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ASSESSMENT OF FACTORS AFFECTING THE FINANCIAL EQUILIBRIUM OF THE SOCIAL SECURITY SYSTEM FUNDS IN ALGERIA

Mohamed El Amine Maouche
Setif 1 University, Setif, Algeria.
https://orcid.org/0000-0001-8615-9714

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ABSTRACT

This study examines the combined factors affecting the Financial Equilibrium (FE) of Algeria's Social Security System (SSS) funds. The research adopts a descriptive and analytical approach to establish the theoretical framework and to investigate the main factors influencing the FE of the system. Empirical analysis was conducted using data from reports of the National Office of Statistics (ONS) covering the period from 2007 to 2017. To evaluate the simultaneous effect of the selected variables on FE, a multiple linear regression model was employed. The findings indicate that social security adequacy, benefits growth, social security coverage, and the operating costs ratio exert a statistically significant effect on the FE of the Algerian SSS funds. In contrast, contributions growth and the average benefit per contributor did not show a statistically significant effect within the estimated model. These results suggest that the FE of the SSS is shaped more strongly by expenditure structure, coverage dynamics, and administrative cost efficiency than by contribution growth alone.

1 INTRODUCTION

The Social Security System (SSS) is an essential element of industrial and service economies, offering protection against diverse social risks such as disease, unemployment, and old age, necessitating sufficient funds to address the recurrence and aggravation of these risks.

This is why Algeria adopted a set of reforms to the SSS in 1983, resulting in the passing of legislation that facilitated the localization of the SSS and its autonomy from outdated French regulations. It also paved the way for subsequent reforms and policies that improved various social services and insurance coverage, such as the third-part payment system, as well as digitizing the sector by introducing the *Chifa Card*, *El-Hanaa* space and diversifying funding sources.

Recently, many studies have focused on Algeria's SSS reforms and their impact on its Financial Equilibrium (FE), where the metrics analyzed varied from one study to another. Maouche (2024)

Address of the corresponding author:
Mohamed El Amine Maouche
maouche.medelamine@univ-setif.dz

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employed both the contributions to benefits ratio and the operating costs ratio to highlight the financial cost of risks that are not classified as occupational risks, notably psychosocial risks, and demonstrate how this impacted the FE of the Algerian SSS. While Berber (2019) reviewed many reforms implemented for the SSS in Algeria and their effects on the FE, in which he applied a descriptive approach, which emphasized the growth of contributions and benefits. Also, Tehten & Mezioud (2014) used the descriptive approach in data analysis to evaluate the benefits and contributions to sustain the FE of SSS in Algeria.

Against this background, it is clear that the FE of Algeria's SSS has been addressed from various perspectives, with priority on particular metrics (factors) rather than an exhaustive assessment. Therefore, this study tries to assess the combined factors affecting the FE of the SSS's funds: the national social insurance fund for salaried workers (CNAS), the social insurance fund for self-employed professionals (CASNOS), and the national retirement fund (CNR), (CNAC) and (CACOBATPH) funds.

Based on the above, the main research question of this study is:

RQ: *What is the extent to which the combined factors affect the Financial Equilibrium (FE) of Algeria's Social Security System (SSS) funds?*

To tackle the research question, we put forward the subsequent hypotheses:

H_1: The Adequacy of SS has a statistically significant effect on the FE of SSS funds in Algeria.

H_2: The Contributions Growth has a statistically significant effect on the FE of SSS funds in Algeria.

H_3: The Benefits Growth has a statistically significant effect on the FE of SSS funds in Algeria.

H_4: The Average Benefit per Contributor has a statistically significant effect on the FE of SSS funds in Algeria.

H_5: The SS Coverage has a statistically significant effect on the FE of SSS funds in Algeria.

H_6: The Operating Costs have a statistically significant effect on the FE of SSS funds in Algeria.

2 OVERVIEW OF THE ALGERIAN SOCIAL SECURITY SYSTEM

The beginnings of SSS in Algeria link us back to the French presence, as the colonial authorities established the first SSS under Law 49-4**.** Then, between 1950 and 1951, social security funds were formed and divided into three categories: the central social insurance fund, the professional social insurance fund, and the private insurance fund. Following independence, French regulations continued in practice through Law 62-157, until the Algerian state began to localize its social security system in two key phases:

- The first phase between 1962 and 1983

Several successive texts were issued to readapt the SSS to the specific nature of the period, which was characterized by administrative vacancies and a lack of professionally qualified personnel, in addition to the presence of several heterogeneous funds, around seventy, low contributions, and unpaid expenditure. However, Executive Decree No. 70-116, which dealt with the administrative organization of social security bodies, eliminated the previous funds and established six new ones, allowing non-employees and farmers to obtain social insurance coverage.

- The second phase after 1983

In accordance with the Algerian state's reform approach to its SSS and its efforts to generalize security to all parts of society. In 1983, the Algerian legislator released a collection of laws (Law No.83, 1983) :

- Law No. 83-11 for social insurance;
- Law No. 83-12 for retirement ;
- Law No.83-13 for work accidents and occupational diseases;
- Law No. 83-14 for payer obligations in social security;
- Law No. 83-15 for social security disputes.

This period was distinguished from the previous one by the generalization of benefits and privileges to all, as well as the new administrative organization of SSS established two basic funds, the national Fund for social insurance, work accidents, occupational diseases (CNASAT) and

the national retirement fund (CNR). Thus eliminating the six funds established earlier (Decree No.85-223, 1985).

After the issuance of the 1989 constitution, Algeria abandoned socialism in favor of capitalism, which required adapting the SSS to these new transformations.The CNAS was established to replace the CNASAT, as well as the establishment of the CASNOS as a new fund (Executive Decree No.92-07, 1992).

Later, other funds were added, in accordance with the requirements of the economic phases, including the national unemployment insurance fund (CNAC) in 1994 and the National Fund for Paid Leave and Unemployment Resulting from Bad Weather in the Construction, Public Works, and Hydraulics Sectors (CACOBATPH) in 1997 (Merouani & Hammouda, 2014, p. 124).

2.1 The Structure of the Social Security System in Algeria

The current institutional structure of Algeria's social security system consists of five basic funds:

2.1.1 The National Social Insurance Fund for Salaried Workers (CNAS)

It replaced the CNASAT fund, which was established in 1985 following restructuring, thereby becoming a public institution with financial autonomy and self-management. It oversees social services pertaining to workers, addresses various accidents at work and occupational diseases (Executive Decree No.92-07, 1992), registers worker affiliations, collects contributions, facilitates and organizes medical oversight and social security disputes, and enters into agreements with practicing physicians and medical institutions (Abderrahmane & Scalera, 2023, p. 20).

2.1.2 The Social Insurance Fund for Self-Employed Professionals (CASNOS)

It was founded on January 4, 1992, by decree No. 92-07. Its objective is to manage in-kind and cash social insurance services for self-employed professionals like traders, farmers, craftspeople, and others. Additionally, the CASNOS collects and monitors contributions for financial services and arranges, coordinates, and carries out medical monitoring (Kharroubi & Boudellal, 2024, p. 247).

2.1.3 The National Pension Fund (CNR)

A public entity possessing legal personality and financial autonomy was created by decree No. 85-223. The goal of its founding was to manage the various retirement systems that previously existed and unite them into a retirement system that grants the same benefits to all workers regardless of their field of activity. According to the article No. 09 of decree No. 92-07, the CNR was charged with managing retirement wages and grants, as well as the revenue of individuals, ensuring collection operation, monitoring and resolving disputes over contributions required to finance retirement services (Executive Decree No.92-07, 1992).

2.1.4 The National Unemployment Insurance Fund (CNAC)

This Fund was established by decree No. 94-11 as a result of Algeria's transition from socialism and economic centralization to capitalism and a market economy. This economic and political situation brought with it a social crisis that affected over 400,000 workers who were unemployed due to the insolvency of their employing companies. The CNAC was charged with monitoring and updating contributors' cards, as well as collecting contributions to finance unemployment insurance benefits and resolving disputes (Executive Decree No. 94-188, 1994).

2.1.5 The National Fund (CACOBATPH)

It was established on February 4, 1997 by decree No. 97-45, as a public body with legal personality and financial autonomy. the National Fund for Paid Leave and Unemployment Resulting from Bad Weather in the Construction, Public Works, and Hydraulics Sectors (CACOBATPH) was formed to manage and control paid holidays and unemployment caused by adverse weather. Also identifying and numbering beneficiaries and employers, collecting contributions, allocating financial reserves to assure the payment of social benefits in any situation (Executive Decree No. 97-45, 1997).

2.2 Social Security Funding in Algeria

Two main sources fund Algeria's social security system:

- Contributions, and
- Government Subsidies and Transfers.

2.2.1 Contributions

They are the primary source of funding for Algeria's SSS funds. The contribution rate was grouped according to the types of contributors:

- Salaried workers pay 34.5% of their wages, divided between employees and employers, as shown in Table 1.
- Self-employed professionals pay 15% of their non-taxable income or the guaranteed minimum yearly wage, divided evenly between social insurance and retirement benefits.

Table 1. The Contribution Rate Distribution

	Employer	Employee	Social Services	Total
Social Insurance	11.50%	1.50%		13%
Work Accidents, Occupational Diseases	1.25%			1.25%
Retirement	11%	6.75%	0.50%	18.25%
Pre-Retirement	0.25%	0.25%		0.50%
Unemployment Insurance	1%	0.50%		1.50%
Total	25%	9%	0.50%	34.50%

Source: (Executive Decree No. 15-236, 2015)

According to Table 1, the contribution rate is distributed as follows: 14.25% for the benefit of the CNAS fund, 18.75% for the CNR fund, and 1.50% for the CNAC fund. Also, the employers give 25%, workers contribute by 9%, and the Social Services Equalization Fund (FNPOS) contributes by 0.5%.

2.2.2 Government Subsidies and Transfers

Many countries finance a portion of their SSS through government subsidies and transfers, such as insurance services for children, housewives, the elderly, and the unemployed, or health coverage, in which the state contributes up to 60% of the cost of social security.

In Algeria, the government's contribution consists of disbursing family allowances and grants, as well as benefits directed to serving national solidarity for retirees who receive low retirement grants, in addition to other sources of financing such as investment returns, employer contributions to unemployment insurance and advance retirement, increases late fees, and other penalties imposed on employers who fail to meet their obligations (Mahmoudi & Ghedjati, 2020, p. 342).

3 METHODS

To test hypotheses and answer research questions, the descriptive approach was used to present and analyze data related to the concepts. The multiple linear regression was also used to construct the effect model of the combined factors on the FE of the SSS, using the statistical analysis program SPSS v27.

The population considered in this study is the Social Security Funds, and the research sample consisted of five funds, each of which was observed for 11 years from 2007 to 2017, providing a total of 55 observations.

The data were taken from the National Office of Statistics' (ONS) yearly reports, and it is important to highlight that 2017 was chosen as the study's cutoff year because the ONS has not published any subsequent yearly reports on social security in Algeria.

The study includes two types of variables: the dependent variable and the independent variables. Therefore, the statistical representation of the multiple linear regression model is presented as follows (Uyanık & Güler, 2013, p. 235):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_n X_n + \varepsilon$$

Where:

Y: is the dependent variable;
β_0: is the intercept value;
β_i: are the estimated regression coefficients of respective independent variables;
X_i: are the independent variables (Table 2);
ε: is the model error, i.e. the variation of our estimate of Y with respecting to the real value.

3.1 Dependent variable

This study investigates the FE as the dependent variable, which represents the amount of the SSS funds surplus or deficit as a consequence of the difference between total contributions collected and total benefits paid during the year. Table 2 shows that the financial equilibrium (FE) of social security funds varied between 2007 and 2017, with periods of increase and decrease. The FE of the CNAS increased continuously from 9645.19 million DZD in 2007 to 196532.29 million DZD in 2012, before declining sharply to 57113.24 million DZD in 2017. The other funds showed similar variation, with the exception of the CNR, which had a continuous and growing deficit after 2012, from 9.2 million DZD to 486.3 million DZD in 2017.

Table 2. *Financial Equilibrium Evolution (Million DZD)*

Years	CNAS	CNR	CASNOS	CNAC	CACOBATPH
2007	9645.19	-5.81	-840	14167	2494
2008	25696.9	6.14	15	17436	2761.17
2009	50176.06	18.8	1356	6147	3497.41
2010	81093.01	10.41	3432	13160	3754.53
2011	133531.01	67.3	1836	1121	3179.28
2012	196532.29	106.5	4180	2778	3241.32
2013	107314.58	-9.2	2438	17734	3449.56
2014	85696.29	-155.1	376	14262	2870.36
2015	79549.06	-265.5	960	22998	3143.34
2016	81511.75	-312.6	21944	20777	3619.14
2017	57113.24	-486.3	12228	-60238	1427.94

Source: (ONS, 2021)

3.2 Independent Variables

Table 3 summarizes the independent variables of the research, specifically their measurement, dimension, and the previous research that applied them.

Table 3. *Independent Variables Description*

Variables	Measurement	Unit	Dimension	References
Adequacy of Social Security	$X_1 = \frac{\text{Total Contributions}}{\text{Total Expenditures}}$	%	Financial	(Yuh, 2011) (ILO, 2021) (World Bank, 2023)
Contributions Growth	$X_2 = \text{Ln}\left(\frac{\text{Contributions (n + 1)}}{\text{Contributions (n)}}\right)$	%	Financial	(Olalekan, 2018) (Pramusinta et al., 2023)
Benefits Growth	$X_3 = \text{Ln}\left(\frac{\text{Benefit (n+1)}}{\text{Benefit (n)}}\right)$	%	Financial	(Popova, 2023) (Santos & Simões, 2025)
Average Benefit per Contributor	$X_4 = \frac{\text{Total Benefits}}{\text{Number of Contributors}}$	Million DZD	Benefit	(ILO, 2021) (World Bank, 2023)
Social Security Coverage	$X_5 = \frac{\text{Number of Contributors}}{\text{Working Population}}$	%	Coverage	(ILO, 2021) (World Bank, 2023)
Operating Costs Ratio	$X_6 = \frac{\text{Operating Costs}}{\text{Total Expenditures}}$	%	Performance	(Maouche, 2024)

Source: inspired by the author

4 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4 presents the lowest value of the ln (FE), which is 5.16 for 312.6 million DZD as a real value, the maximum value of ln (FE) is 12.9 for 196532.292 million DZD, and the average value of ln (FE) is 8.8525 for 6988.05 million DZD as a real value.

Furthermore, the results of Table 4 demonstrate that the average adequacy of social security is 116.16%, with proportions ranging from 59% to 200%. The average contributions growth is 12.77%, with proportions varying from -136% to 123%, whereas the average benefits growth is 3.6% with proportions ranging from -131% to 49%. The average benefit per contributor is 0.02565 million DZD, with values varying from 0.00024 to 0.26 million DZD.

The average Social Security Coverage reached 25.65% with 100% as maximum, while the average operating costs ratio was 42.86% with proportions ranging from 4% to 100%.

Table 4. Descriptive Statistics (N=55)

Variables	Minimum	Maximum	Mean	St. Deviation
Financial Equilibrium	5.16	12.19	8.8525	2.10926
Adequacy of Social Security	0.59	2	1.1616	0.26299
Contributions Growth	-1.36	1.23	0.1029	0.36850
Benefits Growth	-1.31	0.49	0.0360	0.27723
Average Benefit per Contributor	0	0.26	0.0251	0.04749
Social Security Coverage	0	1	0.2565	0.33401
Operating Costs Rate	0.04	1	0.4286	0.33205

Source: based on the output SPSS v27

4.2 Assumptions Checks

Prior to executing the multiple linear regression model, it is essential to validate certain assumptions:

4.2.1 Linearity & Homoscedasticity Assumptions

According to (Uyanık & Güler, 2013, p. 236), linearity refers to a proportional relationship between the independent and dependent variables. At the same time, homoscedasticity indicates that the variance of residuals is constant across predicted values.

Figure 1 shows that the points are randomly distributed around the horizontal line at zero, with no discernible pattern, so validating both the assumptions of linearity and homoscedasticity.

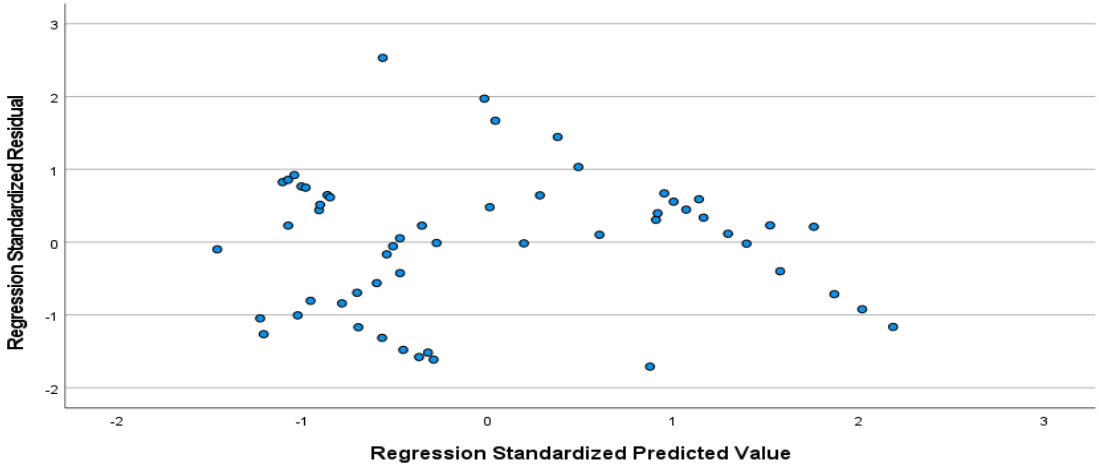

Figure 1. Scatterplot of Residuals vs Predicted values
Source: based on the output SPSS v27

4.2.2 Multicollinearity Assumption

To confirm that there is no multicollinearity, the Variance Inflation Factor (VIF) and the Tolerance tests were employed to check this assumption. Tolerance and VIF values were calculated for each independent variable listed in Table 5. It is obvious that all tolerance values for all variables are higher than 0.1 (Uyanık & Güler, 2013, p. 238) and the VIF values for all variables are less than 10 (Bobbitt, 2021), consequently verifying the assumption of multicollinearity.

Table 5. *Tolerance & VIF Tests*

Independent Variables	Tolerance	VIF
Adequacy of Social Security	0.601	1.663
Contributions Growth	0.917	1.091
Benefits Growth	0.667	1.499
Average Benefit per Contributor	0.648	1.543
Social Security Coverage	0.639	1.565
Operating Costs Rate	0.5	2.001

Source: based on the output SPSS v27

4.2.3 Normality of Residuals Assumption

Table 6 indicates that the significance value of (Sig = 0.2) exceeds the predetermined threshold (α = 0.05). So the null hypothesis (H_0): the residue is normally distributed, is accepted, while the alternative hypothesis is rejected (Barakat et al., 2022, p. 224).

Furthermore, Figure 2 illustrates the Q-Q plot, where the points approximately align along a straight diagonal line, indicating that the normality assumption of multiple linear regression is met.

Table 6. *Kolmogorov-Smirnov Test*

	Statistic	df	Sig
Standardized Residual	0.095	55	0.2

Source: based on the output SPSS v27

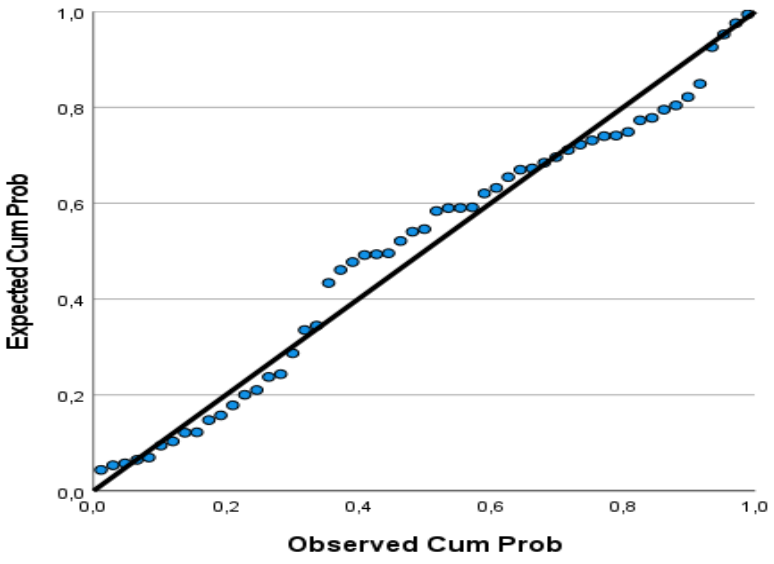

Figure 2. *Normal Q-Q plot of Financial Equilibrium*

Source: based on the output SPSS v27

4.2.4 Outlier's Assumption

To confirm the absence of outliers, Cook's distance was calculated for each point. Table 7 indicates the maximum value is 0.411, which is less than 1 (Trunfio et al., 2022, p. 4), confirming that no outliers exist in the datasets and verifying the assumption regarding outliers.

4.3 Regression Analysis

Table 7 shows the ANOVA Statistics with F (6.55) =17.316 and a significance value of (Sig = 0.001), which is less than the predetermined threshold ($\alpha = 0.05$). So, the null hypothesis (H_0) that the model has no overall statistical significance, is rejected. In comparison, the alternative hypothesis is accepted. Consequently, the regression model employed to examine the factors impacting the SSS's FE is shown to be appropriate. Moreover, changes in these factors as the model's independent variables explain 68.4% of the variance in FE, whereas other factors explain 31.6%, according to the R^2 value 0.684.

Table 7. *Multiple Linear Regression Results*

	Coefficients	Std.Error	t-Statistic	Sig (p-value)
constant	2.455	0.981	2.502	0.016
Adequacy of Social Security	3.972	0.839	4.732	0.001
Contributions Growth	-0.430	0.485	-0.887	0.38
Benefits Growth	-1.714	0.756	-2.268	0.028
Average Benefit per Contributor	-0.047	4.476	-0.01	0.992
Social Security Coverage	3.610	0.641	5.632	0.001
Operating Costs Rate	2.253	0.729	3.09	0.003
R=0.827 R^2=0.684 F(ANOVA)=17.316 Sig=0.001 Cook's Distance: min=0.000, max=0.411				

Source: based on the output SPSS v27

Furthermore, the regression model coefficients using the T test, with P-values less than $\alpha = 0.05$ indicating statistical significance, are shown in Table 7. The results revealed that the adequacy of social security has a notable and positive impact with a regression coefficient of 3.972 and a significance value of (Sig = 0.001), indicating that the adequacy of social security has a statistically significant effect on the FE of SSS in Algeria. Therefore, hypothesis 1 is accepted. This fits with Yuh's (2011) findings and is further supported by assessments from the World Bank and the International Labour Organization (2021).

Similarly, social security coverage has a considerable positive effect with ($\beta = 3.610$) and (Sig = 0.001), indicating that increasing the number of contributors greatly affects the FE of SSS in Algeria. As a consequence, hypothesis 5 is accepted. This is supported by assessments from the World Bank and the International Labour Organization (2021).

Operating costs ratio also displays a significant positive coefficient equal to 2.253 and a significance value of (Sig = 0.003), indicating that the operating costs ratio has a statistically significant effect on the FE of SSS in Algeria. Thereby, hypothesis 6 is accepted. This is aligned with the previous study of Maouche (2024).

Benefits growth has an immense negative effect with ($\beta = -1.714$) and (Sig = 0.028), showing that the growth in benefits reduces the financial equilibrium. Therefore, hypothesis 3 is accepted. This is aligned with the previous studies of Santos and Simoes (2025), Popova (2023), Berber (2019), and Tehten and Mezioud (2014).

In contrast, contributions grow with (Sig = 0.380), and average benefit per contributor with (Sig = 0.992) indicate no statistically significant effects, meaning that their impact is insufficient for drawing significant predictions from this model. So, hypotheses 2 and 4 are rejected. From the prior results, the regression equation is:

$$Y = 2{,}455 + 3{,}972X_1 - 0{,}43X_2 - 1{,}714X_3 - 0{,}047X_4 + 3{,}610X_5 + 2{,}253X_6$$

Where: Y: financial equilibrium; X_1: adequacy of social security; X_2: contributions growth; X_3: benefits growth; X_4: average benefit per contributor; X_5: social security coverage; X_6: operating costs ratio.

5 CONCLUSIONS

Based on the test results and discussion, it is concluded that the four factors of social security performance-namely, the adequacy of the social security system, benefits growth, social security coverage, and the operating cost ratio- had a statistically significant effect on the FE of SSS funds in Algeria. Empirically, the regression model demonstrates how a one-unit rise in the SS adequacy results in a 3.972-unit improvement in FE. This emphasizes the importance of social security adequacy to enhance the financial equilibrium of Algeria's SSS.

Similarly, a one-unit increase in social security coverage leads to a 3.610-unit enhancement in FE. This reflects the level at which the workforce is integrated into the formal social security system, directly impacting the financial equilibrium of the system. A high coverage ratio presents a significant number of workers who engage in contributing to systems, ensuring consistent cash flows and increasing the system's capacity to provide adequate benefits.

Likewise, a one-unit change in the operating costs ratio results in a 2.253-unit rise in FE. This emphasizes the important role of the operating costs ratio as a key indicator of the operational efficiency and cost structure of the SSS funds.

In contrast, a one-unit increase in benefits growth results in a -1.714-unit decline in FE. This points to an inverse relationship between benefit growth and FE, implying an issue with contribution distribution, resulting in reduced FE capacity and efficiency. Overall, the observed effect underlines the importance of adopting a balanced approach that takes into account unexpected effects when implementing policies for rationalizing benefits and other forms of spending.

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