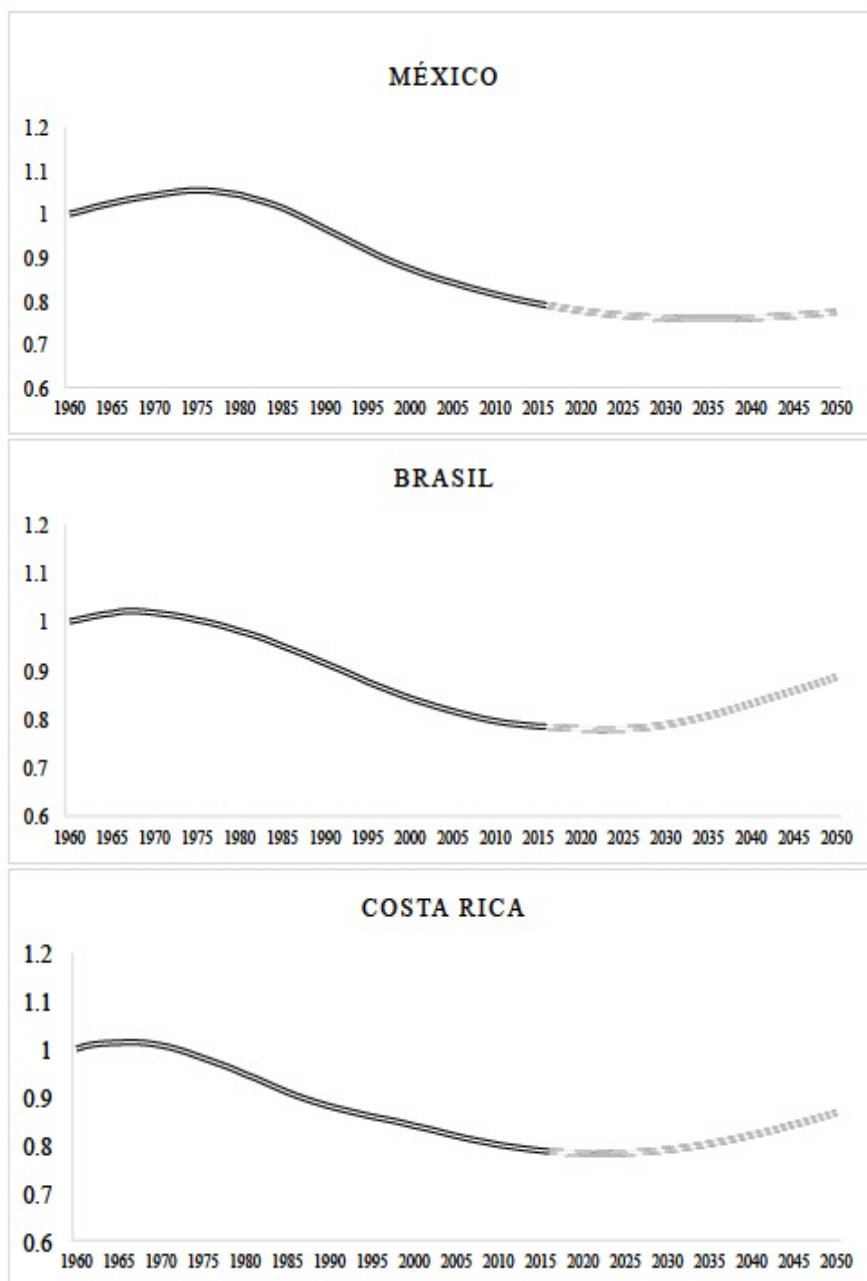
Source: Own work, based on data from United Nations (2017).

Figure 3a: Economic dependency ratio. 1960-2050. Normalised values (1= Economic dependency in 1960)



Source: Own work, based on data from United Nations (2017) and NTA (2017).

Figure 3b: Economic dependency ratio. 1960-2050. Normalised values (1= Economic dependency in 1960)



Source: Own work, based on data from United Nations (2017) and NTA (2017).

However, when it comes to analysing the consequences of ageing, the main reference for determining its challenges and material implications is usually the dependency ratio of "old age". Since we do not find in the bibliography a ratio of support or economic dependency "of old age", we designed one, replacing the total of effective consumers of the overall ratio with those of 65 years or over.

In Figure 4a and Figure 4b, we can see that, while in Uruguay and Argentina there is a steadily rising trend in the economic dependency of old age, in the other countries there is exponential growth. Mexico seems to be about to begin the process of increase. Meanwhile, in Chile, Brazil and Costa Rica, there is a first upward impulse that is now about to explode again. As a result, towards 2050, the economic dependency of old age is projected to increase the 1960 values between three- and five-fold in all countries, with the largest increases in Costa Rica and Brazil. These results fuel concern, especially in those countries where a more accelerated process is expected, with the difficulties involved in dealing with more sudden changes.

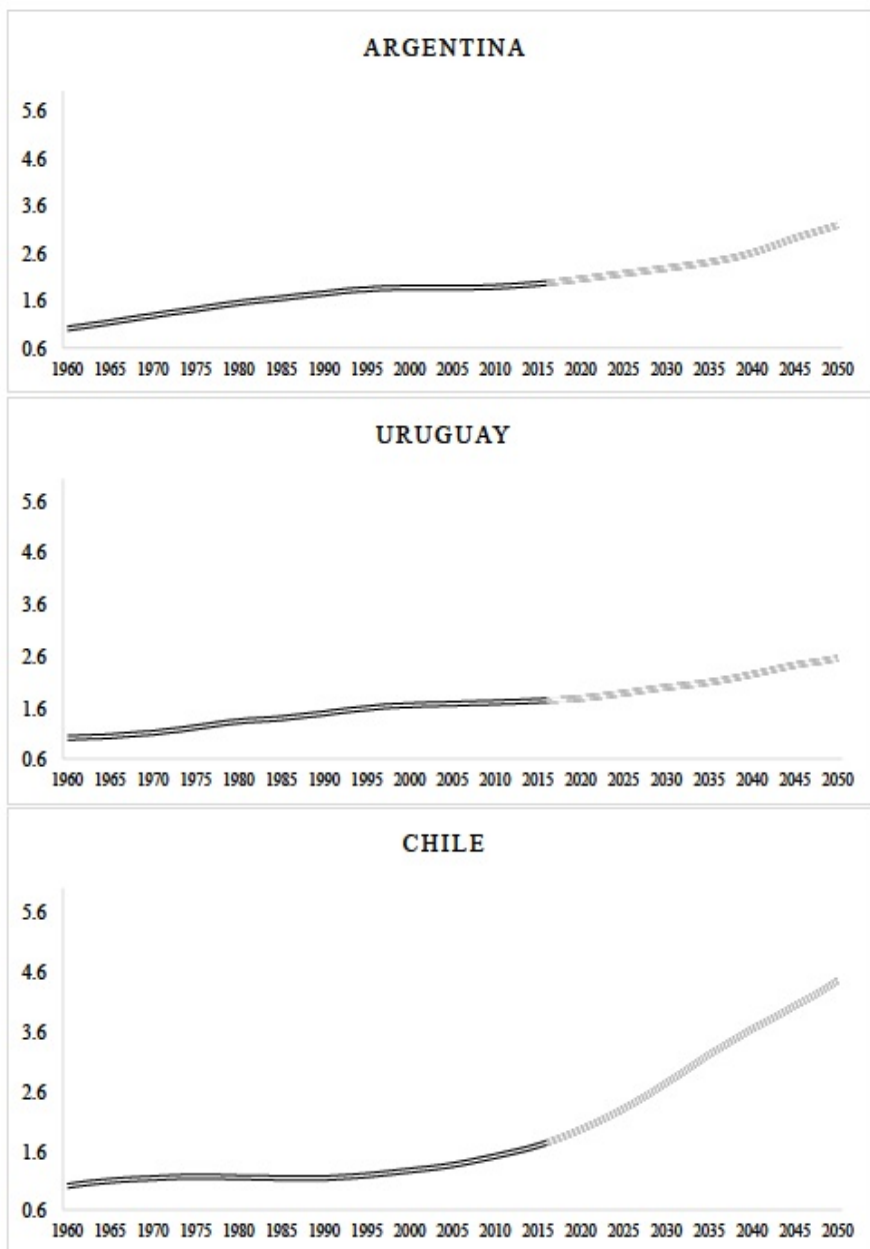
But can we, in fact, be sure that these will be the fluctuations in the relationship between consumption and production demands in these countries? Are the population projections and age profiles of a specific year sufficient to characterise the real situation in each of these countries? If two countries show similar developments in the evolution of economic dependency, as we see in Brazil and Costa Rica, can we be sure that what happens in the period with the development of their production systems will be irrelevant to defining the challenges in each case? Also, to what extent can the fluctuations in the economic dependency ratio be attributed to ageing and the general change in the age structure? In particular, how does ageing impact the economic dependency ratio?

A breakdown of the economic dependency ratio

How does the change in age structure affect consumption?

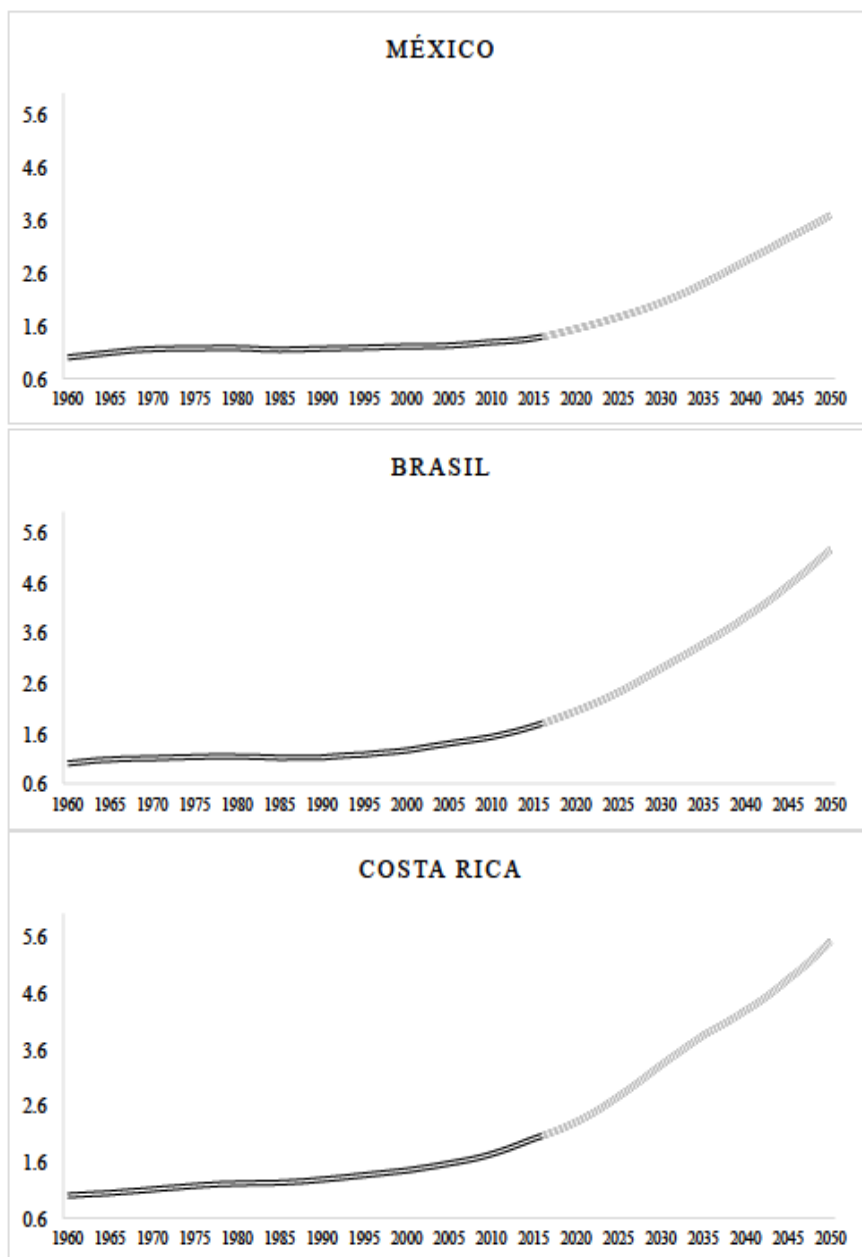
The evolution of the economic dependency ratio depends on two variables: on the one hand, the evolution of consumption expenditures (or effective consumers) of the population and, on the other, of the wage mass (or effective workers), established as the material reference baseline to cover this consumption. We will start by focussing on what happens to consumption as the age structure is transformed.

Figure 4a: Economic dependency ratio of the old age. 1960-2050. Normalised values (1= Economic dependency in 1960)



Source: Own work, based on data from United Nations (2017) and NTA (2017).

Figure 4b: Economic dependency ratio of the old age. 1960-2050. Normalised values (1= Economic dependency in 1960)



Source: Own work, based on data from United Nations (2017) and NTA (2017).

By counting consumers of all ages and not just of "dependent" ages, the economic dependency indicator makes it possible to recognise that what is truly relevant for determining the "burden" on labour income has to do with how much the population consumes globally. And to determine this, its age structure and how much each age group consumes is important. That consumers cover their expenses with their own labour income or with transfers from other age groups, and are therefore active/workers or dependent, does not affect the weight of an individual as a consumer (as long as we are interested in such consumption as a constant with respect to the age of the consumer). In other words, the way in which consumption is financed does not influence global consumption, but has to do with the other variable that makes up the economic dependency ratio, i.e., income. But how much of that global consumption is actually explained by the age structure? And how much of its evolution can be attributed to changes in that structure?

Clearly, the simple verification of a particular evolution of consumption (either increase or reduction) does not reflect the specific impact of the transformation of the age structure, since global consumption levels could be modified for other reasons. Thus, the reduction or the vegetative growth of a population will affect the overall consumption estimated by age patterns, given that it modifies the number of individuals consuming. But, in addition, real consumption can evolve in a different way from that estimated for a population with a certain age structure, due to changes in the levels of consumption per capita (either in a generalized way in the population or differentially in different age groups) related, in turn, with economic factors affecting material availability for consumption, distributive factors influencing access to consumption, changes in the cultural patterns of consumption/savings, public policies, etc.

To investigate the extent to which the transformations in the age structure have a significant impact on the evolution of consumption that may imply either its overall increase, tending to intensify economic dependency, or its reduction, favouring the supposed demographic bonus, i.e., in order to establish the specific impact of ageing on the evolution of consumption, we will break down consumption into three components:

- Firstly, the part explained by the vegetative evolution of the population (i.e., changes only in the absolute number of people), which we will call "vegetative consumption", and which is estimated by indiscriminately attributing to each individual a mean consumption corresponding to the reference year.

- Secondly, the part explained by the age structure, which we will call "age consumption", and which results from the differential between vegetative consumption and the consumption estimated by taking into account the patterns of consumption by age.
- Thirdly, the part that we will call "non-demographic consumption", explained by variables that alter the levels of consumption per capita, modifying levels of consumption in all or some age groups, due to mainly economic, distributive and cultural reasons. This part is estimated as the differential between "demographic consumption" (resulting from the sum of vegetative consumption and age consumption) and actual, i.e., really verified, consumption.

The following graph shows a breakdown of the evolution of total consumption in the 6 selected countries.

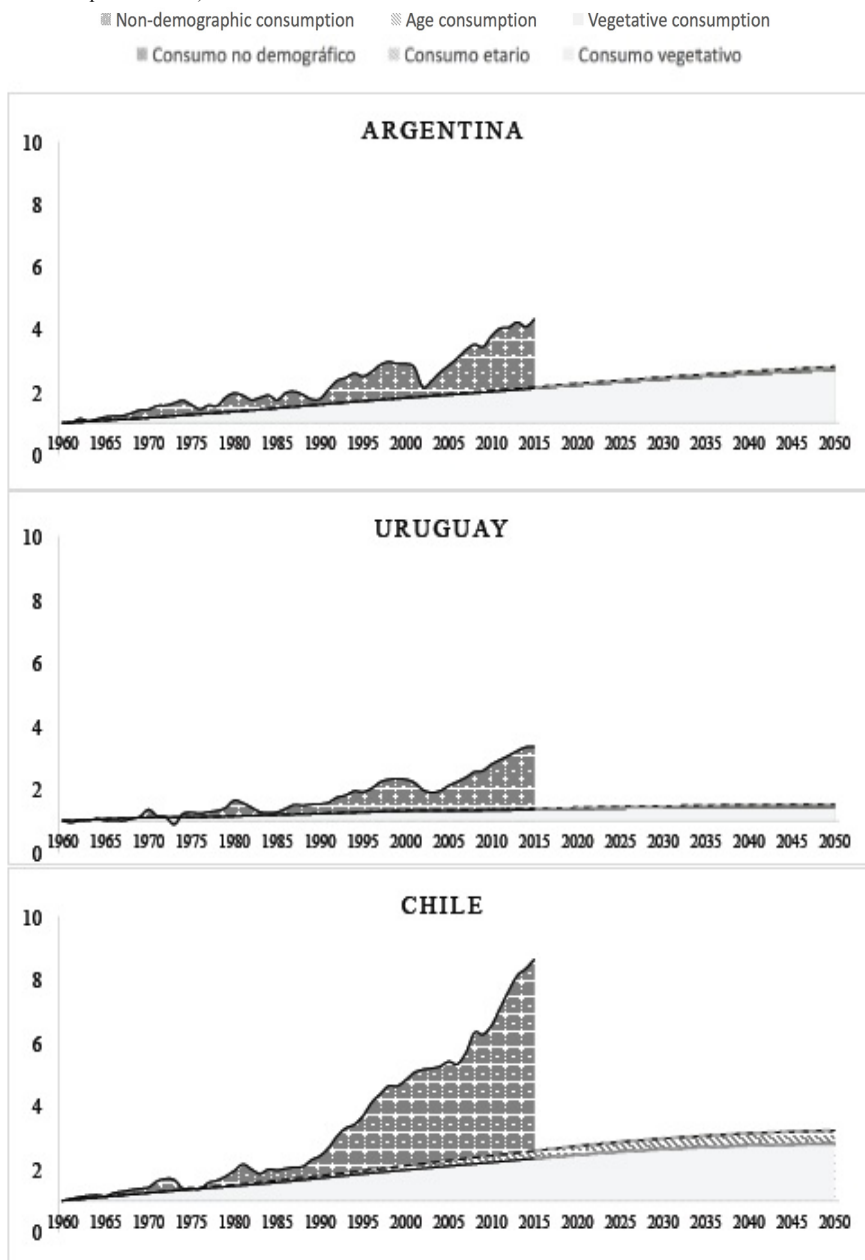
Breaking down consumption we observe, in Figure 5a and Figure 5b, that, in the case of Argentina or Uruguay, the change in the age structure impacts the variation of consumption marginally (with respect to the impact of the other components of consumption). In Chile, it barely raises it, and its role is more noticeable in the cases of Brazil, Mexico and Costa Rica. However, its impact is markedly less than that of the population's vegetative growth. In no case do we observe that age consumption introduces a reduction of aggregate consumption, as the idea of "bonus" suggests, not even by neutralising the variable of vegetative growth in terms of variation per capita.

For its part, the evolution of consumption for non-demographic reasons had, in all cases, key importance in the evolution of real consumption. While real consumption is not accounted for in the economic dependency indicators (based on estimates), its measurement allows the significance of the variation in consumption introduced by the transformation of the age structures to be put into perspective, measuring the significance of its relative weight in populations whose consumption is transformed also for non-demographic reasons.

As well as the differences between countries, the results indicate a variable potential of change in the age structure to modify the economic dependency ratio, altering the levels of consumption. Let's see, now, what happens with the age structure and the material base.

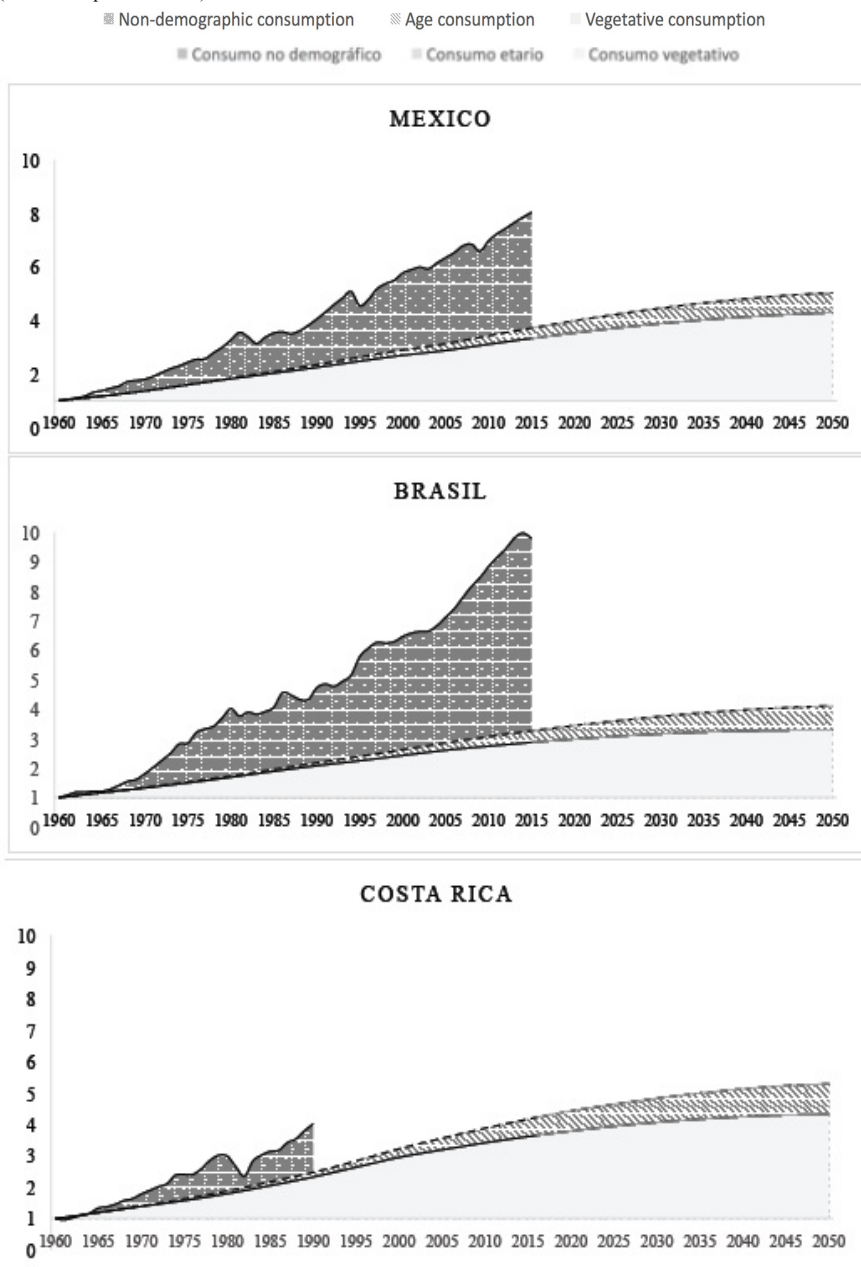
What happens with production during the demographic transition?

Figure 5a: Global consumption broken down. 1960-2050. Normalised values
(1= consumption in 1960)



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 5b: Global consumption broken down. 1960-2050. Normalised values
(1= consumption in 1960)



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

As we have pointed out, the labour income of a population will depend on its age structure and on the production patterns of each age, that is, on economic behaviour, labour variables and productivity by age, which vary from one society to another and over time. The fact that these patterns can change historically in the same society implies that, by making estimates from static age patterns in a long-term series, it is possible that in some years of the series an economic significance proper to age patterns is attributed to the age structure that are not the patterns that actually operate in that population. Consequently, they would be estimating employment incomes different from those corresponding to that population. Also, as we have pointed out, the variation of such patterns cannot be considered wholly independent of the transformation in the age structure, so it would not be appropriate to analyse the effects of the change in one variable (the transformation of the age structure) assuming the stability of the other (income patterns) when its variation is associated with the first. In short, the use of fixed income patterns will not enable us to know if, together with the transformation in the age structure, there were changes in the variables that determine the economic significance of that structure. To the extent that the effective workers calculated at different times in the series have different capacities for generating income, their number will be inappropriate data for long-term analysis: such numbers will not be comparable for the purposes of determining their ability to cover reference consumption items that are themselves comparable to each other in terms of monetary value. If, for example, an effective 30 year-old worker of the year 2000 produces income equivalent to that of 3 workers of the same age in 1970, it would not be appropriate to treat them as comparable, since that of the year 2000 is equivalent, in income, to three workers of 1970.

Aware of the limitation involved in assuming that current age patterns are maintained over time, the NTA has suggested the possibility of adapting profiles over time, raising them in the same proportion as productivity (United Nations, 2013). However, adjusting the age patterns of income by productivity could also lead to a false estimate of the workforce's overall ability to generate income: changes in productivity might not affect all ages homogeneously and, in addition, other variables (activity and employment ratio) are relevant in the transformations of the income age profiles.

Bearing in mind that income patterns are constructed from national accounts data related to the actual labour income of the population, we could argue that it is irrelevant to build such patterns to adequately calculate economic dependency in those years in which we have the data of total

labour income, since this will be equivalent to that which could be estimated for that population if the actual patterns in that year are available. And it is then that we notice the limitation implied in using, in long-term analyses, income patterns by age adequately recorded for each year: the direct observation of labour income actually received by the workforce precludes distinguishing the role of distributive contingencies in wage-mass fluctuations. Given that the NTA's income patterns are built on a *de facto* situation, they reflect a particular primary distribution of income between capital and labour. As a result, using real income patterns in the long-term series would reflect not only the changes by age in labour participation, employment and productivity, but also any fluctuations in that distributive relationship.

This is an issue that it would be interesting to differentiate analytically, since a possible relative reduction in the participation of labour in the gross domestic product (GDP), for example in deteriorating labour market contexts, could drive a deterioration in the relationship between labour income and demands for consumption, and even be a core factor in the imbalance of the finances of social security systems financed by contributions. And in that case, the explanation would be found in distributive contingencies not necessarily related to the demographic situation or to the general economic cycle.

So, how then do we estimate a wage mass that reflects the capacity of the workers provided by a population to cover particular demands of consumption? We propose to do so from the total production data (GDP), assuming a stable primary distribution pattern throughout the period. In this way, we can estimate a hypothetical (H) wage mass, unaffected by the contingent variation of the ways in which the production factors appropriate income, which reflects the potential for material production of a population. Once the salary mass for each year is estimated, we can convert it to "equivalent workers" (equivalent in terms of productive capacity), which are comparable to each other throughout the series in terms of their ability to generate income, using as a reference measure the income corresponding to the effective worker of the reference year.

The following graph shows the different evolution of the workers in each population, according to whether we count effective or equivalent workers (the latter, depending on the estimation of the H wage mass).

In Figure 6a and Figure 6b, we see that the increase of effective workers, estimated by static income patterns, results in fact completely exceeded by the number of equivalent workers that the populations contribute,

taking into account the changes in their productive capacity and, therefore, in the generation of income per worker. Consequently, in all these countries, the estimated wage mass based on fixed income patterns results in an underestimate of the true capacity of wage income as the material basis of consumption.

Reformulating the economic dependency ratio

The question is, then, how important are these equivalent workers, more numerous than those that are counted as "effective", for the evolution of economic dependency. We therefore propose recalculating the economic dependency ratio, but this time considering the H equivalent workers instead of the "effective" workers estimated with the NTA methodology (maintaining the generational consideration to estimate the evolution of consumption). The gap between the conventional economic dependency ratio and the H economic dependency ratio could be interpreted as the bias imposed by indicators abstracted from real economic contexts, extrapolating stable income patterns throughout long-term time series.

In Figure 7a and Figure 7b, we note that economic dependency drops much more sharply when recalculated with equivalent workers. The difference with the economic indicator of the NTA is that explained by the evolution, in each country, of the significance of its working population in production terms.

By projecting a stagnant GDP, economic dependency would be maintained at stable levels in Uruguay, with a minimal increase. In the other countries, given a stagnant GDP, an increase in economic dependency is projected, especially in Argentina and Mexico. In the case of Mexico, this would imply reversing the trend estimated by the NTA and immediately leaving the bonus period. Considering the breakdown that we previously made of consumption, we could point out that this is explained, mainly, because in this case the wage mass would not accompany the vegetative growth of the population.

Compare now the results of the economic dependency ratio of old age with the indicator recalculated with the H salary mass.

Figure 8a and Figure 8b shows that, in all countries, considering the transformation of the productive capacity of workers throughout the period, to the present day, the economic dependency of old age not only did not grow but, in some countries, it fell.

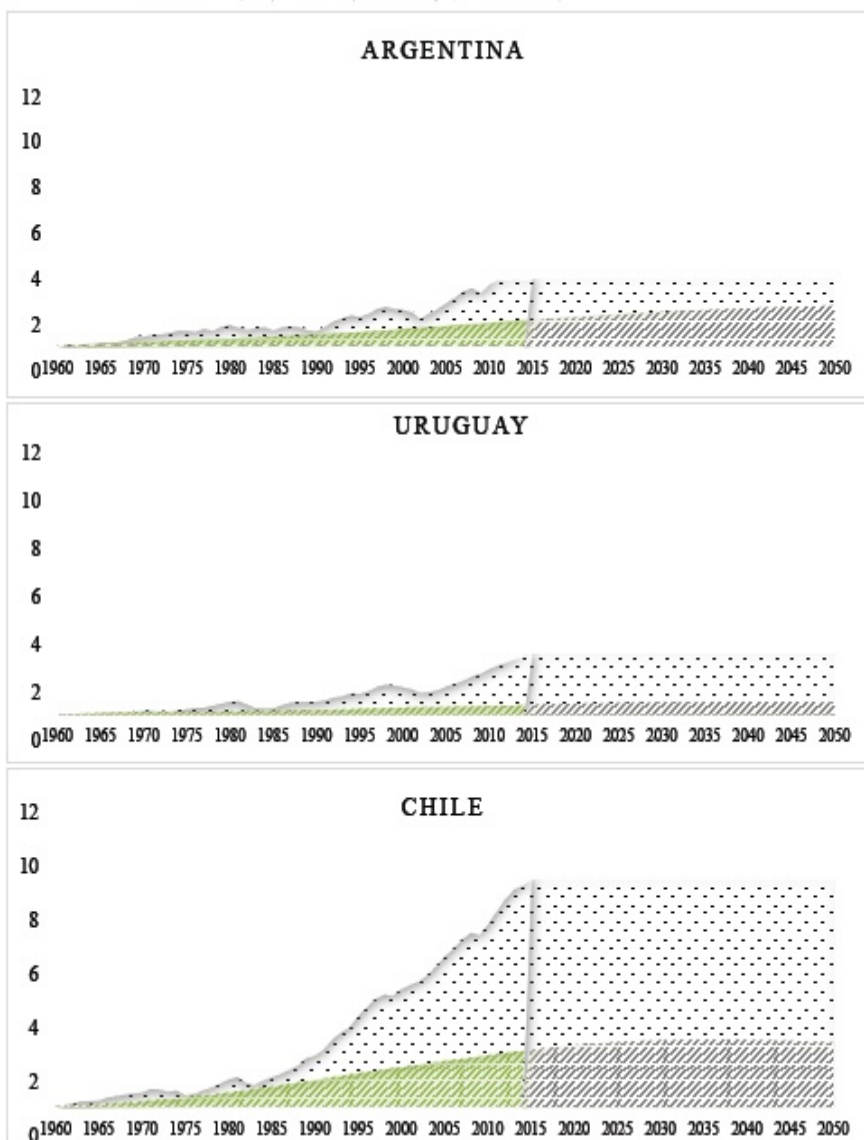
Figure 6a: Effective and equivalent workers. 1960-2050. Normalised values (1 = workers in 1960)

▣ H estimation (based on GDP, preserving the 1960 primary distribution pattern throughout the period)

▣ NTA estimation (based on static age patterns of production, in its 1960 value)

▣ Estimación H (según el PBI constatado, preservando distribución primaria del ingreso de 1960)

▣ Estimación NTA (con patrones de producción fijos, a valor de 1960)



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

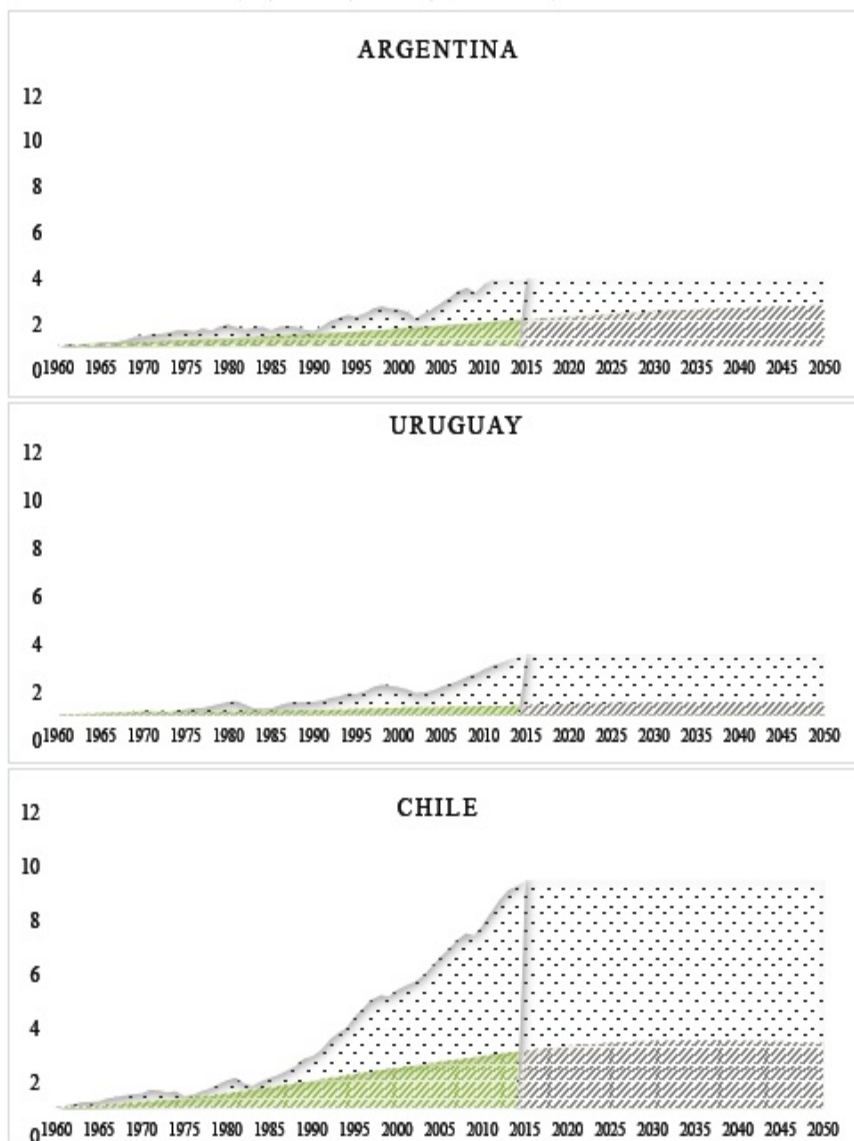
Figure 6b: Effective and equivalent workers. 1960-2050. Normalised values (1 = workers in 1960)

▣ H estimation (based on GDP, preserving the 1960 primary distribution pattern throughout the period)

▣ NTA estimation (based on static age patterns of production, in its 1960 value)

▣ Estimación H (según el PBI constatado, preservando distribución primaria del ingreso de 1960)

▣ Estimación NTA (con patrones de producción fijos, a valor de 1960)

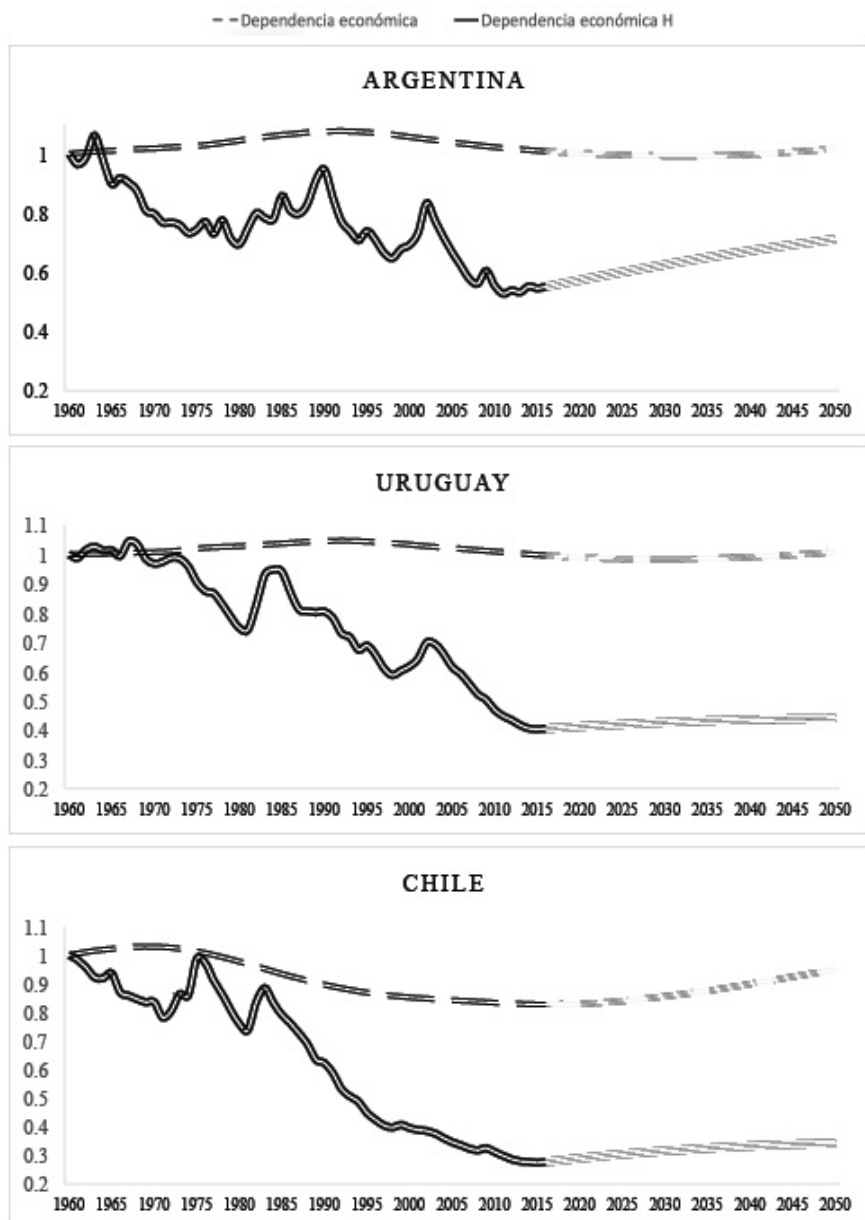


Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 7a: Economic dependency ratio. Compared indicators. 1960-2050.

Normalised values (1=Economic dependency in 1960)

— = Economic dependency — = H economic dependency



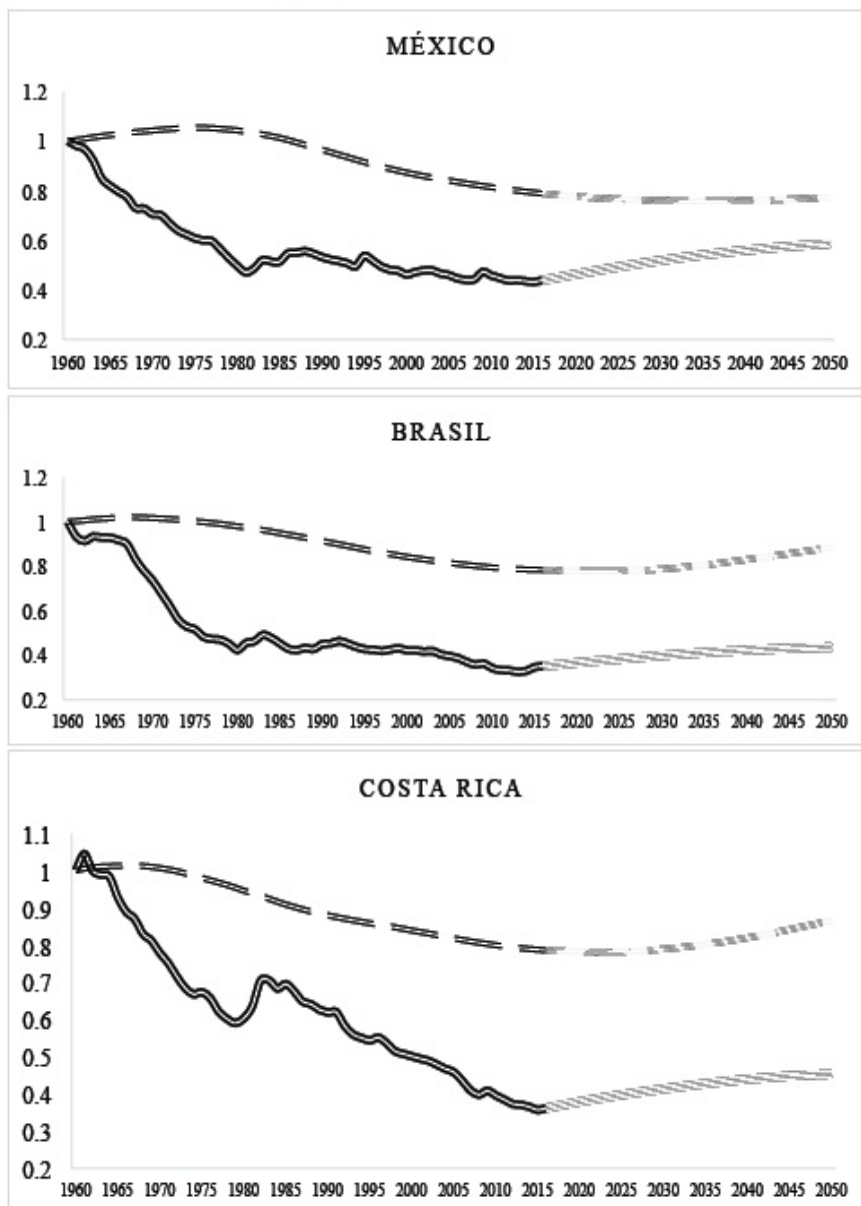
Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 7b: Economic dependency ratio. Compared indicators. 1960-2050.

Normalised values (1=Economic dependency in 1960)

— Economic dependency — H economic dependency

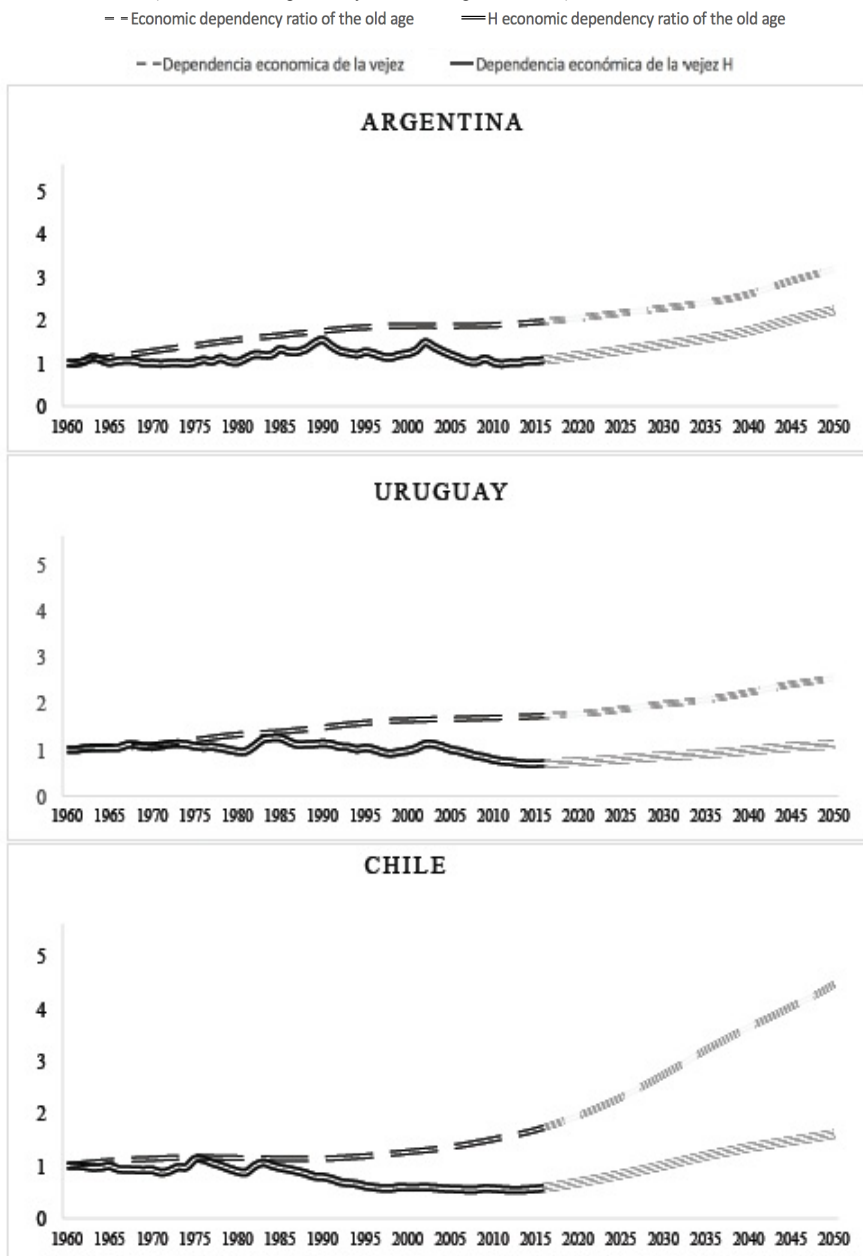
-- Dependencia económica — Dependencia económica H



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 8a: Economic dependency ratio of the old age. Compared indicators. 1960-2050.

Normalised values (1= economic dependency of the old age in 1960)



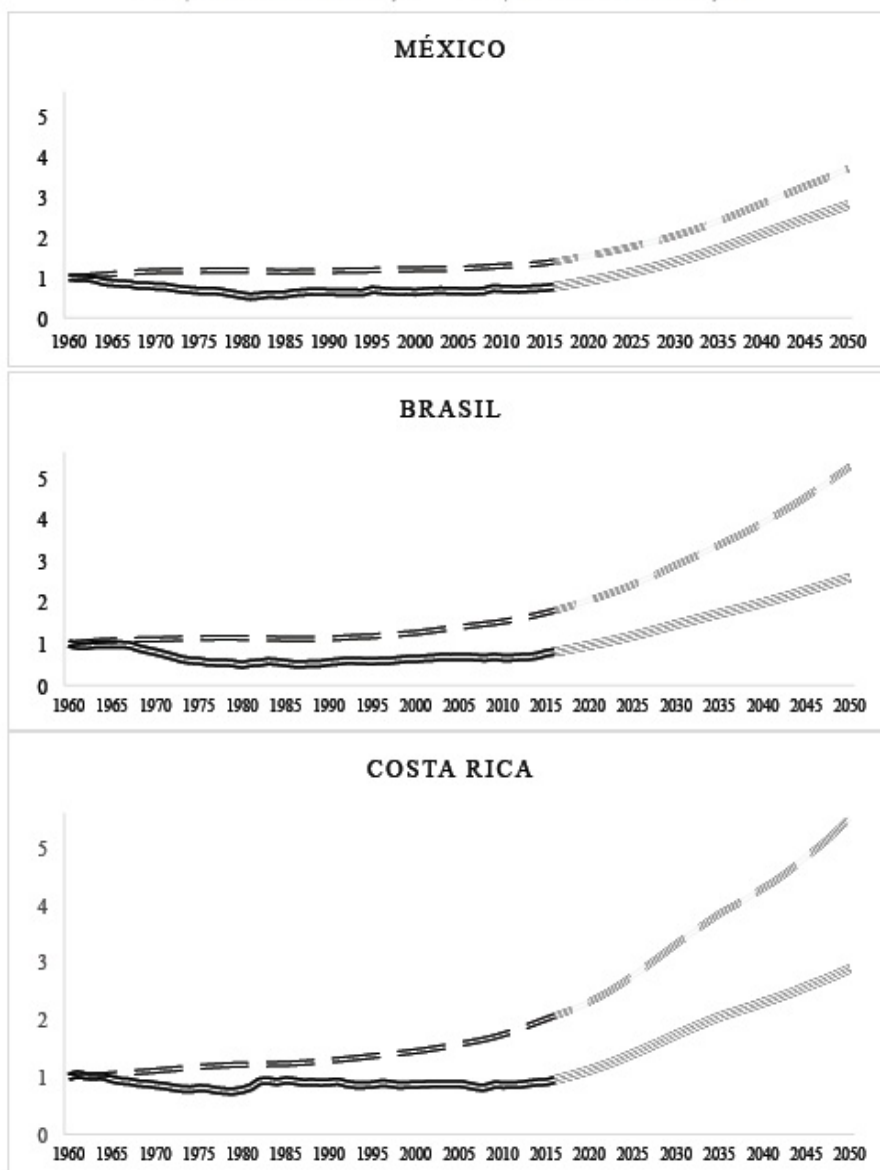
Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 8b: Economic dependency ratio of the old age. Compared indicators. 1960-2050.

Normalised values (1= economic dependency of the old age in de 1960)

— Economic dependency ratio of the old age —H economic dependency ratio of the old age

— Dependencia económica de la vejez — Dependencia económica de la vejez H



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

We would like to particularly underline this result, as it indicates a trend in the evolution of old age dependency which is practically inverse to that generally indicated in ageing studies.

Projecting a scenario with stagnant GDP gives, in all cases, a future upward trend for H old age economic dependency. This result is expected because, according to the projections for the next few decades, the estimated consumption of the elderly will grow, and for H old age dependency not to deteriorate, it would be necessary for the GDP to grow at the same rate.

But what does the evolution of H dependency imply in relation to the questions we want to pose about the real material impact of population ageing? How should we interpret a reduction or an increase in the H economic dependency ratio?

The significance of the results and the possibility of quantifying future challenges

We have pointed out that the transformation of the age structures, and ageing in particular, raise concern about possible imbalances between the consumption demands of the population and its capacity to meet them. We could systematize the various worries in the concern that the growing demands for consumption of the elderly, in the face of ageing, threaten (1) the welfare of the other age groups (i.e., the continuity of their consumption levels per capita), (2) savings (or any resource not intended for consumption, relevant for the operation and development of the productive system), and even (3) the increase in consumption in age groups that lose relative weight in the population (such as the group of minors).

If, by virtue of the limitations noted in this document, the conventional indicators of dependency, demographic or economic, do not adequately establish how the relationship between consumption and capacity of populations to produce the wealth to pay for it is evolving, nor will they be able to adequately quantify the extent to which these three main concerns have a real basis empirically. We propose, then, to resort to the H economic dependency ratio to respond adequately to these questions.

The way in which the H indicator estimates the wage mass, i.e., considering a stable percentage of GDP, implies that H economic dependency is established by the ratio between the evolution of the GDP and that of estimated consumption, whether that of the population as a whole or, for the indicator of old age, that of older people. This approach, which is abstracted from the contingent distributive relationship between capital and

work in order to be able to evaluate the total productive capacity of the population, makes the H economic dependency ratio converge with the sustainability indicators proposed by Minoldo (2016), which evaluate the sustainability to cover consumption in the populations, observing the entirety of material production. Minoldo (2016) argues that, by assuming as a premise that the main support for transfers to dependent groups derives from labour income, we ignore the role of part of the capital resources which can also support consumption. And, while social security systems are financed mainly by contributions in most parts of the world, it is necessary to have tools to measure the challenges and possibilities of financing social security in alternative funding scenarios, i.e., to recognize the differential performance that we can expect, whether or not its equilibrium depends solely on the evolution of the wage mass. Thus, from an approach oriented to the productive capacity of the population, different results of H economic dependency indicators and of the sustainability indicators, enable it to be established whether the empirical evidence confirms or refutes, in each concrete case, the validity of these three main concerns:

1. To refute that the material well-being of our population is compromised implies confirming, in each year of the series, a material basis that makes it possible to preserve the levels of consumption per capita in all the age groups. That is to say, sufficient production must be verified to cover the consumption of all individuals, without reducing the level of well-being per capita for any of them at any age. Of course, ascertaining the genuine availability of these resources implies that, to cover consumption, resources are not made use of that were previously destined for other purposes. Ultimately, then, it must be possible to establish if the population has sufficient production to meet the estimated overall consumption (according to its age structure and its consumption patterns by ages), preserving the absolute value of the Resources Not Applied to Consumption (RNAC) available in that population. That is what is confirmed when the level of sustainability called Basic Sufficiency is verified (Minoldo, 2016).
2. Refuting that savings are threatened and that, thus, ageing compromises material resources that are key to sustaining the productive capacity of our societies, implies confirming a material basis that enables, in each year of the series, not only preserving per capita consumption levels in all age groups, but also preserving the relative value (as a percentage of GDP) of Resources Not Applied to Consumption. To do this, a fixed percentage over time of the total wealth must be sufficient

to cover global consumption, so that the RNAC do not lose their share. That is precisely the equivalent of achieving the sustainability level of Guaranteed Availability. And it is also equivalent to verifying a stable H economic dependency ratio, in which the ratio between aggregate consumption and a fixed percentage of GDP (which is attributed to the H salary mass) does not vary and, therefore, the relative value of the RNAC will not be affected because it is not necessary to increase the percentage of wealth destined for consumption. So, to the extent that the H economic dependency ratio does not increase, we can infer that neither the material welfare of the population nor savings are threatened.

3. Finally, to rule out that consumption by the elderly makes an increase impossible in per capita consumption in age groups whose participation in the population is reduced (such as childhood), or its equivalent, which is to verify whether it is feasible for such groups to sustain their relative share in consumption and, thus, raise their per capita income, it is necessary to verify, in each year of the series, a material base that makes it possible not only to preserve the relative value (as a percentage of GDP) of the Resources Not Applied to Consumption, but also the relative value of overall consumption by older age groups. To do this, a fixed percentage over time of the total wealth must be sufficient to cover the consumption of the older adults, in such a way that neither the RNAC nor the consumption of other groups lose their share. This is what is equivalent to achieving the sustainability level of Zero Inter-generational Redistribution Pressure. And it is also equivalent to verifying a stable H old age economic dependency ratio, in which the ratio between the consumption of the elderly and a fixed percentage of GDP does not vary, and therefore neither the relative value of the RNAC nor of the consumption of other age groups will be affected because it is not necessary to increase the percentage of wealth destined to the consumption of the elderly. In a context of ageing, maintaining the relative share in consumption of a group that reduces its share of GDP will mean an increase in per capita consumption in the group. Therefore, the increase in the H old age economic dependency ratio will imply that, to meet the consumption of the elderly at constant values per capita, it will be necessary to increase the percentage of GDP destined to their consumption. In any case, this will not necessarily imply affecting per capita consumption levels in other ages or the relative value

of savings (something that is determined with the H global economic dependency ratio).

We present below the evolution of the sustainability indicators in the 6 selected countries, in order to observe in a single graph the performance of each population in relation to each of the three concerns around the consequences of ageing.

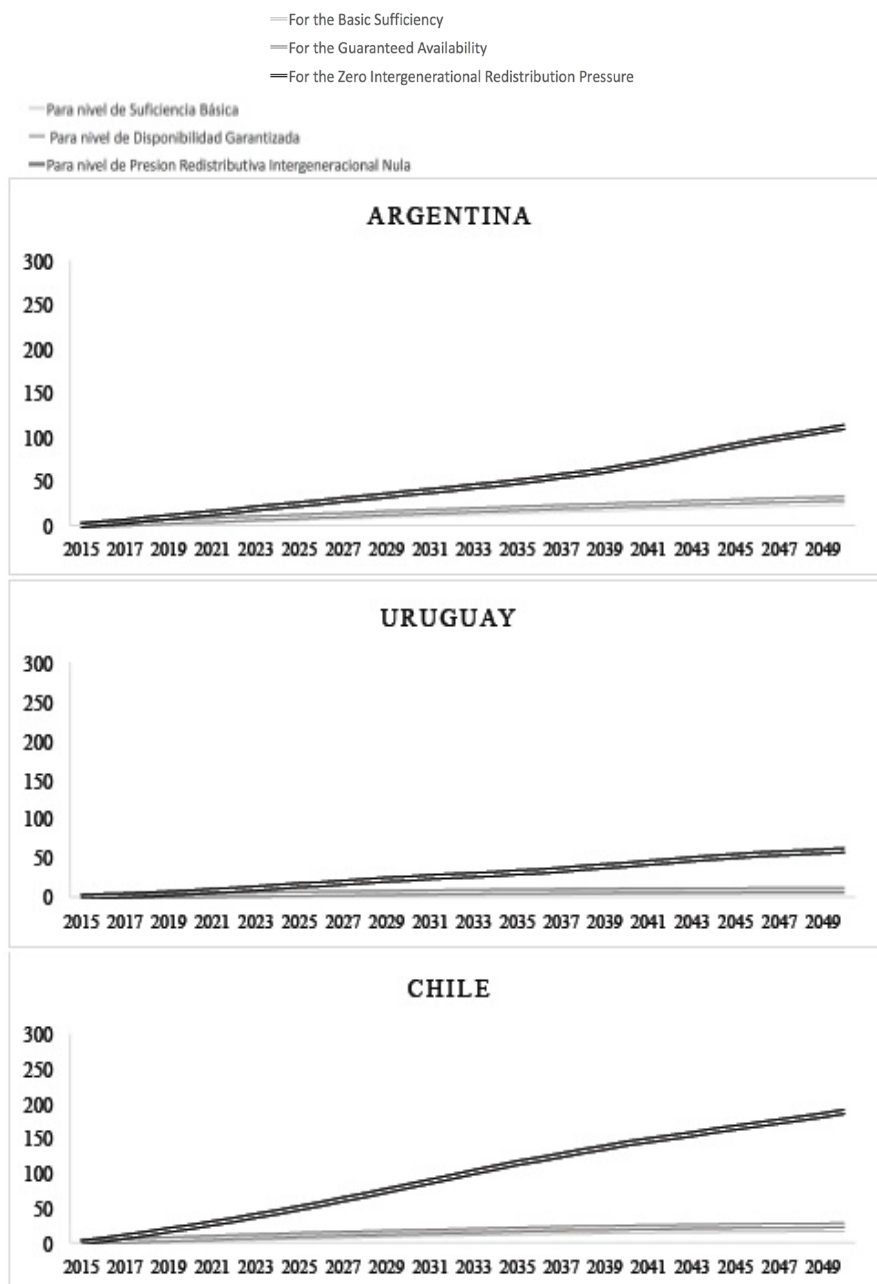
Figure 9a and Figure 9b shows the differential performance in these countries with respect to the scope of sustainability. Only in Argentina and Uruguay is the highest level of sustainability, Intergenerational Redistribution Pressure, affected, which implies the need to increase the share of the elderly in GDP. However, this has not involved affecting material well-being in other ages, as the other two levels of sustainability show.

By projecting sustainability with a stagnant GDP, we can anticipate a collapse of sustainability in all the countries at all the levels. In any case, this is to be expected if we take into account the projections we have made for consumption in the coming decades, which will grow in all cases (both global consumption and that of older people), so that the ratio between consumption and the material base will deteriorate if that base does not grow. We must not ignore, however, that much of the growth in this consumption is explained by vegetative growth rather than by change in the age structure.

To quantify the material challenges facing our populations in the future, we can project the GDP that we should produce, in each country, to preserve a balance between consumption and the material base that covers it. In this way, we can estimate economic growth targets and envisage scenarios that will be insufficient or sufficient in relation to such parameters. We can do this by establishing the economic growth that needs to be achieved in each year by projected sustainability GDPs. In the case of Guaranteed Availability and Zero Intergenerational Redistribution Pressure (or to preserve H overall and old age economic dependency at stable levels), the required growth of GDP will be equivalent to the estimated growth in each country for overall consumption and old age consumption, respectively.

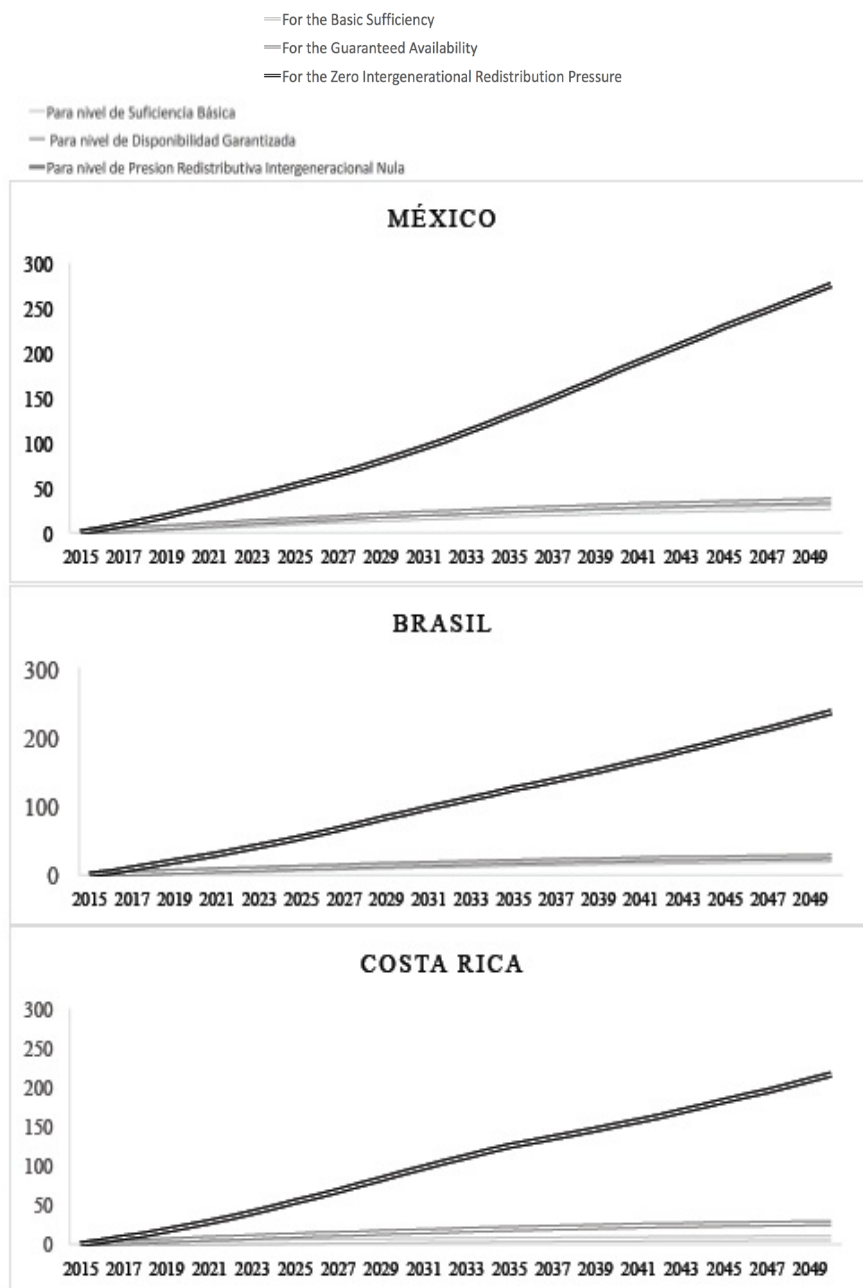
Since we are interested in seeing the evolution as from now, we will take 2015 as a reference year, and so the estimated consumption levels per capita have values corresponding to that year. In the figure, we present them as the required GDP for each level of sustainability, to clarify the implications of achieving each of the targets of economic growth.

Figure 10a: growth of GDP required to guarantee futur sustainability. 2015-2050. Reference year: 2015



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 10b: growth of GDP required to guarantee futur sustainability. 2015-2050. Reference year: 2015



Source: Own work, based on data from World Bank (2017), United Nations (2017) and NTA (2017).

Figure 10a and Figure 10b shows that the challenges of sustainability in the future are located around 20% growth between 2015 and 2050, i.e., in 35 years, for the first two levels, except in Uruguay, where 9% growth would suffice. In this way, recording this growth, we could anticipate that the production would make it possible to meet stable per capita consumption levels, despite the vegetative growth of the populations and the transformation of their age structure.

GDP poses a substantially larger challenge in all cases, albeit with differences between countries. While in Uruguay 50% growth of GDP would be required, in other countries, 100, 200 and up to 300% growth would be necessary. Only such growth would meet the consumption costs of the elderly without increasing their share of the GDP. In any case, if these growth levels are not obtained and redistribution pressure increases, any growth above the guaranteed availability level will imply that the increase in the share of GDP required by the elderly is not as much as the increase of their participation in the population, which implies a part of additional resources is released to raise the per capita consumption of other age groups.

FINAL REFLECTIONS

The starting point, which has led us to challenge the tools with which we measure the material impact of ageing, has been to recognize that the relationship between ages and production is not linear. That is why, not only can we not attribute a certain "natural" significance to the ages in all populations, but also that relationship can change over time. Thus, understanding the consequences of the change in age structures implies understanding their interaction with patterns of production by age, the changes in which are not only key to establishing the significance of age structures but are also partially interdependent with the demographic changes that we are studying. However, as we have said, the main contemporary studies on the material consequences of ageing focus on tools that, when interpreting the impact of demographic phenomena over time, exclude consideration of the labour and economic changes with which such processes occur, even when they take into account the labour variables in the significance that the age structure has in the reference year of the series.

After a critical analysis of the dependency ratio, we focused on the economic dependency ratio, breaking it down into its variables of consumption and income. The results suggest, on the one hand, that ageing could have a relevance for the evolution of the burdens of consumption

far below that which is traditionally imputed. On the other hand, counting workers with different levels of productivity as material "support", as if they had an identical weight, leads to distorting the true impact of the change in the age structure on the levels of economic dependency and of old age economic dependency. We therefore proposed calculating amounts of workers equivalent in their capacity to generate income, stipulating the wage mass as a stable percentage of GDP, and dividing that wealth by the amount of income corresponding to an effective worker of the year of reference. In doing so, we note that the growth of equivalent workers, i.e., of the material base of consumption, has in recent decades been much higher than we can estimate with age patterns fixed in time, as is done to calculate the economic dependency ratio. With this recalculated material base, we reformulate the economic dependency ratio through the H economic dependency ratio. This indicator helps to de-abstract the consequences of demographic change, in the sense of situating its challenges in each socio-productive context, warning that the same demographic change can imply very disparate consequences and challenges in different productive contexts. In this way, it shows up the differential implications of the fact that population ageing is occurring in societies that are more productive than those of other demographic equilibriums or that, in contrast, it is occurring without simultaneous progress in the economic development of the society. Latin America's own challenges will not, then, be the same as those implied by ageing in first world countries, however similar their population structures and the demographic processes they are going through may be.

While this work does not seek to oppose the methodologies available today, but aims to deepen and advance with them, it does imply a categorical review of results related to the relationship between ageing and material challenges, which in turn implies a review of the diagnoses and focuses of interest of the policies addressing these challenges. With regard to the diagnoses, the results of this study suggest that, by abstracting from the evolution of productive conditions, we tend to overestimate the material problems involved in the transformation of the age structures to meet the consumption demands of the population. This could hamper the possibility of recognizing that, instead of facing constraints of material wealth generated, the financial difficulties of the social protection systems of old age could, in some cases, be distributive in nature. On the other hand, this methodological reformulation also impacts the formulation of recommendations aimed at favouring the balance between production and consumption in a society. By highlighting variables that interact with de-

mographic factors, it favours an integral analysis of the consequences of different measures on what is ultimately the key to sustainability: the material wealth that we produce. Thus, it reveals the importance of each measure being designed considering the specific productive and labour contexts in which its application is planned, and of considering how the variables at different levels (social, demographic, economic, labour) interact. In this way, it can be noticed, for example, that increasing the population available to work, whether with demographic growth or by increasing rates of economic participation (for example, raising the retirement age), could be less necessary than dealing with employment policies. On the other hand, even when a beneficial effect could be expected (on the production of wealth) from increased labour availability, other policies could be more cost-effective and, in some cases, they might even be incompatible with the increase in people of productive age. In turn, when it comes to seeking solutions to problems of the sustainability of social security, it will not be the same to be faced with restrictions of wealth as with a shortage of transfers to older people. In other words, faced with a distributive problem. Thus, in contexts where sustainability can be observed through the tools presented here, i.e., if we should confirm that the wealth produced is as sufficient as before to meet consumption, the core of the problem could be shifted from the "ageing problem" toward the efficacy of intergenerational income transfer mechanisms, and particularly of the design of financing and distribution of social welfare.

By being able to distinguish the issues that are distributive, and therefore susceptible to being modified, from the consequences of ageing itself, this methodology makes it possible to identify when it might be the institutional and distributive characteristics of social security systems, and not general material constraints, that are generating budgetary conflicts in the context of ageing. This, in the particular case of contributory systems, which are ultimately those that dominate the western world, and that show budgetary problems in the face of the advance of demographic ageing, provides a significant indication to begin analysing the exhaustion of an entire institutional and distributive paradigm of social protection of old age. In these systems, since solvency depends on the number of taxpayers and on the amount of their income, rather than on the levels of production of workers as a whole (mercantile and non-mercantile, formal and informal), solvency is directly affected by problems of inequality in the distribution of wealth and particularly those of the labour market, such as exclusion, informality, or lower rates of participation of labour in income in respect

of capital. Given a lower representation of wages in the evolution of productivity, the tax base of the pension system in relation to the evolution of the production is also reduced. All of this has particular relevance to adequately thinking through the region's own challenges since, given the characteristics of Latin America, it will be crucial to be able to identify the role that its profound problems of inequality, as well as its structurally precarious and informal labour markets, have on the restrictions of sustainability, and even on the expansion of social welfare. And it is also important for being able to understand, not only the consequences that such characteristics imply for social security contributory systems, but also the need to question the very fact that the provision of pension funding is tied to the contingencies and evolution of such labour markets.

In relation to what this study tells us about the specific challenges of the countries analysed, we consider it important to continue with a careful analysis of the results obtained here. This, given that the study has focused on the methodological approach to the problem of ageing and its material impact, would help to show up the potential of a new methodological focus on the problem. The specific analysis of each country must be deepened in future research studies, to be able to contextualize the information obtained here and to fully comprehend it.

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Article received on 22 april 2017 and accepted on 31 july 2017.