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Financial and Econometric Study of the Sustainability and Evaluation of Scenarios of Reforms for the Civil Regime of Moroccan

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Abstract. The decline in the demographic ratio corollary to the maturity of the regime and in particular its generosity raise the question of the medium-and long-term financial sustainability of the civil pension scheme of the Moroccan pension fund. This article studies the financial sustainability of civil regimes and evaluates the options for reforms envisaged by the government mainly parametric reform. In this framework, an actuarial and financial model based on demographic assumptions and macroeconomic parameters is constructed and used to analyze the financial sustainability of the status quo regime and the projected regime and also to test the parametric reform. We also use econometric tests such as non-stationarity, causality and cointegration between technical recipes and technical expenditures to empirically evaluate the sustainability of civil scheme of pensions. This paper concludes that the parametric reform of our civil pay-as-you-go system is unsustainable. It would therefore be in favor of other remedial measures and reform strategies to improve and enhance the financial sustainability of the fund, such as the model based on the addition of a funded pillar, and unification of all funds in a single integrated system.
Keywords. PAYG, Financial sustainability, Econometric tests, Model actuarial, Parametric reform, Civil pension scheme of the Moroccan pension fund.
JEL. C12, C13, C58, C53, J1, G22, F65.

1. Introduction

For several years, the question of the unsustainability of pension schemes has become one of the priorities of social policies at the level of several countries. Demographic, economic and social changes have imposed many constraints on pension systems. Countries that have become aware of the risk of unsustainable pension systems and their impact on public finances have initiated successive reform processes aimed at redefining the fundamentals of their systems so that they remain balanced and sustainable. In this respect, Morocco has also entered into the process of correcting and reforming its current pension system.

Indeed, Morocco's pension systems, particularly those based on the pay-as-you-go principle, pose enormous problems of sustainability. The situation of the

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financial balances of all the national pension funds has become a concern of the public authorities since the diagnosis of this pension system has revealed major dysfunctions. This difficult situation varies from one regime to another, it arises more acutely and more urgently for the civil pension scheme managed by the Moroccan Pension Fund 'CMR'.

The implementation of reforms of civil pension regimes 'RPC' is therefore fundamental. A simple action on the parameters, retaining the current structure, could extend the viability horizon for a few years but could not solve the problem of its long-term financial sustainability. The objective of this paper is to study and evaluate the pre-reform and post-reform sustainability of the civil pensions regime and to propose different reform options to restore and improve the sustainability and financial balance of this regime. To achieve our objectives, this research addresses the main question: "*What are the possible reform strategies that the civil regime of the CMR can adopt to ensure and improve its financial sustainability?* ".

After an introduction, the second section will present a short review of the literature on financial sustainability and analyze the problem of this concept within the current pension fund as well as the various reforms already developed in this context, a presentation of the different factors of imbalance is also discussed. The third section will be devoted to the presentation of the econometric tests of the sustainability of regime and the development of an actuarial and financial model allowing to analyze the impact of the different options of reforms on the sustainability of our regime. The fourth section will present the results of the analysis of the status quo sustainability indicators, empirical tests as well as the simulation results of the scenarios of civil service pension reforms. Similarly, we discuss in the same section the other reforms envisaged. And finaly we conclude with recommendations.

2. Overall Framework for Financial Sustainability

The problem of financial sustainability is not new. It is linked to the structural changes in pension systems and made more immediate and more perceptible as a result of the 2008 financial and economic crisis.

2.1. Literature Review on Financial Sustainability

Poor financial market returns and low long-term real interest rates in recent years have created challenges for the sponsors of defined benefit pension schemes. At the same time, lower payroll tax revenues in a period of high unemployment, and rising fiscal deficits in many advanced economies as economic activity has fallen, are also testing the sustainability of pay-as-you-go public pension schemes, Srichander (2012). While concerns about the sustainability of many pension schemes have come to public attention in recent years, specific challenges these schemes face as a result of increasing longevity.

The academic literature on the pension fund industry, which deals with the causes of financial sustainability, is extensive Black (1989), Brown *et al.* (2011), Dushi (2010) and Franzen (2010). According to Volker (2001), financial sustainability is the gradual reduction in the need for fiscal transfers from pension schemes in order to gradually and completely eliminate these transfers. Sustainability is a component of financial sustainability which implies that the benefits of the pension system can be covered by future revenues, the High Commission for Planning, High Commission for Planning HCP, (2012). The financial sustainability of social security is the ability of contributors and beneficiaries of the system to finance current benefits autonomously without resorting to the national budget or the state debt in order to maintain the long-term financial equilibrium of their system, Davis (1995). According to the World Bank

(1994); The aging of the population in the futur decades will certainly lead to major changes in the sustainability of pension systems, Bealite (2004). The question of the financial sustainability of social security has taken on a broader dimension for the construction of the Economic and Monetary Union Drèze..

The European Union set up a working group on Ageing Populations and Sustainability (AWG: Ageing Working Group), which develops medium and long-term projections for age-related expenditures. The fourth edition of the AWG Report was released in May 2012. The Report covers all the main items financed by member States through PayGo: pensions, acute health care, long-term care (LTC), education, and unemployment benefits. Medium and long-term projections on the sustainability of public finances incorporate some of the figures from the Ageing report and are regularly produced in the Sustainability Report, informing the process of budgetary consolidation within the Monetary Union, Pammolli (2013).

Assessing the sustainability of a welfare system requires the analysis of future trends in expenditure and thus a forecast of future liabilities and entitlements, Pammolli (2013). In an environment of globalization and increased competition, the financial sustainability of pension systems affects competition, as well as the financial stability of the European economy Davis, (2002). The challenges facing social programs are formidable, McHall (1999). Consequently, the role played by actuaries, demographers and statisticians in responding to these challenges is inevitably linked to issues of financial sustainability, Bohn (1999).

The long-term sustainability of recent pension reforms depends crucially on their impact on the pension system's ability to reduce poverty and replace pre-retirement income and also on the ability of individuals to change their work and saving behaviour to accommodate the effects of reforms, Aaron (2010).

One of the main goals of pension reform is to achieve financial sustainability, meaning the payment of current and future benefits according to an announced path of contribution rates without unannounced hikes in contribution rates, cuts in benefits, or deficits that need to be covered by budgetary resources. To be credible, a pension reform requires, above all, credible financial projections that include both short-term and long-term flows and an assessment of the status and utilization of stocks of accumulated assets, Holzmann & Hinz (2004). The idea that sustainability is achieved only by reducing future spending is, however, far too simplistic. Zaidi (2006) points out that "decision makers must remember that pensions are not introduced by chance." A retirement system does not succeed simply because it involves little expenditure. For Disney (1999) and Williamson (2003), notional accounts (NDC) are more sustainable than pay-as-you-go schemes.

The philosophy underpinning the reform (NDC) was that the system should be financially stable in a changing demographic and economic climate and should, at the same time, create fairness between generations and income groups by diversifying economic, financial, and demographic risks, Holzmann, Palmer, & Robalino (2013).

2.2. Issues of financial sustainability for the Moroccan pension system

Reflection on the issue of the financial sustainability of pension systems in Morocco began in 1997 when the Ministry of Economy and Finance with the World Bank launched actuarial studies and financial audits for the pension system. The results of the various committee studies were alarming. This prompted the Government to organize a national symposium on 16 and 17 December 2003 to deepen the debate on the issue of the financial sustainability of existing schemes. In

this regard, two committees were set up in 2004: the National Commission and the Technical Commission.

The debate on pension reform therefore focused on the long-term financial sustainability of schemes, highlighting the concepts of "sustainability horizon" and "implicit debt" to justify the urgency of reform. In May 2008, the Technical Commission was entrusted with the follow-up of the study on pension reform, and in May 2009, the commission presented the results of the first part of the study "updating the diagnosis". The year 2012 saw the continuation of the work of the Technical Commission for Retirement Reform. For its part, the High Commission for Planning (HCP) made public in 2012, a study on the sustainability of the pension system. The Court of Auditors conducted an evaluation mission in 2013 on the issue of balance, sustainability and coverage provided by pension schemes in Morocco.

On November 17, 2015, the International Monetary Fund (IMF) recommended to the Moroccan government to launch a reform of the pension system. In this connection, the Government had referred the matter to the Economic, Social and Environmental Council (EESC). This consultative body confirmed on 31 October 2015 the urgent need for a parametric reform.

2.3. Key Factors of civil regime Unsustainability and Imbalance

The unsustainability of the regime is imputed to many constraints due to demographic, economic and governance factors that the parametric construction of the regime is unable to take care of.

Degradation of demographic factor: In the case of civil regime, the demographic transition has meant that the demographic report has been considerably short-lived and on an ongoing basis High Commission to Plan (2005). Add to this the reduction in the contribution period due to the late entry into the labor market (28 years in 2015) due to the lengthening of the years of study and the level of recruitment which will not even allow the replacement of Retirements in terms of future workforce.

Generosity of retirement system: The civil pension system is characterized by a high level of generosity of benefits compared to the contribution effort made. It offers its members a 2.5% right of the last salary for any year of contribution, which is a replacement rate which, with the high tax allowance (55%) available to retirees, can in some cases reach 100% after only 30 to 35 years of career Similarly, early retirement rules tend to be more generous.

The payment of the pension on the basis of the last salary instead of an average career salary is a situation which can not be reconciled with the level of contribution. In addition, the generous nature of the scheme created an appealing effect favoring categorical demands to integrate it (the case of teacher-researchers, and teachers in senior management training institutions). In particular, mention should be made of the fixing of a minimum pension and its revalorisation at 1000 DH per month, which is supported by the scheme alone. The scheme supports family allowances, which represent almost 4% of the expenditure and are unbearable in comparison with its financial situation.

Impact of economic context: One of the main shortcomings of the civilian pension system is its close dependence on cyclical fluctuations in the economy. Indeed, the economic crisis, which began in 2007, affected the national economy and aggravated its social problems. Thus, by 2015, the unemployment rate is 13% for higher-level graduates and 28.4% for graduates with an average level, which has jeopardized the sustainability of the fund. Decrease in recruitment in the public service has led to an increasing number of pensioners, while the number of new recruits is steadily decreasing in response to the requirements of the World Bank and the IMF (2).

Anomaly in the management and governance of the civil pensions regime: The governance of CMR and the mismanagement of its savings are the responsibility of the government. Indeed, since 1960 and until 2004 the state does not pay the employer's share. True, it makes repayments, but without interest. There are backlogs that have been accumulating since 1994. The State takes over the deficit of the military regime through the use of part of the resources of the civilian pension scheme for a long period. The delay in the formation of reserves (1997) and the non-payment of the employer's contribution in a regular and total manner deprived the fund of a significant contribution to the investment of its contributions in recent years. The civil regime has other shortcomings due to its governance system and to certain management rules, notably the following: i) Insufficient steering mechanisms within the CMR; ii) Failure to invest and manage the pension reserve: use of CMR funds in speculative investments (MANAGEM and BNDE); iii) Regulatory constraints limiting the investment of these funds in treasury bills may deprive the CMR of the opportunities offered by other investments in the financial market.

2.4. Major Reforms Undertaken by the Civil Regime RPC

In Morocco, public authorities and pension plan officials have already resorted to some adjustments to their parameters without undertaking any in-depth reforms. In this context, the first modification carried out by the Moroccan pension fund concerned the elements of the remuneration on which the pensions are calculated. In this sense, the residence allowance was included within the limit of 10% of the basic salary and 50% of the fixed and permanent allowances on 1 January 1990 and the second half of the allowances in 1997.

Since the creation of the CMR in 1930, its legal and financial status did not undergo true reform until the entry into force of Law 43-95 reorganizing the institution. This law 43-95 rehabilitated the CMR in its original mission as a public institution with a more appropriate legal status guaranteeing an effective administrative and financial autonomy. Similarly, the fund of pensions continued its reform process in 1996, through the institution of the obligation to establish contingency a fund of reserves. In 2004, the government decided to raise the contribution rate from 14% to 20% over a period of three years. At the same time, with a view to strengthening the reserves set up, the public authorities agreed to release to the CMR the sum of 11 billion DH to pay the arrears due in respect of the period prior to 1996. The joint effect of these two measures makes it possible to achieve financial sustainability by deferring the appearance of the deficit by 5 years. In January 2006, the Government enacted Law N°. 37-05 (BO No. 5398 of 23 February 2006), terminating the system of transfer of pension rights from the RCAR to the CMR. In 2014, two legislative changes were introduced: i) Article 1 of Act N°. 012.71 fixing the age limit for retirement "The retention until the end of the school or university year of teaching researchers and officials of the Retirement age occurs during the said year "; ii) Article 44 (7) of Law N° 011.71 establishing a civil pension scheme relating to the postponement of the date of entitlement to the pension up to the legal age of retirement (revocation, professional inadequacy, delisting of executives following the regularly accepted resignation).

On 20 August 2016, Law N°. 72.14 is promulgated by Dahir N°. 1.16.110 fixing the age limit for personnel affiliated to the CMR. However, the punctual nature of these measures and their limited impact show that they do not respond fully to the problem of deep imbalances and unsustainability of pension schemes that must be analyzed and dealt with over a very long-term horizon.

3. Methodology and Data

3.1. Data and assumptions

The main data and assumptions used to study the sustainability of the civil regime between 1996 and 2015 and to carry out actuarial simulations come from several sources: i) The Moroccan pension fund of the retired 'CMR'; ii) The High Commission for Planning (HCP); iii) Department of Financial Studies and Forecasting (DEPF) of the Ministry of Economy and Finance. For simplicity, we keep the inflation rate, the fixed mortality and birth rate over the projection period.

Demographic assumptions: The modeling of the populations covered is based on average data by age group and sex; i) The database used for demographic and financial projections is 31/12/2015; ii) The projection will be carried out until the 2045 horizon; iii) To estimate the number of deaths, we will adopt the TD 88-90 and TV 88-90 female and male mortality tables adjusted by the CMR; iv) The disability rate retained for our projection is 1%; v) The number recruited each year replaces the number of deaths, invalids and retirees of the year. These new recruits will be divided by age and by category according to the proportions calculated on the basis of data; vi) The age difference between active and retired and spouse is on average 10 years; vii) The early retirement rate is 5%. This rate is applied to the age of 57 years; viii) On suppose qu'il n'y a pas de remariage en cas de décès du conjoint.

Economic assumptions: i) The rate of wage evolution is calculated on the basis of the series of average incomes of Morocco of the last decade, equal to 4.5%; ii) Contribution rate is equal to 20%; iii) The rate of revalorisation of pensions is set by the CMR at 1%; iv) The number of orphans will be projected in terms of weight in relation to spouses, ie a rate of 19% of spouses; v) The discount rate is equal to the yield on risk-free bonds whose duration corresponds to the duration of the commitments, ie 4.4%; vi) The investment rate of reserves must exceed the average yield of a 15-year Treasury bond on the secondary market, ie 4.25%; vii) $P_{Marital}(x, t)$= 85%; viii) $P_{Ret}(x,t)$=100%; ix) $T_{Réversion}$ =50%; x) The annuity rate is 2.5% for the main pension and 2% for the recipients.

3.2. Models used

3.2.1. Econometric Sustainability Tests

To study and empirically evaluate the sustainability of RPC deficit, we will use stationarity, causality and cointegration tests based on the articles by Smith & Zin (1991), Hakkio & Rush (1991), Trehan & Walsh (1988, 1991), Afonso (2005), and Haber-Neck (2006) on the sustainability of public debts. First, we apply the stationarity test on the technical balance series and the outstanding reserves. For this we use the tests Dickey & Fuller (1981), Phillips & Perron (1988) and Kwiatoowski, *et al.*, (KPSS) in (1992). Then, we determine Granger causality tests between contributions and benefits. Finally, we perform the cointegration tests between these two variables using a two-step method, as suggested by Engle & Granger (1987). The first is based on an estimate of the long-run relation by performing an ordinary least squares (OLS) regression. Finally, the second consists in applying the ADF tests on the estimated residues.

3.2.2. Actuarial and Financial Model

We will construct a model to evaluate the demographic and financial situation of the civil regime in 2045 according to different hypotheses that we can modify subsequently for piloting. The projection consists in carrying out a stock-flow balance on a yearly basis according to the following principle:

$$Stock\ 31/12\ /\ N\ =\ Stock\ 31/12\ /\ N-1\ +\ inputs\ N\ -\ outputs\ N \qquad (1)$$

$Act(x,t)$, $Ret(x,t)$, $Ant\ (x,t)$, $Inv(x,t)$, Rev(x,t) and Orph(x, t); Active, retired, anticipated, invalid and orphans of age x at date t;

- $Q_{Act}\ (x,t)$: Probability that an affiliated contributor died of age x at date t ;
- $P_{Ret}\ (x,t)$: Probability that an asset of age x retires in t;
- $P_{Ant}\ (x,t)$: Probability of early retirement at age x at date t;
- $P_{Inv}\ (x,t)$: Probability of becoming invalid at age x;
- $Q_{Act}\ (x,t)$: Probability of death of a pensioner (or beneficiary) of age x at date t
- $P_{Remariage}(x, t)$: Probability for a person of age x to be married;
- $P_{Marital}(x, t)$= probability for a person of age x to be married.
- $T_{Réversion}$ = reversion rate applied by the scheme

The number of entries in the workforce of early retirees, invalids, pensioners and Beneficiary of a survivor's pension of age x + 1 at date t + 1 is:

- $NAnt(x+1,t+1) = Act(x,t) \times P_{Ant} \times (1 - Q_{Act}\ (x,t))$.
- $NInv(x+1,t+1) = Act(x,t) \times P_{Inv} \times (1 - Q_{Act}\ (x,t)$.
- $NRet(x+1,t+1) = Act(x,t) \times P_{Ret} \times (1 - Q_{Act}\ (x,t))$.
- $NRev(x+1,t+1) =$ $[(Act(x,t) \times Q_{Act}\ (x,t) + Ant(x,t) \times Q_{Act}\ (x,t) + Ret(x,t) \times Q_{Act}\ (x,t)\ ] \times$ $P_{Marital}(x, t)\times(1 - Q_{Act}\ (x,t)(x \pm d, t))$

The number of assets, early retirees, invalids, pensioners and pensioners leaving this status between year t and year t + 1 is:

- $SAct(x+1,t+1) = [1 - (1 - Q_{Act}\ (x,t)) \times (1 - P_{Ant}\ (x,t) \times (1 -$ $P_{Inv}\ (x,t) \times (1 - P_{Ret}\ (x,t)] \times Act(x,t)$.
- $SAnt(x+1,t+1) = [1 - (1 - Q_{Act}\ (x,t)) \times (1 - P_{Ant}\ (x,t)] \times Ant(x,t)$
- $SInv(x+1,t+1) = [1 - (1 - Q_{Act}\ (x,t)) \times (1 - P_{Inv}\ (x,t)] \times Inv(x,t)$
- $SRet(x+1,t+1) = Q_{Ret}\ (x,t) \times Ret(x,t)$
- $SRev(x+1,t+1) = Q_{Ret}\ (x \pm d,t) \times Rev(x,t) + Rev(x,t) \times$ $P_{Remariage}\ (x,t)$.

$$Act(x+1,t+1) = Act(x,t) + NAct(x+1,t+1) - SAct(x+1,t+1) \quad (2)$$

The relationship is the same for invalids, retirees (anticipated and by age limit) and Beneficiary of a survivor's pension. In the civil pensions system, the population covered is considered open. This means that every year new people enter the system.

$$NAct(x\ +\ 1,t\ +\ 1) =\ NAct\ (x,t) +\ E_{nette}\ \ (x\ +\ 1,t\ +\ 1) \quad (3)$$

3.2.3. Financial projection

The long-term financial forecast consists of estimating the amount of contributions and benefits.

- $sal_{Act}\ (x+1,t+1)\ \times Act(x+1,t+1) = sal_{Act}\ (x,t) \times Act(x,t) \times (1 + T_{reval}\ (x,t))$ $+ sal_{Act}\ (x+1,t+1) \times NAct(x+1,t+1) - sal_{Act}\ (x+1,t+1) \times SAct(x+1,t+1)$
- $pens_{Ret}\ (x+1,t+1) \times Ret(x+1,t+1) = pens_{Ret}\ (x,t) \times Ret(x,t)\big(1 +$ $T_{index}\ (x,t)\big) + pens_{Ret}\ (x+1,t+1) \times N_{Ret}\ (x+1,t+1) - pens_{Ret}\ (x+1,t+1) \times$ $SRet(x+1,t+1)$
- $pens_{Rev} = pens_{Ret} \times Q_{Ret}\ (x,t) \times T_{Réversion} + sal_{Act} \times Q_{Act}\ (x,t) \times T_{Remplacement} \times$ $T_{Réversion}$

The plan's income is derived for the most part from the contributions paid by the plan's contributors and for another part of the financial income generated by the reserves.

$$Cotisation\ (x,t) = \sum_x sal_{Act}\,(x,t) \times Act(x,t) \times \varphi(t) \quad (4)$$

The deficits recorded in 2014 and 2015 negatively affected the reserve and consequently the financial income generated by the fund. Therefore, we are not going to project financial products.

$$pension\ (t) = \sum_x pens_{Ret}\,(x,t) \times Ret(x,t) + pens_{Rev}\,(x,t) \times Rev(x,t) + pens_{orp\,h}\,(x,t) \times Orph(x,t) \quad (5)$$

Administrative and management costs represent too low a percentage of total plan expenses, or 0.51% in 2015. As a result, these management fees will not be projected

- The equilibrium rate

In pure pay - as – you - go, this rate is: $T_c = \frac{N_r \times P_r}{N_c \times S_c}$

Pension plan in pay as you go provisioned : $T_c = \frac{N_r \times P_r + (R_n - R_{n-1}) - \mu \times R_{n-1}}{N_c \times S_c}$

- N_c : Number of active contributors
- T_c : contribution rate of the scheme
- S_c : contribution base
- N_r : number of pensioners
- P_r : average pension received by the pensioner
- R_n : reserves of year n
- $R_n - R_{n-1}$: change in reserves
- μ: rate of return on reserves

The model thus constructed can be used to simulate the new parametric reform, which will focus on combining the four scenarios, such as increasing the statutory retirement age to 63, modifying the contribution rate 28% (currently 20%), the reduction of the annuity rate to 2% and finally the liquidation of the pension taking the average of the last eight years

4. Finding

4.1. Analysis of current sustainability indicators

During the year 2015, the collection of employee contributions and employer contributions to the scheme reached almost the same amount in 2014, or 15,878 MDhs. Expenses of the civil pensions scheme amounted to 18,556.19 MDhs in 2015 against 16,815.04 MDhs in 2014, registering an increase of 10.35%.

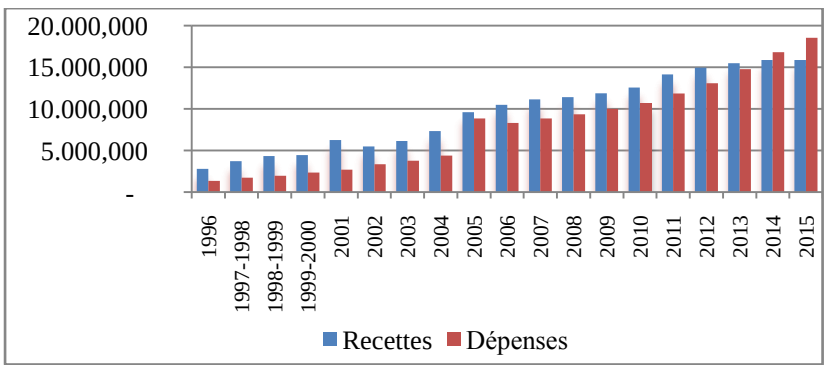

Figure 1. *Evolution o income and expenditure between 1996 and 2015*

The civil pension scheme remains in excess of 2013 but with a downward trend of 62.58% compared to 2012. With the exception of the year 2011 when the civil regime registered a surplus value of 456.73 million DH due to the impact of the measures decided by the government relating to the revaluation of the minimum pension and the increase of the net salary of civil servants of 600 Dirhams monthly and the payment by the State of a share of its arrears of the previous years. This surplus continues to have a downward trend and to reach different values until 2014 when for the first time it reached a deficit of 936 million DH against a technical surplus of 704 million DH in 2013. In 2015, this deficit continued its upward trend by realizing an amount of 2,678.19 billion DH.

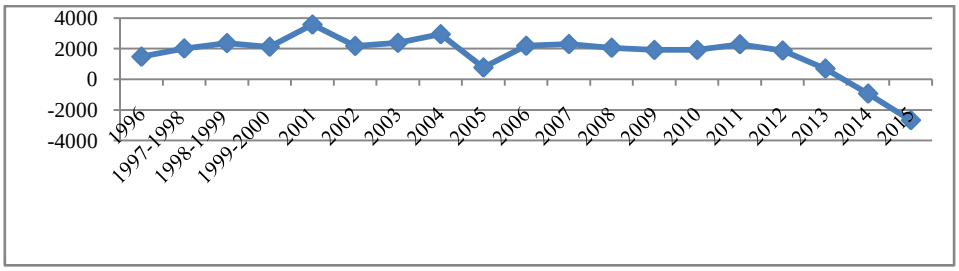

Figure 2. *Evolution of technical balance of RPC in MMDhs between 1996 and 2015*
Source: Established by us, data from the Moroccan Pension Fund

The rate of coverage of expenses by technical resources is changing with a downward trend over the past decade, from 94.4% in 2014 to 85.5% in 2015. The reserve fund ends the year at book value (net of provisions), with 84.92 MDhs against 85.02 MDhs in 2014. The cumulative income generated by the fund since the beginning of the asset management business in 1997 amounted to 34.166 billion Dhs at the end of 2015, compared with 31.443 billion in 2014, ie 40% of the total reserves made up.

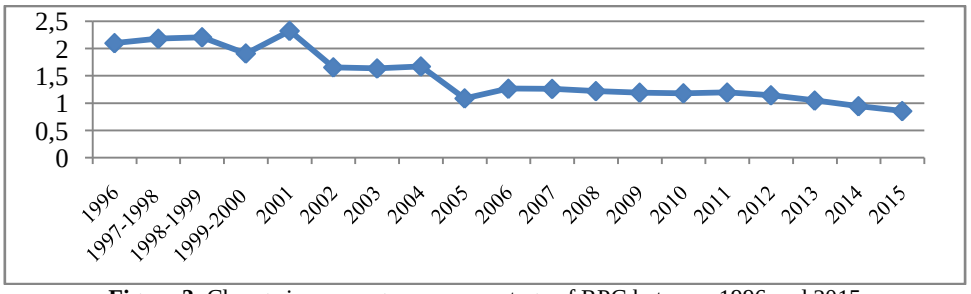

Figure 3. Change in coverage as a percentage of RPC between 1996 and 2015
Source: Established by us, data from the Moroccan Pension Fund

The reserve fund ratio represents the proportion of benefits at the end of the year that can be paid out of outstanding reserves at the beginning of the same year. In 2015, the reserve fund was able to cover 4.58 times of benefits against 4.81 in 2014.

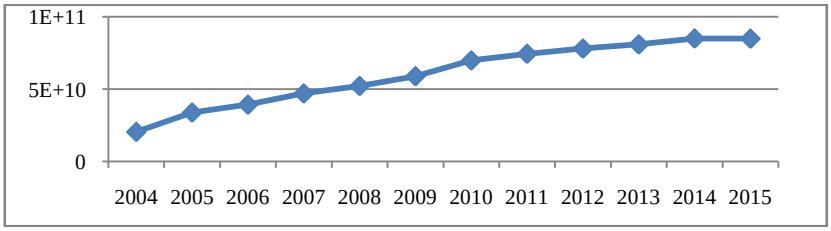

Figure 4. *Evolution of RPC reserves in Billions of Dhs between 2004 and 2015*

The demographic ratio changed from 4.79 active contributor for a retired in 1998-1999 to only 2,303 in 2014 and to 2,269 in 2015. The analysis of the financial results of the pension system reveals a heavy trend of widening deficits and a decline in the coverage of benefits by the reserve fund, which could weigh heavily on public finances over the long term and jeopardize the viability and The sustainability of the pay-as-you-go system.

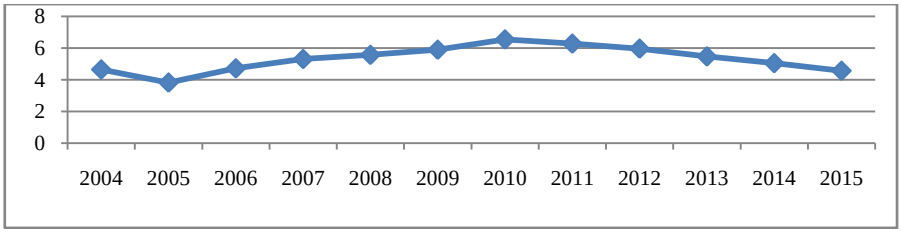

Figure 5. *Evolution of the ratio of funds in the reserves of the civil pensions system between 2005 and 2015*

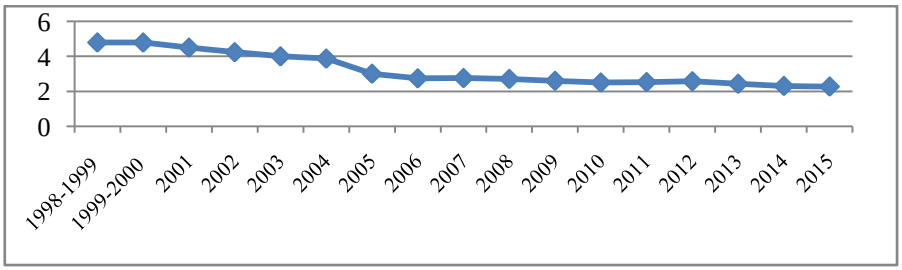

Figure 6. *Evolution of the civil regime demographic ratio between 1998 and 2015*

4.2. Results of econometric tests

Stationarity test of technical balance and reserve funds: The results obtained for the Dickey-Fuller and PP statistics indicate that the null hypothesis of non-stationarity can not be rejected for the technical balance and the reserve fund. Statistics are well above critical values at 1%. These results are an indication of the unsustainability of these two variables.

Table 1. *Results of the stationarity tests of Technical balance*

Variable tested	Test	Null hypothesis tested	Calculated value	Unit critical value	Result
Technical Balance	ADF	Non stationarity	-0,876867	-4.571559	Non stationarity
	PP	Non stationarity	-0,876867	-4.571559	Non stationarity
	KPSS	stationarity	0.146642	0,21600	stationarity

The KPSS statistic is less than the critical value at 1%, so it is not possible to reject the null hypothesis of stationarity for the technical balance and the reserve fund. These results indicate a level of technical balance and sustainable reserve funds. These results do not allow us to decide on the sustainability of the civil regime of the CMR.

Table 2. *Reserve Fund Stationarity Test Results*

Variable tested	Test	Null hypothesis tested	Calculated value	Unit critical value	Result
Reserve Fund	ADF	Non stationarity	-0,833813	-5,124875	Non stationarity
	PP	Non stationarity	-0,795818	-5,124875	Non stationarity
	KPSS	stationarity	0,176007	0,21600	stationarity

Source: Established by us, data of the Moroccan pension fund using Eviews

Co-integration test: Test of stationarity of contributions and benefits. The results obtained for the ADF (-2.320735) and (-1.826708) respectively indicate that the null hypothesis of non-stationarity (in level) can not be rejected for contributions and benefits. Statistics are well above critical values at 1%, 5% and 10%.

Table 3. *Result of the ADF test applied to the first difference of the contributions*

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.986813	0.0309
Test critical values:	1% level	-4.616209	
	5% level	-3.710482	
	10% level	-3.297799	

For the first difference, the results of the ADF (-3.986813) and (-4.744146) respectively are lower than the critical values at 1%, 5% and 10%. Therefore the null hypothesis is rejected for contributions and benefits.

Table 4. Result of the ADF test applied to the first difference in benefits

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.744146	0.0079
Test critical values:	1% level	-4.616209	
	5% level	-3.710482	
	10% level	-3.297799	

Causality test in the sense of Granger: We have recovered the two stationary series, that is, the first difference series of benefits and contributions. For the criteria of AIC (Akaike Information Criteria) and SC (Schwarz Criteria), the number of delays is 2.

Table 5. *Results of the Granger causality test*

Null Hypothesis:	Obs	F-Statistic	Prob.
DCOT does not Granger Cause DPREST	16	0.00785	0.9922
DPREST does not Granger Cause DCOT		0.08531	0.9188

We note that both p-values 0.9922 and 0.9188 are both above the critical values of 1%, 5% and 10%. Consequently, neither of the two differentiated series is influenced in the Granger sense by the other.

Residue testing: The non-stationarity of the residues meant the non-cointegration of benefits and contributions. In general, these results show the non-sustainability of the civil regime of the CMR essentially in recent years.

Table 6. Result of the ADF test applied to residues at 1%

Variable analyzed	Test	Null hypothesis tested	Calculated value	Unit critical value	Result
Residue	ADF	Non stationarity	-0.804434	-4.571559	Non stationarity

(2) Direct responsibility lies with the State, which has implemented dictated neoliberal policies, reduced the number of civil servants, reduced wages and increased unemployment.

The economic idea behind the cointegration tests is that the technical balance (the difference in value between contributions and benefits) should increase as contributions increase and benefits decrease. The increase in the technical balance then makes it possible to reduce the deficit and to improve the outstanding funds of the reserves and this to deal with the payments of the implicit debt.

The civilian regime must therefore focus on the technical balance for several reasons. Indeed, if this difference is negative, then there is a deficit that will have an effect on the depletion of reserves. In this case, the regime will have to fill this lack of financing by using other means of financing (borrowing, for example).

4.3. Sustainability analysis for the current scheme projection.

Table 7. *Pre-reform civilian projection result*

	2016	2020	2023	2025	2030	2045
Demographic Report	2,198	1,656	1,507	1,438	1,084	0,656
Technical coverage	90,33%	69,23%	63,35%	60,60%	46,44%	32,25%
Technical Balance in (MD	-4,4E+09	-1,6E+10	-2,5E+10	-3,1E+10	-4,6E+10	-6,4E+10
Outstanding Reserve Funds	8,13E+10	5,45E+10	-1,6E+10	-1,03E+11	-5,7E+11	-1,6E+12
Reserve Fund Ratio	433,06%	138,16%	-26,45%	-128,13%	-349,56%	-522,46%
equilibrium rate	22,45%	28,85%	31,50%	33,00%	37,00%	45,75%

The continuing decline in the demographic ratio is due to the effect of the increase in the number of pensioners compared to the number of workers whose number remained stagnant from the year 2015 to the year 2045. The occurrence of a technical deficit of Dh 937 million from 2014 and the second deficit in 2015 has led to a mechanical increase in the contribution rate needed to balance the scheme. The contribution rate must be of the order of 45.75% in 2045, which shows the serious deficit incurred by the civil regime of the CMR.

Given the increase in benefits and the reduction in contributions, it is clear that the coverage rate is falling. Thus, it rose from 85.5% in 2015 to 32.25% in 2045. From the year 2014, the scheme began to draw on its reserve fund to finance the gap between the revenue and expenditure of the scheme. However, this situation would gradually lead to a depletion of reserves which would become negative in 2023 with an amount of about DM 15 995 billion if no action is taken. Until 2022, reserve fund ratio values are positive and above 100%, which means that CMR reserves would cover at least 100% of its commitments.

4.4. Parametric reform simulation results

By adopting the parametric reform, we were able to gain a positive technical balance during the period 2019-2025. This will have a remarkable effect on the viability of the regime compared to the central scenario. Beginning in 2026, the technical balance would become deficit and this deficit would continue to increase in a very remarkable way in the long term, which would make the system once again financially unsustainable.

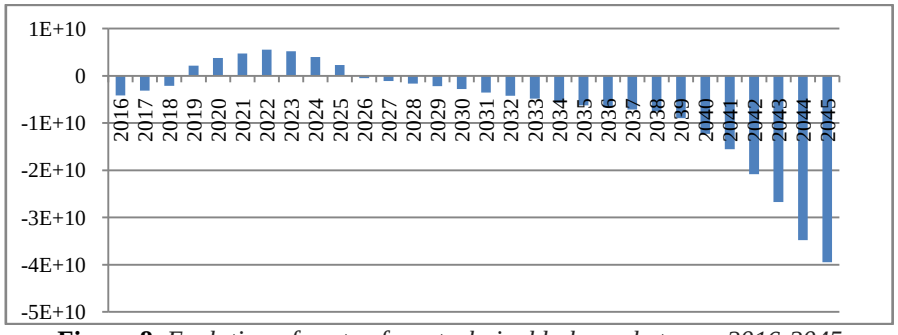

Figure 8. *Evolution of post-reform technical balance between 2016-2045*

Changes in the parameters will result in an increase in fund inflows (contributions and investment income) higher than outflows (benefits). This translates into a deferral of the date of depletion of reserve funds to 2032 (instead of 2023 in the case of the status quo).

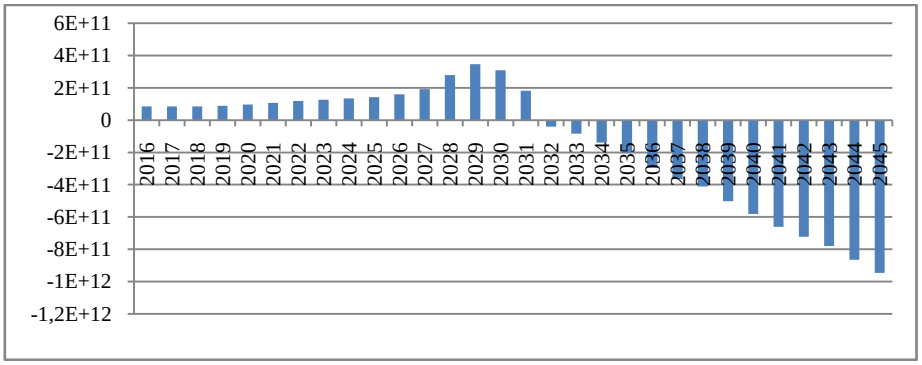

Figure 9. *Trend in the stock of post-reform reserves between 2016-2045*

The results of the post-reform financial analysis of the pay-as-you-go system suggest that the current system is unsustainable and continues to require significant transfers from the budget.

4.5. Proposal of the other reforms

Introduction of a funded pillar: The current situation of the system and the risk of the long-term deficit require a reorientation towards the economic logic, namely the capitalization that will increase the yield and build abundant reserves to cover the income of retirees and be able to adapt to the change demographic situation in Morocco. In this sense, it is preferable to adopt the approach advocated by the World Bank, which consists of a gradual transition to a two-pillar system that combines pay-as-you-go and funded retirement. This principle is therefore related to the acceptance of the fact that the pension consists of a cumulation of income, part of which is linked to the pay-as-you-go mechanism and other parties linked to the own contribution and savings affiliated contributors. These accounts will be converted into life annuities upon retirement. The transition from a distribution-managed system to a two-pillar system, however, poses the difficult problem of financing the cost of transition

Creation of a public pole and a private pole (reform proposed by the State): In a second step, the government will put in place two major pension poles. The first concerns the civilian system under the CMR and the RCAR as a basic system and another complementary system. The second, private, will be managed by the CNSS, in addition to a complementary scheme. The regrouping of existing schemes within one pole dedicated to the public sector and another group dedicated to the private sector has many advantages; i) Orientation towards a new regime that is less deficient than the current CMR civil pension system; ii) Ceiling on civil pensions; iii) Harmonization of pension settlement rules throughout the public sector; iv) Extension of the old-age risk coverage for the benefit of the uncovered populations of the private sector (liberal professions, ...) in a single system managed by CNSS; v) Development of the demographic engine for the private sector through new affiliations.

A fusion of the schemes in a public entity, in the Moroccan case, is directly to favor certain schemes, to the detriment of others. Two aspects derive from this statement: A first aspect is the distribution of the generosity of the schemes over time. Typically, the RCAR is not very generous with regard to the creation of the first pension (2% annuity rate, basis of calculation based on all wages) and generous as regards the revaluation (based on wages). The CMR presents an exactly opposite situation: first very generous pension (annual rate of 2.5%, basis of calculation based on last salary) and a low revaluation, indexed in practice to one-third of inflation. This is compounded by the fact that the average salary of the RCAR is much lower than the average salary of the CMR. Since generosity is not

at the same level in time, a first problem of equity between regimes arises. At the time of consolidation, the least prudent public plan will use the provisions of the plan that have had strong reserves to clear its accounts. The most penalized regime in the state is obviously the RCAR, functioning practically in capitalization. The consolidation of the two-pole fund is certainly a more solid and advantageous solution, but it requires a very high transition cost and is therefore not immediately applicable.

Grouping of all regimes into one single pole: The Single Plan (single multi-pillar system), which consists of the merger of all the funds into one, which is responsible for managing all pensions, proves to be the most radical solution. This scenario remains the most difficult and unlikely both due to the specificity of each fund in terms of generosity, reserves constituted and operating procedures as well as the characteristics of the population covered (public, semi-public, Private and independent). Similarly, the fusion of the Public Pole with the Private Sector will risk placing the burden of retirement in the public sector on private companies.

5. Conclusion

Based on the principle pay-as-you-go, the civil scheme has shown real difficulties in coping with new demographic, economic and financial constraints. It should also be noted that the measures taken so far remain anchored solely on the financial sustainability of the schemes, without taking account of the social and economic aspects of the members and pensioners or of expanding social coverage. It is therefore important to propose the establishment of intelligent ways of reforming our current system at several levels in order to maintain both the long-term viability and the fair distribution of burdens between generations. According to the analysis of the different scenarios envisaged, it appears that each scenario presents negative and positive effects at the same time, making the choice increasingly difficult. In this context the reform of the pension system should be rethought in a framework of overall coherence and should be accompanied by the introduction of new measures to improve financial and social sustainability, the most important of which are: i) Improving governance through the establishment of modern, representative, effective governance bodie; ii) The civil regime must be subject to a control which must go beyond the administrative and financial side to deal with the technical aspect; iii) The implementation of legal and institutional reforms aimed at updating the legal status of the pension fund, as well as all legislative texts describing its operation; iv) Optimization of the financial management of civilian reserve funds; v) The increase in employment rates and coverage rates, which currently appear to be excessively low to alleviate the financial difficulties that will characterize the Moroccan civilian pension system.

The pensions'funds should simulate a reform based on the technique of notional (NDC) that allows to overcome the purely financial logics and to draw a departure from the top of the current crisis of pension system, by putting in place a system democratically more transparent, financially more sustainable, and socially more fair.

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