

Comparative study of Moroccan pension systems in terms of generosity

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Abstract— The pension system is based on the Bismarckian principle: it is compulsory, professional and contributory. Employees in the public sector and private companies are subject to the obligation of liability. Pensions are defined benefit, calculated on the basis of the number of years of contributions and a reference salary. The financing is done on a pay-as-you-go basis, the retirement pensions are paid by the contributions of the working population (at the expense of employers and employees). Some Moroccan pension funds implement a funded distribution: the purpose of the reserves is to allow the setting of contribution rates ensuring balance over the medium term. Morocco has four funds, two for the public (Caisse Marocaine des Retraites for holders, Régime Collectif d'Allocation de Retraite for contract employees) and two for the private sector (Caisse Nationale de Sécurité Sociale for private employees and Caisse Interprofessionnelle Marocaine des Retraites). We have seen previously that one of the functions of retirement is redistribution as well as the Moroccan pension system is often described as generous, we will deal with this notion later, by studying different indicators to know which is the most generous fund.

Index Terms— retirement system, generosity, redistribution, intergenerational, intergenerational.

1 INTRODUCTION

The pension system is based on the Bismarckian principle: it is compulsory, professional and contributory. Employees in the public sector and private companies are subject to the obligation of liability.

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We have seen previously that one of the functions of retirement is redistribution as well as the Moroccan pension system is often described as generous, we will deal with this notion later,

by studying different indicators in order to know which fund is the most generous. This article is based on the work of several researchers who have tried to analyse the impact of pension reforms around the world, in particular the work of Samia Benallah, Carole Bonnet, Renginar-Dyangac, Claire El Moudden and Antoine Math who have proposed reforms for the sustainability of pension systems. In this sense, Morocco has embarked on a process of analysis and reform of its pen-

sion systems, a reform that must meet the expectations of the political, economic and social world. These reforms have an impact on the redistribution that occurs in different generations and within the same generation. In this context, our article will constitute an attempt to answer and analyze the generosity of the Moroccan pension system.

2 INTRA-GENERATIONAL GENEROSITY MEASURES

Intra-generational generosity can be characterised by high profitability, a high level of pensions paid, an early retirement age and, finally, a high level of attention paid to low-income policyholders. The table below lists these four categories, giving examples of indicators usually proposed to measure, more or less strictly, the internal generosity of the systems.

Generosity and profitability

- theoretical internal rate of return, calculated on a typical case
- real rate of return (over different generations)
- recovery time

Generosity and level of pensions paid

- Average retirement by plan (by age and sex)
- Overall average pension (all schemes combined) of all pensions (by age and sex)
- Distribution of retirement pensions (quartiles or deciles)
- Annuity rates
- Statutory pension rates (as set by the scales in the legislation): maximum (and/or for a long career), for a shorter career, etc.
- Theoretical replacement rates on typical careers
- Real macroeconomic replacement rate (average pension /

average wage in the economy)

- Real replacement rate (on actual data): average real replacement rate of the last salary at liquidation for a given year (by sex and age)

- Average real replacement rate per salary level (with, for each salary level, the proportion of liquidating pensions concerned)

Generosity and retirement age

- Standard legal age (minimum) per plan (declined by sex)
- Minimum age legal for early retirement schemes (declined by sex)
- Average effective liquidation age (or similar information) per plan and/or for all liquidating pensions (broken down by sex)

Generosity towards low-income insureds

- Amounts of minimum pension contributions for a long career - by scheme (in national currency, euro, PPP (purchasing power parity)...)
 - Minimum amounts expressed as a function of average pension, average wage, minimum wage, GDP per capita (or per worker)
 - Minimum amounts expressed as a function of countries' poverty lines (food poverty line, relative poverty lines)
- Minimum number of pensions (per plan)
- Minimum % of pensions (per plan)
- Intra-generational generosity can be characterised by high profitability, a high level of pensions paid, an early retirement age and, finally, a high level of attention paid to low-

income policyholders. The table below lists these four categories, giving examples of indicators usually proposed to measure, more or less strictly, the internal generosity of the systems.

Of these indicators, only the most relevant will be used to measure internal generosity.

We will try to make a comparison between what a retiree receives and what he contributes to fund his retirement during his working life, based on typical cases. The gap in judging the generosity of the current system. Then we will calculate the rate of return that would allow a funded system to achieve the same level of return for the retiree.

The assumptions are as follows: (see table below)

That is to say that in the public sector, the rate of pension liquidation can reach 100% of the last salary for the CMR and 90% for the RCAR whereas in the private sector this rate is 70% of the salary of the eight years preceding retirement for the CNSS.

Based on all these assumptions, we have chosen four indicators from the previous table to measure the internal generosity of Moroccan pension schemes.

The ratings are as follows:

Ci: total pension contribution (employer + employee) paid in year i.

Ri: retirement pension.

T: number of years of contributions to the pension system.

N: length of the retirement period in years.

We created an application using Windev software to calculate these different indicators (below screen shots of the application).

The first indicator is the payback period (D) defined as the period of time it takes for the pensioner to recover what he or she has contributed.

$$D = \frac{\sum_{i=1}^n C_i}{R_1} \quad (1)$$

With :

D: payback period

Ci : contribution paid during year i

R1: the first pension received

The payback period (D) is the number of years for which the first annual pension can be paid to recover all contributions made.

TABLE 1
WORKING ASSUMPTIONS OF THE CAISSES

Caisses	CMR	RCAR	CNSS	CIMR
Salary	1000	1000	1000	1000
Contribution Rates	20%	18%	11.89%	6 à 12%
Pension rate	2.5%	2%	50% of 3240d+1% for every 216d sus	The points
Rate of salary increase	4.5%	4.5%	4.5%	4.5%
Rate of salary increase	1%	0%	0%	0%
Retirement Length*	19	19	19	19

*according to mortality table TD 88-90

Source: established by us

The recovery time increases with the length of the career, the longer the career increases the longer the recovery time. We note that the payback period is relatively stable whatever the length of service, since it increases by 8.63% between a contribution period of 20 years and another of 40 years in CMR, 9.35% in RCAR, 6.04% in CIMR. The average payback period is almost 12 years for CMR, 15 years for RCAR, and 12 years 9 months for RCAR.

The CNSS is relatively sensitive to career length, since over a 20-year period, it evolves by 32%, it is on average 10 years 5 months.

Let us analyse for a career span of 30 years, we notice that a contributor to the CNSS only needs 10 years and 6 months to recover all his contributions, followed by a contributor to the CMR, the CIMR and finally the RCAR.

Because the CNSS is the most generous in terms of payback time but also the loser for those who contribute for a short period.

The second indicator is the recovery rate (g) which represents the ratio between the sum of pensions received and the sum of contributions paid.

$$g = \frac{\sum_{i=1}^n R_i}{\sum_{i=1}^n C_i} \quad (2)$$

TABLE 3

CALCULATION OF RECOVERY RATE BASED ON CONTRIBUTION YEARS

	Recovery Rate				
	20	25	30	35	40
CMR	4.05	4.44	4.85	5.28	5.72
RCAR	2	2	2	2	2
CNSS	6.61	6.26	5.96	5.56	5.27
CIMR	3.39	3.72	4.07	4.43	4.80

Source: established by us

With :

g: recovery rate

R_i : annual pension

C_i : annual contribution

We note that the recovery rates for the four caisses exceed 1% for all career durations, which translates into the fact that the members of these systems recovered more than they paid, which can be explained by a retirement period longer than the recovery period.

For the CMR and the CIMR, the longer the career increases, the higher the contribution rate also increases, whereas in the CNSS it is the opposite case. The RCAR recovery rate remains stable regardless of the length of retirement.

Take the example of 30 years, the CNSS has the highest recovery rate, because the members of this system receive 5.96 times what they have contributed, followed by the CMR, the CIMR and finally the RCAR or its members receive twice what they have paid.

The CNSS is more generous towards those contributors for a short period of 20 years, a contributor to the CNSS receives more than 6 times what he has contributed, 4.05 times for a contributor to the CMR, 3.39 times to the CIMR and double to the RCAR.

In general, Moroccan pension systems are too generous towards their members, with the CNSS in the first place.

The third indicator is the replacement rate:

The replacement rate is the ratio between the first pension and the last salary.

$$TR = R1 / St \quad (3)$$

With :

TR : replacement rate

TABLE 4

CALCULATION OF REPLACEMENT RATE BASED ON CONTRIBUTION YEARS

	Replacement Rate				
	20 ans	25 ans	30 ans	35 ans	40 ans
CMR	60.73%	62.52	74.98%	87.53%	100%
RCAR	24.46%	27.89%	30.64%	32.84%	34.61%
CNSS	53.41%	57.72%	60.31%	60.31%	60.31%
CIMR	25.14%	31.43%	37.71%	44%	50.29%

Source: established by us

TABLE 2

CALCULATION OF PAYBACK PERIOD BASED ON CONTRIBUTION YEARS

Years of contributions	Recovery time				
	20	25	30	35	40
CMR	11years 7month h	11years 11 month	12years 2month h	12years 5month	12years 7month
RCAR	14years 3month h	14years 9month h	15years 1month h	15years 5month	15years 7month
CNSS	8years 11month h	9years 9month h	10years 6month h	11years 3month	11years 10month
CIMR	12years 5month h	12years 8month h	12years 10month h	13years	13years 2month

Source: established by us

R₁: the first pension received

St : the last salary received

The replacement rate and the percentage of the last salary you receive after retirement

For all four plans, the replacement rate increases with

TABLE5
CALCULATION OF INTERNAL RATE OF RETURN BASED ON SENIORITY

	TRI				
	20	25	30	35	40
CMR	7.69	7.28	6.96	6.71	6.51
RCAR	6.05	5.41	4.93	4.55	4.26
CNSS	10.62	9.06	7.92	6.97	6.28
CIMR	6.64	6.38	6.18	6.01	5.88

Source: established by us

length of service; the more you contribute, the higher the replacement rate.

In terms of replacement rate, the CMR is the most generous, since a contributor to the system receives the totality of his salary at 40 years of service followed by the CNSS (60.31%), CIMR (50.29%), and finally the RCAR (34.61%)

The fourth indicator is the actuarial yield: also called the internal rate of return. This indicator measures the interest rate that the employee must obtain on his contributions in order to obtain the level of benefits insured by the pay-as-you-go system.

$$-\sum_{i=0}^{T-1} \frac{C_i}{(1+r)^i} + \sum_{i=0}^{N-1} \frac{R_i}{(1+r)^{i+T}} = 0 \quad (4)$$

In other words, it is the discount rate that equals the balance sheet of pension benefits/contributions over salaries over the entire life cycle. This is the interest rate at which individuals should have invested their contributions to obtain the same amounts of benefits in a pure savings logic. With a retirement age of 60, we will study the effect of the contribution period on the value of the IRR.

The shorter the contribution period, the greater the TRI, so for an insured who has contributed for a short period, the

TABLE6
DEMOGRAPHIC REPORT OF THE FOUR CAISSES BETWEEN 2007 AND 2012

	2007	2008	2009	2010
CMR*	3,18	3,12	3,1	2,87
RCAR	5,54	3,5	3,3	3,27
CNSS	7,84	8,12	8,19	9,45
CIMR	3	2,99	3	2,96

*Civil Plan

Source: CMR, DAPS Pension Schemes Activity Report

plans must invest their contributions at a high rate in order to pay their pension until their death.

As the figures in the table above clearly show, the CNSS scheme and the one most affected by this indicator, the contributions of a 20-year old insured must be invested at a rate of 10.62% to honour the payment of his pension until his death.

On the other hand, the RCAR scheme is the least affected by this indicator because the investment effort required to honour its commitments is on average 5%.

In addition, the CMR scheme also offers a benefit equivalent to the investment of contributions of on average 7%, which is relatively high compared to the realised investment rate of its portfolio and hardly exceeds 5%.

3 INTERGENERATIONAL GENEROSITY MEASURES

We will analyze intergenerational generosity by addressing two points

3.1 The demographic report

The demographic ratio of a pension plan is defined by the following formula: RD= (total number of active contributors/total number of retirees) and this formula gives how many active contributors contribute to fund a retirement pension.

We have data on the evolution of this indicator for the four caisses between 2007 and 2012:

The deterioration in the demographic ratio is the immediate consequence of the contrasting trend between contributing assets and beneficiaries. In 1980, this ratio was 15 working for a retiree and in 2012 this ratio does not exceed 5 working for a retiree.

Over the 5 years, it is clear that the CNSS is the most viable fund with regard to this indicator, because its demographic ratio has improved in recent years following the policy of encouraging companies to join its pension scheme. It rose from 7.84 in 2007 to 9.43 in 2012.

Nevertheless, all the other funds have experienced a deterioration in their demographic ratio, which on average does not exceed 3 working people for a retiree. Today, this situation weighs heavily on the balance sheets of these caisses. This evolution is well illustrated in the following graph

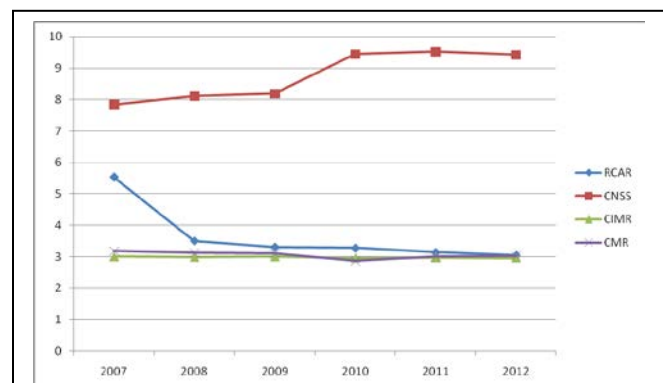


Fig. 1. demographic ratio of caisses between 2007 and 2012.

3.2 the average pension:

In the following, we will analyse the rate of change in the average pension of the various pension funds between 2007 and 2012

TABLE7
AVERAGE PENSIONS OF THE FUNDS BETWEEN 2007 AND 2012

	2007	2012
CMR	6379,59	7015,46
RCAR	3739,88	4783,92
CNSS	1805,48	2083,02
CIMR	2860,35	3342,03

Established by our care
Data Source: CMR, DAPS Pension Activity Report

All the funds have undergone significant changes in terms of average pension payments. But this evolution, which shows the degree of generosity towards pensioners, differs from one fund to another. In first place is the RCAR, which in 2012 offers an average pension 27.92% higher than in 2009, followed by the CIMR (16.87%) then the CNSS (15.37%) and finally the CMR (9.97%).

This shows that the RCAR is the plan that best increases the pension of these retirees. And even if the pension level at CMR is the highest in terms of replacement rates, it is clear that its pensions remain relatively stagnant for a long time.

Moreover, in terms of average pension paid, the public scheme represented by CMR and RCAR is more generous. This is shown in the graph below

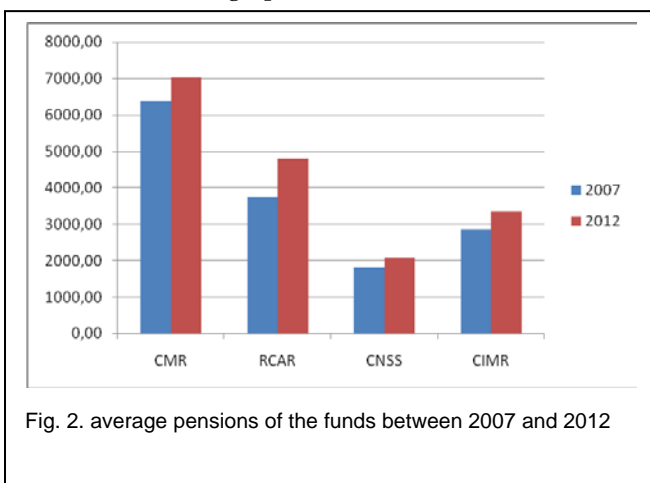


Fig. 2. average pensions of the funds between 2007 and 2012

Moroccan pension system is a system governed in its entirety, by distribution, the pensions paid to current retirees are financed by working people of the same period. Such an operation could disrupt the distribution of income on the one hand within the same generation and on the other hand between individuals belonging to different generations because of the generosity of some plans and inequity of others.

Contrary to what is known and often written, we have shown that the CMR civil regime is no longer the most generous regime and it is to the CNSS regime that this title of generous regime reverts. This generosity is illustrated at the intra-generational level (by a shorter replacement time, and a higher recovery rate) as well as at the intergenerational level (by a larger demographic ratio that evolves in a positive direction)..

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4 CONCLUSION

By way of conclusion, we have seen in this report that the