

# THE ECONOMIC LIFE CYCLE AND THE DEMOGRAPHIC DIVIDEND UNDER THE NTA APPROACH, EVIDENCE FROM EUROPEAN COUNTRIES

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**Abstract.** *This article aims to realize a comparative analysis of the potential demographic dividend and the economic life cycle profiles for several European countries. The demographic dividend is a concept that denotes the positive demographic impact on economic development resulting from the changes in population age structure. Countries where the working-age population predominates have the opportunity to accelerate economic development, thus obtaining the demographic dividend. In estimating the potential demographic dividend, the NTA methodology found its applicability through the economic support ratio indicator, a composite indicator that includes the characteristics of the population structure by age group, and also the production and consumption profiles for each of the age groups. The difference between consumption and income constitutes the deficit or surplus of the economic life cycle. The comparative analysis of the consumption and income profiles, the surplus and deficits of the economic life cycle, the economic support ratio indicator, and the demographic dividends in the selected countries were carried out. The research results show that, although some countries register a population structure beneficial to economic development, the profiles of the economic life cycle are heterogeneous, reflecting the different situations in the labor market and individual productive behavior. Identifying the drivers needed to improve life cycle surplus would provide the necessary support for identifying country-specific methods for achieving the demographic dividend.*

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**JEL:** *A14, J10, J11, J14*

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**Introduction.** Before passing into an aging society, population goes through an age structural transition with important transformations in population composition by age during the process, challenging the current state of economic and social development. But demographic changes may also include paths to prosperity. A useful

framework to address those effects, is provided by the concept of the demographic dividend, the NTA methodology, and the theory of economic lifecycle.

The proponents of the demographic dividend concept state that certain demographic conditions can bring an extra boost to economic development, given necessary policy measures and institutional conditions are in place. To quantify the demographic dividend, the NTA approach provides a renewed perspective, in the frame of life cycle theory allowing us to analyze how people produce, consume, and save throughout their life courses. Although Europe is the region with more rapid population aging, some European countries have experienced a more recently favorable demographic structure, with an increase in working age population. A favourable demographic structure more recently has experienced Moldova too, along with other European countries such as Slovakia, Ireland, Bosnia and Herzegovina, Belarus, Poland, etc. (United Nations 2004).

This article aims to realize a comparative analysis of the potential demographic dividend and the economic life cycle profiles for Moldova, Ireland, and Slovakia. By analyzing the demographic dividend, we took insights into the economic life cycle profiles in selected countries. It was also taken evidence on economic support ratios and demographic support ratios. The analysis results show that, although some countries register a population structure beneficial to economic development, the profiles of the economic life cycle are heterogeneous, reflecting the different situations in the labor market and diverse individual productive profiles. Thus, studying on economic life cycle in general, and of the life cycle surplus in particular, would provide important insights for demographic dividend analysis and prospects for its achievement.

**Literature Review.** The study of the relationship between population dynamics and economic development has gained a different perspective with the works of Bloom and Williamson (1998) and Bloom, Canning and Sevilla (2003), who introduced the variable of age structure in population-development studies. Thus, when the working-age population grows faster than other age groups, the country has the opportunity to gain an economic advantage or bonus in its economic development process, a phenomenon lately called the demographic dividend.

In estimating the demographic dividend, a series of methods have been developed, while the NTA methodology is one of reference. An increasing number of countries were included in the project, while cross-countries comparable studies have become more possible. While the aim of the project is the study of the generational economy and the impact of demographic changes on the transfer system, the data provided by NTA offers also the possibility of studying the macroeconomic consequences of the population's age structure.

Among European countries, the project *Agenta* which includes most important NTA accounts for the 2010 year has been developed. The construction of the NTA data for the Republic of Moldova has dated since 2016 (Lupușor, Popa and Prohnițchi 2017) and was actualized for 2019 (Gagauz and Prohnițchi 2022). Following NTA methodology subsequent studies highlighted the deficit of the economic life cycle in Moldova (Buciuceanu-Vrabie, 2022), while the analysis of the first and second demographic dividend in Moldova was also carried out (Fala 2022). Cross-countries

studies require comparable data, recently becoming more available within [www.ntacounts.com](http://www.ntacounts.com) project.

**Theoretical framework. *The Economic Life Cycle.*** The perspective of the economic life cycle theory is essential in the context of the study of the population by age group. While classical economic theories classify the market into supply and demand, life cycle theory looks at the economy through the lens of age: people at the age of dependency need different forms of financing to ensure their living, and workers, who are able to finance their needs and the needs of dependents (d'Albis & Moosa 2015).

The basic idea of the life cycle theory, of the relation between individuals who have economic resources and those who need these resources has been recognized within the NTA accounting project. In any modern society, people record a life cycle deficit in the period of child and old age, when their consumption exceeds their income from work, and a surplus in the period of their working years when their income is greater than their consumption. This state allows an eventual reallocation of resources between generations and over time, which can be constantly quantified and linked to the economic evolution of each society (ibid).

Understanding the economic lifecycle is important in its own right, but it is also critical to understanding how changes in population age structure interact with the economic lifecycle influencing many features of the macroeconomy (Mason 2006).

***The Demographic Dividend, NTA approach, and the Economic Support Ratio.*** The demographic dividend concept states, that, under proper institutional and political favorable settings, an increase in the ratio of the working age population, keeping the rate of wages, employment rate, and unemployment rate constant, will lead to an increase in income at the aggregate level.

NTA framework allows linking the interactions between changes in age structure and the lifecycle of production and consumption through the computation of the Economic Support Ratio, which is the key indicator in assessing the demographic dividend under the NTA approach. The Economic Support Ratio is used to determine the evolution of the potential demographic dividend when the growth rate of effective producers exceeds the growth rate of effective consumers (Mason, et al. 2017). The full extent of the demographic dividend, outside of the accounting effects of increasing the productive population over the total population, is often assessed through lifetime savings and wealth effects. The second demographic dividend, which takes into account increased productivity levels in the economy, is also assessed using these savings and wealth effects (Prskawetz & Sambt 2014, Mason, et al. 2017)

**Data and methods.** The availability of age-specific data within the NTA allows for a detailed analysis of the influence of age structure on various economic variables, specifically the variations of consumption and production across ages. These data sources permit to obtain information on the age-specific levels of production and consumption.

The difference between consumption and labour income is termed the life cycle deficit (Mason et al., 2006). During the working years when labour income is higher than consumption, the life cycle deficit is negative, representing the life cycle surplus.

The conventional support ratio and the dependency ratio are standard measures for assessing the age structural composition of the population and its evolution. To account the demographic support ratio, fixed age range are used:

$$SR(t) = \frac{P(15 - 64)(t)}{P(total)(t)}$$

The NTA approach uses the economic support ratio as a standard tool to measure the economic effects of a population's changing age structure (Mason and Lee 2006). The support ratio under NTA methodology is defined as the ratio of the effective number of producers (L) to the effective number of consumers (N):

$$ESR(t) = \frac{L(t)}{N(t)} = \frac{\sum_x \gamma(x) \times P(x, t)}{\sum_x c(x) \times P(x, t)}$$

where  $c(x)$  is an age-specific weight of consumption;  $\gamma(x)$  is an age-specific weight of production; and  $P(x, t)$  is the population of age  $x$  in year  $t$ . Age profiles are standardized by dividing age-specific values by the average of the age-specific value of consumption or labor income over the 30-49 year age range.

The economic support ratio is then used to determine how changes in the population's age structure affect the economy. First, income per effective consumer,  $y(t) = Y(t)/N(t)$ , can be written as a function of two multiplicative factors:

$$y(t) = ESR(t) \times y_l(t)$$

where  $ESR(t) = L(t)/N(t)$  is the ratio of the number of effective workers to the number of effective consumers, and  $y_l(t) = Y(t)/L(t)$  is the average income per worker (Dramani and Oga 2017).

The economic support ratio  $ESR(t)$  captures how changes in age structure influence the concentration of the population in the relative productive ages (30-49 years old). The growth rate in income per effective consumer  $gr[y(t)]$ , is the sum of the rate of growth of the economic support ratio  $gr[ESR(t)]$ , and rate of growth in income per worker  $gr[y_l(t)]$ :

$$gr[y(t)] = gr[ESR(t)] + gr[y_l(t)]$$

The growth of the economic support ratio, known as the first demographic dividend, equals the growth rate of effective labor less the growth rate of the number of effective consumers:

$$gr[ESR(t)] = gr[L(t)] - gr[N(t)]$$

The first dividend is positive when the effective number of producers is growing more rapidly than the effective number of consumers.

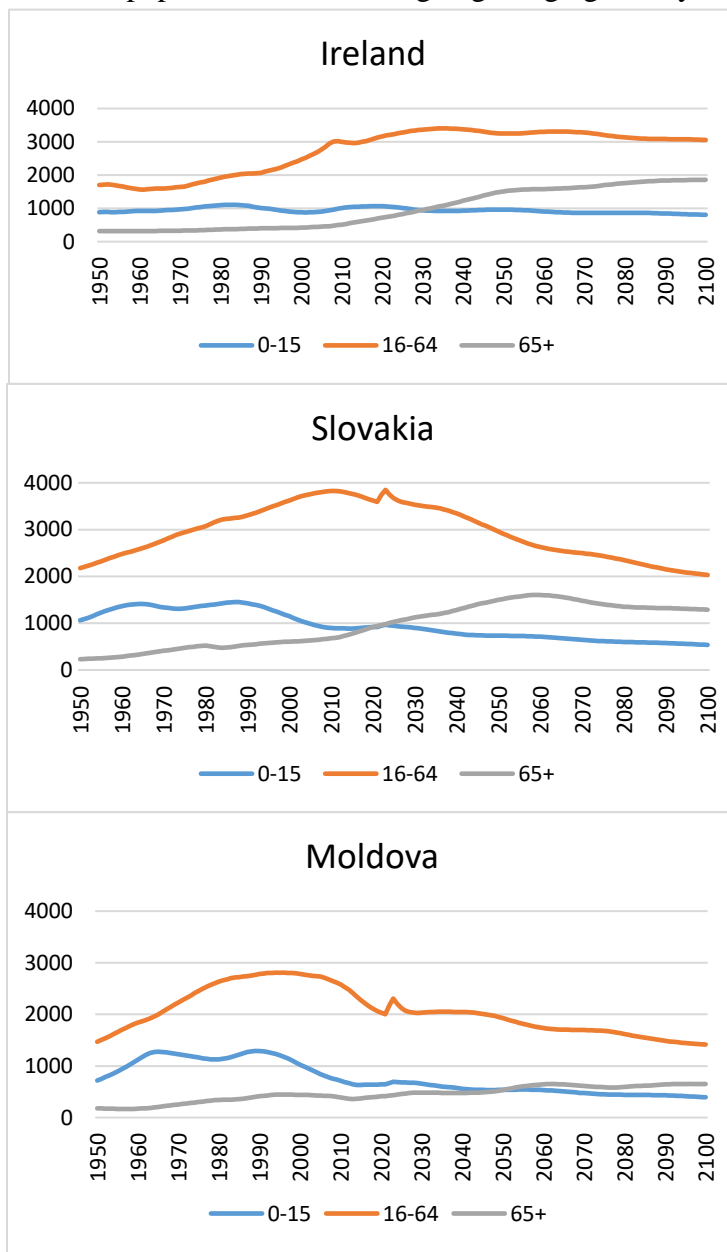
During demographic transformations, when the resources previously devoted to supporting a large, dependent population are shifted to spending on physical and human capital, economic growth can be enhanced. This phenomenon is known as a second demographic dividend and refers to the growth of output per worker (Dramani and Oga 2017).

**Research Questions and Hypothesis.** This article aims to realize a comparative analysis of the potential demographic dividend and the economic life cycle profiles for Moldova, Ireland, and Slovakia. Our assumption is, that the characteristics of economic life cycle patterns can give additional insight into the demographic dividend analysis and to the prospects of demographic dividend achievement.

For this purpose, we have been following some questions:

1. Which age structural dynamics have been recorded in Moldova, Ireland, and Slovakia?
2. What pattern of the economic life cycle has Moldova in comparison with other countries?
3. Which was the dynamics, timing, and magnitude of the demographic dividend, first, second, and combined in Moldova, Ireland and Slovakia?

**Results and discussions. Dynamics in population age structure: evidence from Ireland, Slovakia, and Moldova.** Although Europe is the region with a more rapid population aging, some European countries experience favorable demographic structures, the period when the working-age population predominates. The period of **window of opportunity** occurs when, the young population decreases as a result of low fertility, while the population is still undergoing an aging society.



### Figure 1. Population by age groups in Ireland, Slovakia and Moldova in 1950-2100, thousand

Source: World Population Prospects (2022) of the UN DESA

The emergence of an aging population is preceded by important age-related structural changes, the result of which is the changes in the volume and the proportion of people in each age group.

Significant increases in the proportion and the volume of the working-age population occur when the increase in life expectancy has not yet led to a significant increase in the proportion of elderly people. As a result of the recent fertility decline, large cohorts entering the working age create incentives for economic growth. For a certain period, the dominance of the working-age population is observed in the countries chosen for our analysis - Moldova, Slovakia, and Ireland. While all three of them exhibit an important increase in the working-age group, an important decline of the young population will be registered (Fig. 1). The differences are captured by the pace of working age group decline. In Moldova the decline in working age population is more sharply, and this window of opportunity took place slightly earlier than in Ireland and Slovakia.

It was stated that different countries or groups of countries are in very different situations with regard to what could be expected theoretically, and such differences can largely explain the different economic and social circumstances of the countries (Vallin 2005).

The beneficial demographic situation is captured by the conventional indicator of the support ratio. Similarities in demographic support ratio are observed for Slovakia and Moldova until 2030, while Ireland, due to its still youthful population has a lower support ratio. After 2030 as life expectancy increases, the support ratio in Ireland and Slovakia will experience an important decline, contrasting with the still high support ratio in Moldova. The economic support ratio, by contrast, gives us another picture, where the economic support ratio in Slovakia is much lower than in Moldova and Ireland (Fig.2).

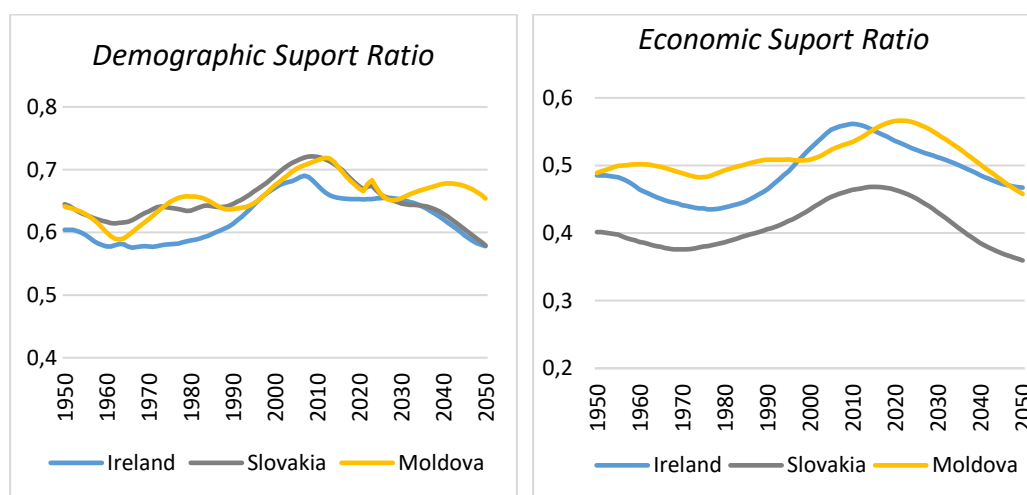
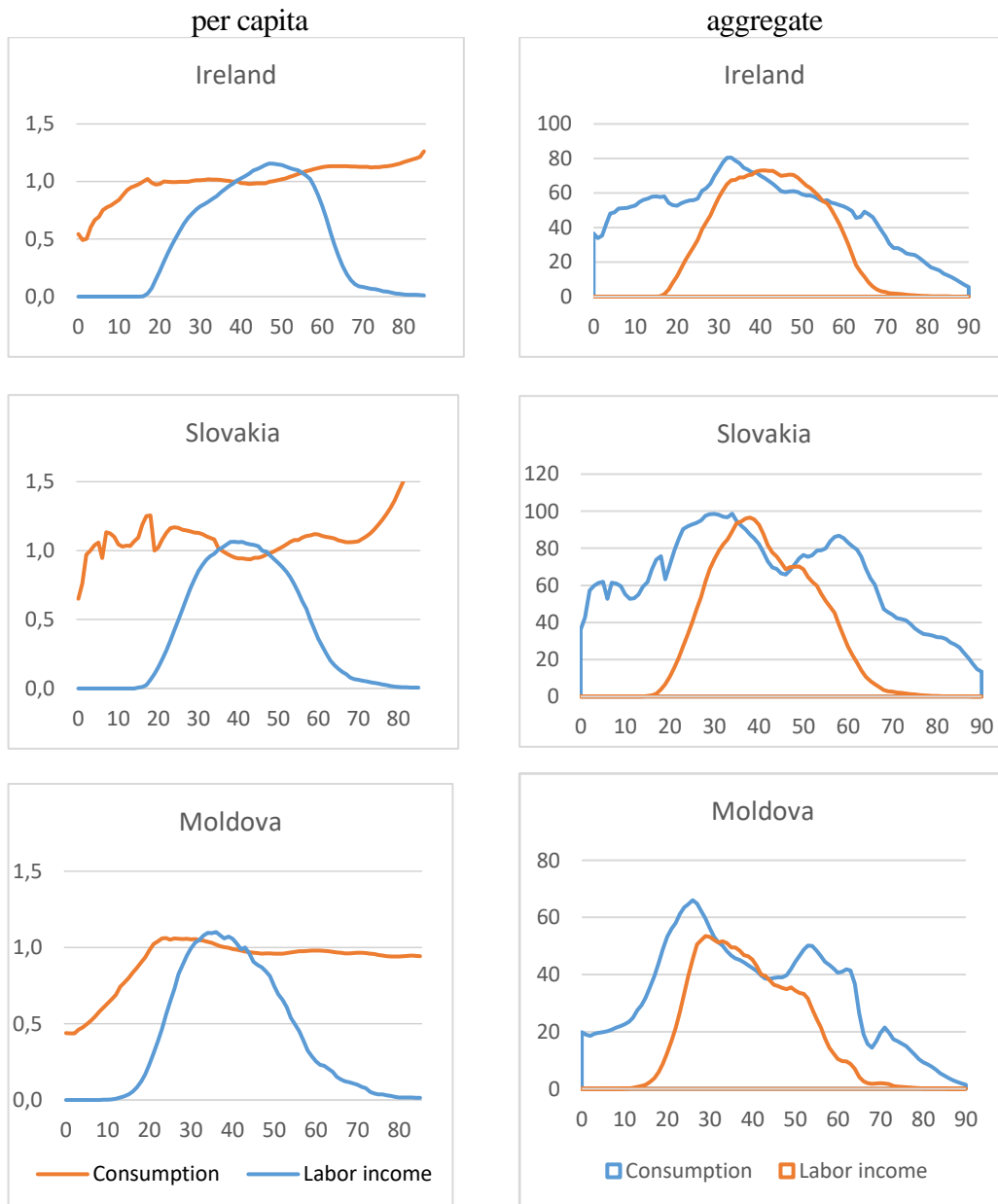


Figure 2. The demographic and economic support ratios in Ireland, Slovakia, and Moldova in 1950-2050, %

*Source:* World Population Prospects (2022) of the UN DESA; National Transfer Accounts Project, UNDP Project 2016, Support Ratio and Demographic Dividends: Estimates for the World, and (Mason et. al., 2017), [www.ntaccounts.org](http://www.ntaccounts.org)

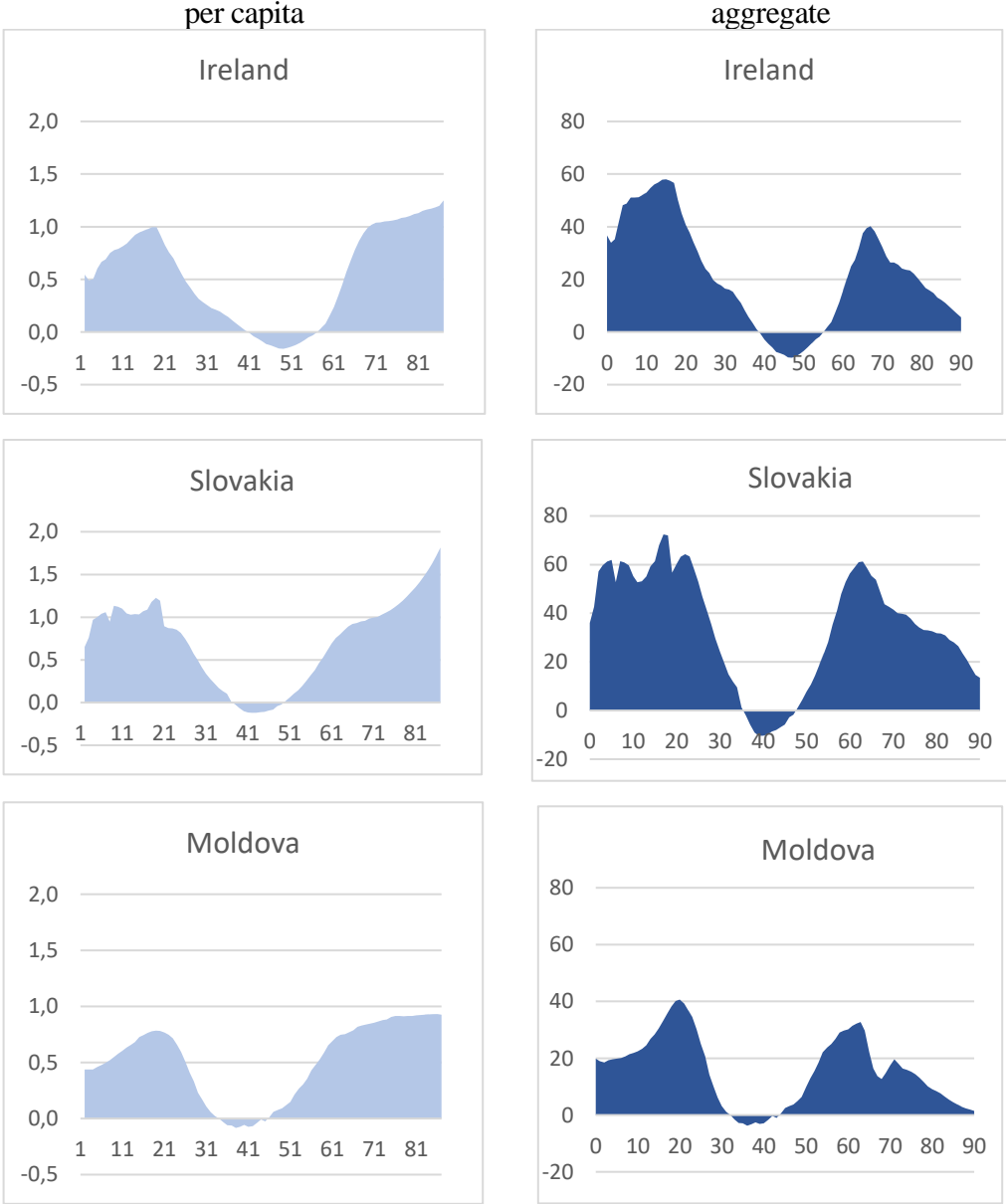
***The economic life cycle in Ireland, Slovakia, and Moldova.*** Examining the profile of the economic life cycle, it has been observed that the low economic support ratio in Slovakia is given by the large consumption at both young and older ages. Even if in Moldova the economic support ratio is comparable with Ireland, the consumption pattern is substantially lower, for both children and elderly people, reflecting limited expenditures and investment in human capital at early ages and limited provision for the elderly compared with the other two countries (*Fig.3*). Striking differences are observed between Ireland and Moldova on production profiles. The per capita volume of production is limited also by the extension productive period and an early pattern of production profile in Moldova comparable with the other two countries. The surplus also differs in Moldova from the other two countries, not only in the volume, which again is lower but also in the period of life when this surplus of production over consumption is experienced. In Slovakia, the production age pattern is characterized as being in the middle range between Moldova and Ireland. At the aggregate level, the economic life cycle profiles will be shaped by the population age structure. Given all three countries experienced a comparable beneficial age structure in the analyzed year, 2014, the volume of the economic surplus will be influenced by the production and consumption profiles at the individual level examined above.



**Figure 3. The life cycle profiles of production and consumption in Ireland, Slovakia, and Moldova in 2014, per capita and aggregate, normalized to age 30-49**  
*Source:* National Transfer Accounts Project, UNDP Project 2016, Support Ratio and Demographic Dividends: Estimates for the World, and (Mason et. al., 2017), [www.ntaccounts.org](http://www.ntaccounts.org)



The profiles of deficit and surplus add additional insights into economic life cycle analysis. Given the still youthful population in Ireland, the deficit is shaped by this age structure at young ages. The deficit at older ages is more striking in Slovakia, due to a higher preponderance of population at older ages compared with the other two countries while maintaining high expenditures per capita at older ages. The deficit is also substantial at young ages in Slovakia at the aggregate but also at per capita levels (Fig.4).

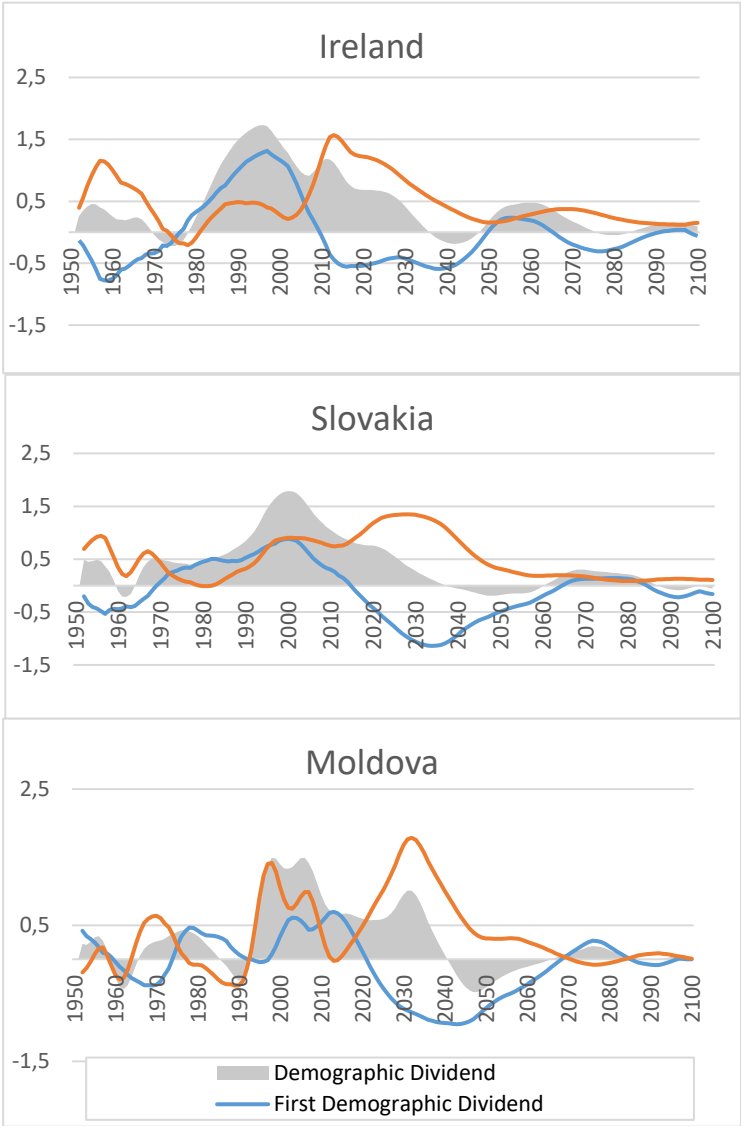


**Figure 4. Life cycle deficit profiles in 2014 in Ireland, Slovakia, and Moldova, per capita and aggregate, normalized relative to age 30-49**

Source: National Transfer Accounts Project, UNDP Project 2016, Support Ratio and Demographic Dividends: Estimates for the World, and (Mason et. al., 2017), [www.ntaccounts.org](http://www.ntaccounts.org)

The surplus of the life cycle in Moldova is lower than the other two countries, but an important difference stays also in the deficit at both young and older ages. As many low-income countries, consumption, including education and provision of health care, are limited, influencing people’s human capital formation and well-being in long term.

**The Demographic Dividend.** The potential increase in income due to account effect of the increase in working age population (first demographic dividend) or the accumulation of wealth due to increase in productivity at older ages (second demographic dividend) for our selected countries are illustrated in *Figure 5*.



**Figure 5. First and second demographic dividend, the demographic dividend combined, selected countries, 1950-2050, %**  
*Source:* National Transfer Accounts Project, UNDP Project 2016, Support Ratio and Demographic Dividends: Estimates for the World, and (Mason et. al., 2017), [www.ntaccounts.org](http://www.ntaccounts.org)

The projected evolution of the population provided by the UN, with an increase followed by a decrease in the working age population will determine the evolution of the first demographic dividend. As the population of working age declines, the first dividend turns negative. The negative contribution of the age structure population may be offset by the second demographic dividend, i.e. the increase in productivity of the aging society which previously might be contributed to the economy through its labor force growth. In each of the selected countries data shows that the negative first demographic dividend is offset by the potential second demographic dividend. Periods of the first dividend is importantly smaller than the period of the second demographic dividend, in all three selected countries. Fluctuations in the composition of the population will determine the fluctuation of the dividend, also being amplified by the characteristics captured by the economic support ratio: production and consumption profiles at the national levels.

The demographic dividend combined, includes both the accounting and behavioral effects of demographics on economic development, exhibiting different patterns in all three countries. Periods are slightly different, but the magnitude of the dividend, which is our focus is considerably higher in Ireland and smaller in Moldova. The magnitude of the Slovak dividend is the result of both accounting and behavioral effects, the first and second demographic dividend respectively. Different patterns are presented in Moldova and Ireland. It seems that the first demographic dividend in Moldova was importantly lower. Data shows also that the projected contribution of the productivity effect will be much higher, although such an assumption should be interpreted with caution. We observed previously that for 2014, the profile of production was importantly younger than in the other two countries, with the surplus registered also at younger ages. By contrast, the second demographic dividend is enhanced by the accumulation of the surplus of older ages. The assumed second dividend is possible if in the projected year the production profile will change substantially; while data are scarce and future uncertain, we must understand the essence of the dividend concept that stays mostly in its theoretical substantiation - a potential that implies a lot of action at the level of state, market, and society.

Overall, we can conclude that the potential demographic dividend, is influenced by the economic life cycle and a more beneficial economic life cycle pattern will positively influence the prospects for obtaining the demographic dividend.

**Conclusions.** The study of the economic life cycle is important in its own right, allowing to analyze how resources are obtained and then redistributed over the age groups. Equally important, however, is the study of the economic life cycle, at the aggregate level and its impact on the macroeconomy (Mason 2006).

The demographic dividend is a positive concept that shows the beneficial contribution of demographic changes to economic development. It offers a perspective through which demographic changes, individual economic decisions, and institutional conditions can induce the economy an important boost.

The accounting framework of the NTA permits to estimate of the potential demographic dividend, given the evolution of the population structure and assuming certain levels of consumption, production, and wealth accumulation.

In achieving the demographic dividend, the need for the functioning of the labor market, of the existence of a necessary health and education framework, for the creation

of human capital, are important. Also necessary is detailed studies at the level of countries of the consumption and production profiles, which would allow the improvement of the consumption and production ratio, ensuring a production profile that reduces the period of dependence, creating the surplus necessary for economic strength, at both individual and macroeconomic level.

Comparable data available limit the analytical frame of the study of the effect of the economic life cycle on demographic dividend. Nevertheless, even limited data of the basic information of economic life cycle profiles provides us a clearer picture of the prospects for obtaining the demographic dividend.

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