Measuring the impact of demographic transition on the sustainability of the pension system in Algeria using the theory of co-integration

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قياس أثر التحول الديمغرافي على استدامة نظام التقاعد في الجزائر باستخدام نظرية التكامل المشترك

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Abstract：The objective of this study is to determine the extent to which demographic factors (fertility rate and life expectancy) contribute to the creation of the pension system deficit in Algeria, based on the results of the estimation long-term relationships using the co-integration test and the ARDL model for the period (1995-2019). The results of the co-integration test showed a long-term steady-state relationship between the ratio of CNR balance/GDP, life expectancy and fertility rates, which is negative, as life expectancy increases, the number of pensioners increases relative to the number of social security contributors, resulting in an increase in the deficit of the CNR.

Key words: pension system; financial balance; national pension fund; demographic factors; co-integration.

JEL classification: C22; J11; J26;

ملخص . تهدف هذه الدراسة إلى قياس تأثير العوامل الديمغرافية المتمثلة في معدلات الخصوبة وتوقع الحياة في خلق العجز المالي لنظام التقاعد في الجزائر، باستخدام اختبار التكامل المشترك ونموذج الانحدار الذاتي ذو المبطئات الموزعة *ARDL* . وأثبتت النتائج أن الصندوق الوطني للتقاعد يعاني من عجز مالي متزايد منذ سنة 2013، كما اثبت اختبار التكامل المشترك وجود علاقة مستقرة طوية الأجل بين نسبة الرصيد المالي لصندوق للتقاعد/ *GDP* وتوقع الحياة ومعدلات الخصوبة، وهذه العلاقة سالبة مما يعني أن بتزايد العمر المتوقع عند الولادة يتزايد عدد المتقاعدين نسبة إلى عدد المشتركين في الضمان الاجتماعي مما يؤدي إلى زيادة عجز الصندوق الوطني للتقاعد.

الكلمات الدالة: نظام التقاعد، الرصيد المالي، الصندوق الوطني للتقاعد، العوامل الديمغرافية، التكامل المشترك.

INTRODUCTION

Retirement is a social security system that first appeared in the nineteenth century to coincide with the industrial revolution. These pensions contributed a great role in providing income for the elderly people who are no more able to work. We distinguish between two types of pension systems; capitalization-based pension systems and distribution principle-based pension systems. And most pension systems are currently exposed to a financial deficit due to many economic factors such as economic crises, unemployment and demographic factors such as the high number of elderly people whose age is quite high. As a response, most countries of the world tend to enact new reforms that will achieve the sustainability of pension systems and ensure pensions for future generations.

The pension system in Algeria is based on the principle of distribution, that is, the principle of solidarity between generations. In recent years, it faces a fiscal deficit, which threatens the sustainability of the Algerian pension system. Algeria has made several reforms, most recently in 2016, among which is the abolition of all forms of early retirement to face these financial difficulties. Experts pointed out that demographic factors contribute significantly to exacerbating the financial deficit of the existing retirement systems due to the principle of distribution, and this is what prompted us to ask the following question:

How do demographic factors affect the financial balance of the pension system in Algeria?

The treatment of this topic is based on the following hypothesis:

- The pension system in Algeria, based on the principle of distribution, suffers from a financial deficit that threatens its sustainability for future generations.

- Demographic factors such as high life expectancy and declining fertility rates lead to a financial deficit for the retirement fund.

This study aims to determine the extent of the influence of demographic factors in creating the financial deficit of the pension system in Algeria.

Previous studies

In light of the exposure of most pension systems to the problems of facing financial burdens, many local and international studies have studied the factors affecting the financial balance of pension systems. Globally, a European study on Schroth (2018) concluded that population

aging in Europe is expected to continue over the next few decades due to increases in life expectancy and lower fertility rates leading to a decline in employment, as well as pressure on Public spending on pensions, health care and long-term care As the population ages, although many European countries have implemented pension reforms, more reforms appear to be necessary to ensure long-term fiscal sustainability. At the Arab level, a Saudi study conducted by Muhammad and Ismail (2017) to estimate a quantitative model to measure the actuarial deficit in social insurance systems in Saudi Arabia concluded that the expected actuarial deficit in social insurance funds is due to demographic factors. The resulting changes resulted from increased life rates, which meant a longer payout while this was not offset by an increase in subscriptions. At the national level, an analytical study by Laour (2017) concluded that the dependence of the retirement system in Algeria on the principle of distribution makes it more vulnerable to demographic changes, as the increase in the ratio (number of retirees to number of active) leads to an increase in the expenditures of the system over its revenues as a result of the demographic transition, which leads to a financial imbalance of the system. While Murad Boudia and Bouchar (2018) conducted an econometric study aimed at evaluating the effectiveness of the 2015 pension reform by raising the retirement age in improving the financial position of the fund, and one of the most important results of this study is raising the retirement age from 60 to 65 that leads to the elimination of the disability fund within 5 years.

To achieve the objective of the study, We first diagnose the demographic reality in Algeria and analyze the financial position of the National Retirement Fund using statistics from various official bodies, and then, we will measure the impact of the demographic transition on the financial balance of the retirement system by studying the relationship between the financial balance of the National Pension Fund as a dependent variable, and fertility rate and life expectancy as independent variables and this through the application of the co-integration methodology, after we determine the degree of integration of each series , we will apply the VECM model if the series are integrated of the same degree, but if the series are not integrated of the same degree, we will apply the ARDL model, where the study period ranges during the period (1995-2019). This is a short period due to the lack of data on the financial position of the National Pension Fund prior to 1995.

1. Algeria's retirement system and the demographic transition

Most studies indicate that the phenomenon of population aging leads to the lack of sustainability of pension systems, especially those based on the principle of distribution (solidarity between generations). The number of working-age population, and this is called the old-age dependency ratio, which means that there are fewer people of working age paying for health benefits and pension benefits for the growing older population (Nicoletta, Giovanni, 2011, p. 19). Contributions paid by workers decrease and the number of compensations paid to retirees increase, which creates a financial deficit of the pension systems.

1.1 Algeria's retirement system

Retirement systems areclassified globally into two basic systems: distribution pension systems and capitalization pension systems.

a- Distribution pension system

The distribution pension system is based on the principle of intergenerational solidarity, whereby contributions are deducted annually from workers' wages and paid directly to retirees. The pension system is organized by distribution according to a tacit contract between generations, so that the employee currently subscribes in exchange for the promise of obtaining a retirement grant that may be funded by subscribers who were not yet born (أقاسم, 2011, p. 29). The value of the annual contributions in this system is determined by the following equation:

Total active annual contributions = total retired pension for the same year

b- Capitalization-based retirement system

The capitalization retirement system depends on the accumulation of the contributions of the current generation of wages, and these contributions are invested in various financial assets and real estate, and the capitalization pension system operates in various ways that may be optional or compulsory, or that it is managed by internal funds or external funds, or to pay the retirement grant in the form of rentals or in the form of one-time capital, … (أقاسم, 2011, p. 50)

The Algerian pension system in the wake of independence was going according to the legislative texts that were enacted during the colonial period, where the pension system consisted of eight (08) pension funds according to different sectors, and these funds are distinguished by the presence of large differences, both in terms of obligations or concessions. Retirement in one fund by enacting Law No. 83/12 of July

2, 1983 which stipulates the establishment of a unified compulsory retirement system for wage workers and is run by the National Retirement Fund (CNR). The aim of these measures was to provide the same benefits to all workers.

Definition of the National Retirement Fund: "The National Retirement Fund (CNR) is a social security organization and is a public institution of an administrative nature and has a legal personality and financial independence and is subject to the laws and regulations in force and the provisions of decree No. 85/223 of August 20, 1985 containing administrative organization Social Security (**تهتان**., 2017, p168), and it was created by merging the eight pension funds into one fund to manage the various pension systems that existed before the year 1983, mentioned previously, and decree No. 07/92 of January 04, 1992 defined the tasks and functions of the fund according to the following:

- Running pension and retirement pensions, as well as pensions and granting rights to people;
- To liquidate and redeem retirees, provide pensions and retirement rights
- The pensions and grants given under the previous legislation in the year 1984 until the implementation of the beneficiaries' rights
- Ensure the collection and monitoring of disputes of contributions for financing the retirement grants;
- Put in place all arrangements related to retirement that are established in international social security agreements.

The types of retirement are: retirement at the age of 60 (regular retirement), proportional retirement, unconditional retirement, pre-retirement, the retirement grant

1.2 Development of the revenues and expenditures of the National Pension Fund

The National Pension Fund seeks to increase the volume of revenues that come from the sources of supply over the expenses represented in covering various types of pensions and grants, while seeking to achieve long-term sustainability of this situation. The following figure shows us the development of the revenues and expenditures of the National Retirement Fund during the period 2001-2017.

Figure 1: Evolution of the National Pension Fund's expenditures and revenues (unit million DA)
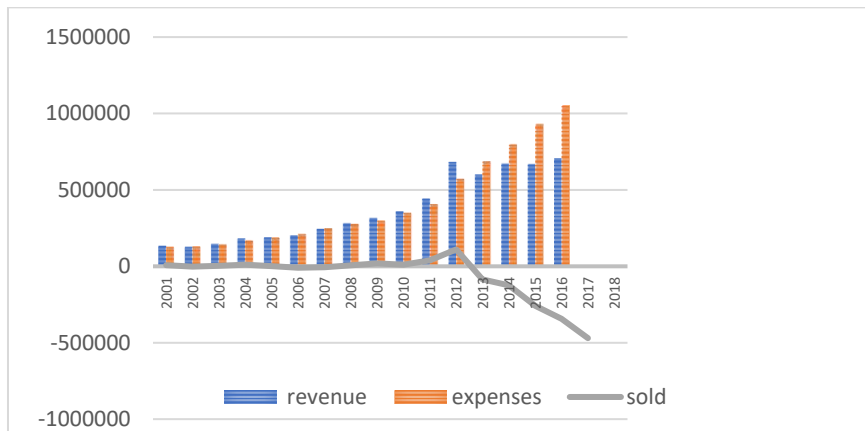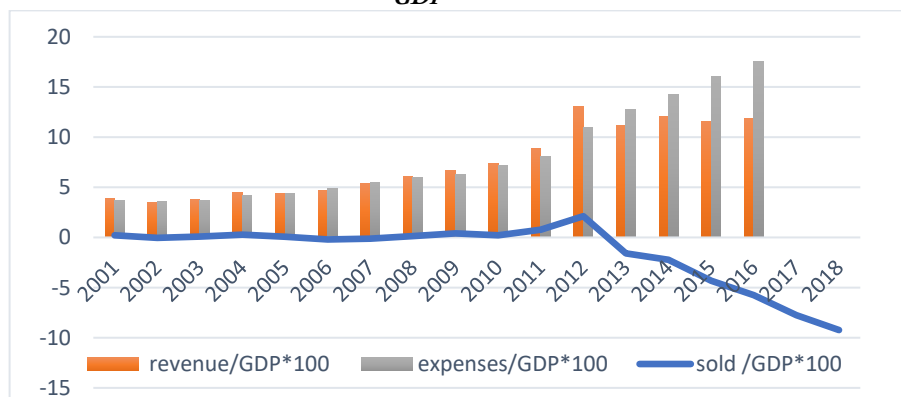

Source: Prepared by researchers using statistics from the National Bureau of Statistics and the National Pension Fund

It is clear to us through the previous figure that each of the fund's revenues and expenditure increases from one year to the next, and the increase in revenues from 135140 million dinars in 2001 to 705861 million dinars in 2016 is explained by an annual growth rate of 12.56%, with wage increases and an increase in the number of associates of social security funds during this same period, which all were a result of high oil prices. The expenses of the National Retirement Fund increased from 127920 million DZD in 2001 to 1048990 million DZD in 2016 with an annual growth rate of 15.34%, and this significant growth is due to the increasing number of retirees and people with rights during this period, as the Fund's expenditures witnessed a steady increase during the period 2011-2012 as a result The pension valuation law, where it went from 406,601 million dinars in 2011 to 572520 million dinars in 2012 with a growth rate of 40.80%, and the fund's expenditures in 2016 reached its highest level of 1048990 million dinars due to the high number of beneficiaries, and this is because many workers tend to benefit from early retirement Before its cancellation under Law 16-15.

As for the net balance, we note that it has gone through several developments that we can divide by two periods: the 2001-2012 period. This period has known several fluctuations between surplus and deficit, and it has witnessed a noticeable improvement during the period 2006-2012. As for the period 2012-2018, the net balance was known to decrease continuously from a surplus of 110,540 million DZD in 2012 to a deficit of -5.6 million DZD in 2018.

The following figure represents the development of each of the revenues and expenditures in relation to the GDP during the period (2001-2018), and it allows us to know the extent of the rate of growth of all revenues and expenditures compared to the rate of growth of GDP, where we calculated these rates to express the rate of sustainable implicit return in this study by using the ratio: the total of the National Pension Fund revenues to the GDP, the total expenditures of the National Pension Fund to the GDP, and the balance (revenue-expenditures) to the GDP.

Figure 2: Evolution of the ratio of the National Pension Fund revenues to GDP, the ratio of the National Pension Fund expenditures to GDP, and the balance ratio to the GDP

Source: Prepared by researchers using statistics from the National office of Statistics and the National Pension Fund

It is clear to us through the previous figure that the National Pension Fund suffers from a deficit of about 9% of the gross domestic product in 2018 compared to a deficit of about 1.59% in 2013 and a surplus of about 2.11% in 2012, as we note that this deficit is increasing from one year to another, which threatens the sustainability of the current retirement system.

In the next axis of this research, we will conduct a standard study with the aim of knowing the impact of the demographic factors on the deficit rates of the National Pension Fund to the GDP.

1.3 Manifestations of the demographic transition in Algeria

Most countries of the world are experiencing major demographic shifts as a result of an increase in life expectancy due to the significant decrease in the death rate made by the development of medicine and health care, and the decline of infectious diseases, and at the same time, a significant decline in fertility rates which led to a decline in birth rates. These factors gave birth to the phenomenon of aging population —The

number of old people is high compared to the number of persons in working age, especially in developed countries that have witnessed the peak of population aging.

Algeria's demographic development has gone through the first stage of the demographic transition, which is characterized by a high birth rate and high death rate and consequently low population growth rates, but at the present time it commences the second transitional stage, which is characterized by a rapid growth in the population and the result of a noticeable decrease in, while the proportion of births remained relatively high (عيساني, 2015, p. **410**).

The most important manifestations of the demographic transition in Algeria are the increasing average of life expectancy and declining fertility rates, which result in a change in the age structure of the population.

Table 1: Evolution of the fertility rate and Life expectancy in Algeria

Year	1960	1970	1980	1990	2000	2010	2018
Fertility rate	7.52	7.46	6.79	4.72	2.51	2.88	2.64
Life expectancy	46.14	50.37	58.20	66.72	70.29	74.68	76.51

Source: World Bank database

We see from the table the decline in the total fertility rates (the number of children per woman) from 7.52 in 1960 to 2.64 in 2018, and this decline in fertility rates is due to the decline in the number of births due to several factors, the most important of which is the delayed marriage age and the high educational level of women and their exit to work, as well as population policies aimed at reducing the number of births.

The statistics in the table also indicate that life expectancy in Algeria has moved from 46.14 years in 1960 to 76.51 years in 2018, and this means that life expectancy has improved by 30 years during the period 1960-2018, and this is due to the improvement in the standard of living. The number of deaths in Algeria has also decreased due to the mitigation of risks caused by epidemics and infectious diseases.

The population can be divided according to the age groups into three main categories, namely the children under 15 years, the active population category from 15 to 59 years, and the elderly category 60 years or more. The following table shows us the age structure of the population in Algeria.

Table 2: Evolution of the age structure of the population according to age groups (% of the total population)

Age groups	1966	1977	1987	1998	2000	2008	2012	2019
Less than	47.2	47.9	46.3	36.4	34	28.1	27.9	30.4
From 15 to 59	46.1	46.2	50.2	57.1	59.3	64.5	64	60.0
60 years and over	6.6	5.8	5.7	6.6	6.7	7.4	8.1	9.5
Total	100	100	100	100	100	100	100	100

Source: Prepared by researchers using statistics from the National office of Statistics

It is clear to us through the table that the age structure of the population in Algeria is characterized by the dominance of the active population group over the rest of the age groups since 1987, as we note that there is a continuous decline in the percentage of the age group under 15 years, as it moved from 46.3% in 1987 to 30.4% in a year. As for the active population group, this percentage has witnessed a continuous increase, from 46,1% in 1966 to 60% in 2019, while there is a continuous increase in the proportion of the elderly over 60 years since 1987 as it moved from 5.7% in 1987 to 9.5% in 2019.

2. An econometric study of the effect of demographic factors on the financial balance of the pension system in Algeria

To measure the extent of the influence of demographic factors on the fund balance of the pension fund in the long and short term, we look for the possibility of a co-integration relationship between the ratio of the fund's balance to the GDP and the demographic factors (life expectancy and fertility rate).

2.1. Methods and Materials

a- Data: The data on which this study will be based are time series for the period (1995-2019) where:
sources:World Bank database
        -The dependent variable is:
SOLD: Ratio of the National Pension Fund balance (revenue - expenditures) to GDP, sources:the National office of Statistics, the National Pension Fund

-The independent variables are demographic factors, which are life expectancy at birth (life expectancy) and fertility rate, sources: World Bank database

> **ESP:** life expectancy;
>
> **FIC:** fertility rate.

b- Time Series Stationary Study and Methods:

We study the Stationary of each time series by testing the unit root by conducting the extended ADF for the three models, where we first estimate the model that contains the trend and constant and then the model that contains the constant only, and then the model without a constant and without the trend as we test each time the null hypothesis H0 is the presence of the unit root in the series, that is, the series is not stationary. The test results are listed in the following table

Table 3: Unit root test results

Variable	The model	in the level		first-differences level		critical values at 5%	integration degree
		stat	prob	stat	prob		
SOLD	The first model	2.06	0.98			-1.95	**I(1)**
	The second model					-3.02	
	The third model			-4.90	0.0036	-3.65	
ESP	The first model					-1.95	**I(0)**
	The second model					-3.02	
	The third model	-5.78	0.0008			-3.65	
FIC	The first model					-1.95	**I(0)**
	The second model	-4.46	0.0023			-3.02	
	The third model					-3.65	

Source: Prepared by researchers using Eviews.9

Looking at the results of the unit root test, we notice that the SOLD is stationary after applying the first-class differences, that is, they

are integrated from the first degree, while the FIC series and ESP series are stationary in the level, that is, they are integrated from the degree 0.

Since the strings are not integral of the same degree, the VECM model cannot be applied, so we will apply the ARDL model.

2.2.   Results:

Since the co-integration of variables is a mixture of (I (0) and I (1)), the VECM model cannot be used, but the autoregressive distributed lag model- ARDL), which is distinguished from the rest of the other co-integration methods by that the boundary test in this methodology can be applied if time series are Stationary at their I (0) levels or at the first difference I (1) or a mixture between the two.

The ARDL form in this case is written as follows:

$$d(SOLD_t) = c + \lambda SOLD_{t-1} + \beta_1 ESP_{t-1} + \beta_2 FIC_{t-1}$$
$$+ \sum_{i=1}^{m} \alpha_{1,i} d(SOLD_{t-1}) + \sum_{i=1}^{k} \alpha_{2,i} d(ESP_{t-1})$$
$$+ \sum_{i=1}^{k} \alpha_{3,i} d(FIC_{t-1}) + \varepsilon_t$$

$d(SOLD_t)$ is the first difference of the dependent variable balance / GDP, and is explained by:

Long term information which is: $(c + \lambda SOLD_{t-1} + \beta_1 ESP_{t-1} + \beta_2 FIC_{t-1})$

Short-term information: Consists of the block of delays of the dependent variable $\sum_{i=1}^{m} \alpha_{1,i} d(SOLD_{t-1})$, and the block of delays of the explained demographic variables $\sum_{i=1}^{k} \alpha_{2,i} d(ESP_{t-1})$; $\sum_{i=1}^{k} \alpha_{3,i} d(FIC_{t-1})$

in which:

λ represents the error correction parameter and must be negative and significant in order for there to be a long-term relationship between investment and savings which is the percentage of short-term errors that can be corrected over a period of time to return to balance in the long term.

β:It is the parameter capacity of the variables explained in the long-term relationship.

$b_1 = -\frac{\beta_1}{\lambda}$: is the long-run equation between the balance as a dependent variable and life expectancy as an interpreted variable.

$b_2 = -\frac{\beta_2}{\lambda}$: is the long-term equation between the balance as a dependent variable and the fertility rate as an interpreted variable.

After estimating the model parameters for the period (1995-2019), we obtained the following results: (Estimation results in the appendix)

Table 4: Results of estimation of an ARDL model (1, 2, 4)

Selected Model: ARDL(1, 2, 4)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
SOLD(-1)	-0.542006	0.211198	-2.566338	0.0262
ESP	5.118082	11.39753	0.449052	0.6621
ESP(-1)	-79.28500	20.29212	-3.907182	0.0024
ESP(-2)	66.41909	14.03414	4.732679	0.0006
FIC	-23.77830	37.74902	-0.629905	0.5416
FIC(-1)	-194.0201	91.80192	-2.113464	0.0582
FIC(-2)	314.0090	140.1483	2.240548	0.0467
FIC(-3)	17.62754	150.8234	0.116875	0.9091
FIC(-4)	-150.8281	69.83489	-2.159782	0.0537
C	693.6862	103.0734	6.730024	0.0000
R-squared	0.991902	Mean dependent var		-1.724088
Adjusted R-squared	0.985276	S.D. dependent var		3.438398

Source: using Eviews.9

Optimal model with the graph of the SIC information criterion

Figure 2: Optimal model with the graph of the SIC information criterion
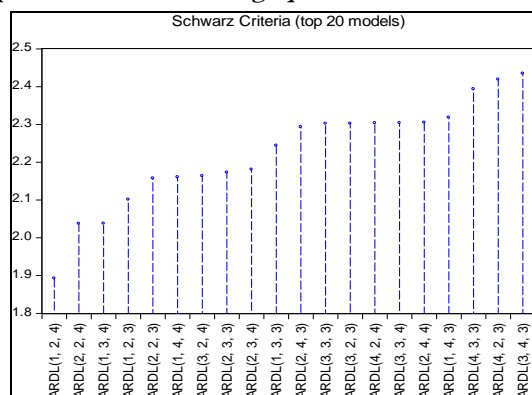
Source: using Eviews.9

As can be seen, the ARDL model (1,2,3) is the most optimal among the 19 others presented, because it offers the smallest value of the

SIC. Moreover, with regard to the tests which help to diagnose the estimated ARDL model, we note the absence of autocorrelation of the errors, there is no heteroskedasticity, and the model has been well specified, as for the normal distribution test, the errors do not follow the normal distribution, and this is due to the presence of a small number of observations(Cfr Table 5):

Table 5: Estimated ARDL model diagnostic test results

Test hypothesis	Tests	Values (probability)
Autocorrélation	Breusch-Godfrey	2.579750(0.1301)
Heteroskedasticity	Breusch-Pagan-Godfrey	1.061119(0.4552)
Normalité	Jarque-Bera	*8.085 (0.0175)*
Spécification	*Ramsey RESET*	0.041973(0.8418)

Source: using Eviews.9

The null hypothesis is accepted for all these tests except for the normal distribution of errors. Thus, our model was statistically validated. The estimated ARDL model (1,2.4) is generally good and explains the dynamics of SOLD / GDP in Algeria, from 1995 to 2019 at a rate of 98.52%.

To ensure the presence or absence of a long-term relationship, we conduct a Bounds Testing, where the null hypothesis states that there is no co-integration relationship between investment and savings.

Table 6: Bounds Testing results

Test Statistic	Value	k
F-statistic	19.53	2
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Source: using Eviews.9.

The results in the previous table show that the calculated Fischer statistic value is greater than the Tabular value for the upper limit of the Bounds Test (l1) at the 5%, 2.5% and 1% significance levels, and therefore we reject the null hypothesis, and this confirms the existence of a long-

term relationship (co-integration relationship) from life expectancy and fertility rate towards the balance of the pension fund.

Table 7: Results of the error correction factor estimate and long-range parameters

parameters	error correction factor(λ)	long-range parameters		
		$b_1 = -\dfrac{\beta_1}{\lambda}$	$b_2 = -\dfrac{\beta_2}{\lambda}$	$a = -\dfrac{c}{\lambda}$
Results of the estimate	-1.54 (0.00)	-5.02 (0.00)	-23.98 (0.01)	449.85 (0.00)

Source: Prepared by researchers using Eviews.9.

Through tables 7, we notice the significance of the long-term parameters is about 5%, and we note the significance and negativity of the error correction factor.

2.3 Analysis of the results:

To answer the hypothesis of the study, we conducted a econometric study of the relationship between the financial balance of the retirement fund in proportion to the gross domestic product and demographic factors represented in life expectancy and fertility rate based on the theory of co-integration during the period (1995-2019).

It is clear from the results in the table7 that the ESP and fic variables have a significant effect on sold in the long run, as well as significant and negative error correction coefficient, which reveals the existence of a co-integration relationship of explanatory variables (life expectancy and fertility rate) towards the dependent variable (the financial balance of the pension fund), that is, there is 154% of the imbalance in the short term that is corrected annually to return to the balance in the long, and this means that increased fertility rates and life expectancy result in an increase in The National Pension Fund deficit.

As expected, there is a negative relationship between the financial balance of the pension fund and life expectancy in the long run, where an increase in life expectancy by one unit increases the deficit of the National Pension Fund relative to GDP by 5.02 units, and this is due to the fact that The higher the life expectancy, the longer the retirement stage and the longer the pension benefit period, which leads to an increase in expenses and this increase is not matched by an increase in income that is affected by the length of service and the collection of contribution proceeds. One of the manifestations of the demographic transition in Algeria is the rise in life expectancy due to the continuous decline in the crude death rate as

a result of progress in the health field, which has led to a change in the age structure of the population, where the number of elderly people is increasing at a greater rate than the increase in the population of working age. As the proportion of the elderly reached 9.5% of the total population in 2019. According to the forecasts of the National Bureau of Statistics, life expectancy in Algeria will continue to rise to 82 years for males and 83 years for females in the horizons of 2040, leading to an increase in the proportion of the elderly to the threshold of 17.72% of the total population, which aggravates the financial deficit of the Fund and threatens the sustainability of the pension system for future generations if Algeria does not undertake the necessary reforms.

The results also showed that a rise in fertility rates by one unit leads to an increase in the deficit of the National Pension Fund by 23.98 units, and this means that an increase in fertility rates leads to a decrease in the revenues of the National Pension Fund, contrary to economic theory. the negative fertility rate may be due to the fact that the study period is short, so the population born during the study period (1995-2019) is still mostly outside the labor market and uninterested. in paying contributions because they are still dependents. This may explain the negative effect of the fertility rate on the financial balance of the pension fund. Figures indicate that one of the manifestations of the demographic transition in Algeria is the continuous decline in the fertility rate, and therefore the arrival of those born in the study period (1995-2018) to working age may lead to a decrease in the number of the active population, which leads to a decline in the collection of contributions, which is reflected negatively. Directly on incomes, exacerbating the deficit of the pension fund. The results of the Schroth (2018) study find that continued population aging as a result of increases in life expectancy and lower fertility rates in European societies leads to a decrease in employment and an increase in spending on public pensions.

The results of the study show that the continuous increase in the proportion of the elderly in the total population has led to an increase in the number of beneficiaries of the retirement system (retirees and those with rights) at a faster pace than the number of participants (workers who pay pension contributions), which is growing weakly due to the increase in unemployment rates, and employment in The informal market, and the failure to create new jobs due to the collapse of oil prices, Where the figures of the National Pension Fund indicate that the proportion of the number of social insurance subscribers decreased from 2.7 subscribers per retiree in 2001 to about 1.5 subscribers per retiree in 2017, which led to

the growth of the expenditures of the National Pension Fund at a rate greater than the growth of revenues, and the exacerbation of its financial deficit from year to year. According to the study of Mohamed and Ismail (2017), the expected actuarial deficit in social insurance funds is due to demographic changes resulting from the increase in life rates, which means that the compensation is paid for a longer period and is not offset an increase. in contributions.

This financial deficit is not only due to the large increase in the number of beneficiaries as a result of the increase in the number of the elderly, but is also due to the increase in the number of beneficiaries of early retirement forms within the framework of the regulatory provisions that govern retirement, as we find a good number of workers who have not reached the retirement age. (60 years) benefited from proportional retirement and retirement without the age condition before its abolition by Law No. 16/15, which led to an increase in the number of retirees who did not reach the retirement age (60 years). Consequently, expenditures will increase and revenues will decrease, and in light of the increase in life expectancy, the period of early retirement pensions will be prolonged for a long time, which in turn will exacerbate the financial imbalance of the pension fund, but the deficit resulting from this problem will gradually disappear as a result of the abolition of early retirement models, the matter Which may improve the financial position of the Fund in the short term. But it doesn't radically solve it because life expectancy continues to rise.

Most studies prove that the distributive pension system is more sensitive and affected by demographic changes. Faced with this situation, Algeria will find itself facing the problem of the unsustainability of the pension system due to the aggravation of its financial deficit from year to year, due to the continuous rise in life expectancy that leads to the extension of the retirement period and benefit from it. From pensions, and therefore raising the retirement age would reduce the period of benefit from pensions and thus reduce expenses on the one hand, and prolong the service period and raise the collection of contributions and thus increase revenues on the other hand, which leads to positive results on the financial balance in the short term. However, in the long term, the fund will return to a state of deficit, since the extension of the period of service of existing workers will mean an increase in unemployment rates among the active group, which will negatively affect. It affects the fund's financial balance, the labor market and productivity in the long term.

3 CONCLUSION

The distributive retirement system in Algeria is based on the principle of solidarity between generations and is managed by the National Retirement Fund CNR, through which contributions are deducted annually from workers' wages in addition to investment fund returns and 2% of petroleum taxation since 2006. As for the expenditures of the National Pension Fund They are pensions and grants paid to retirees and rights holders.

The financial balance of the National Pension Fund witnessed several developments between a surplus and a deficit, and since 2013 it has been in a state of continuous and increasing deficit from year to year, as it moved from a surplus of 110,540 million dinars in 2012 to a deficit of -560,000 million dinars in 2018, and this decline is primarily due to Implementation of exceptional measures in 2012 for retirees, including the revaluation of 15 to 30% of retirement pensions and grants, raising the minimum retirement pension to 15,000 dinars, increasing the number of beneficiaries of early retirement models, and decreasing oil taxation as a result of the drop in oil prices since 2014. This led to a decrease in the pension fund resources.

It is clear from our results that in light of the continued rise in life expectancy as a result of the demographic transition, the number of elderly people will continue to rise at a rate higher than the number of the active population, and this means that in the absence of reform of the pension system, the deficit of the National Pension Fund will continue, and this threatens its sustainability for future generations, especially that the pension system Retirement in Algeria is based on the principle of distribution that is most affected by demographic changes, unlike the pension system based on the principle of capitalization.

Raising the retirement age can reduce the financial deficit of the retirement fund in the short term, but in the long run, this solution will lead to an increase in unemployment rates for the working-age population. Therefore, reforming the retirement system in Algeria requires in-depth actuarial studies that include all demographic and economic variables such as unemployment and the informality market, wages, etc., which allows for the development of a pension system that responds to all these changes and achieves social justice.

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