Assessing the financial sustainability of parametric pension system reforms: The case of Morocco

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Abstract

In 2015, the government adopted a parametric reform intended to deal with the critical financial situation of the CMR civilian pension regime. In this paper, we examine the robustness of this parametric reform by using the Cohort-Component population projection model to the fund's population during the period 2014-2064. First, we divide the population of the baseline year into cohorts classified by age and sex and then we project the year-on-year demographic transition of each cohort. Second, we lead a projection of the financial situation related to the 2015 parametric reform. Moreover, we project the status quo situation and an alternative scenario where we propose to increase solely the retirement age, and then compare the results with those of the 2015 parametric reform. Our results show that, for the three scenarios, a parametric reform will have a limited effect on the financial situation, in both the long and the short-terms. Under a status quo situation, the reserves are expected to run out in 2023, while under the current parametric reform and our proposed reform, they are expected to expire in 2033. Furthermore, our alternative scenario seems to have some more advantages so that it doesn't reduce the rights of beneficiaries.

1. Introduction

Recently, the pension system in Morocco has reached maturity, in other words, the collected contributions no longer manage to finance all pensions. The Moroccan pension system is financed conforming to a Pay-As-You-Go (PAYG) financing principle. According to Towerbridge (1952), in a pure PAYG pension system, revenues equal outlays each year. This is a system where actual contributions collected from workers adherents to the pension scheme finance actual retirement pensions to those retirees. In Morocco, there are two compulsory retirement regimes for the public sector workers namely the Moroccan Pension Fund (CMR)[1], and the Collective Scheme for Retirement Allowances (RCAR)[2]. Likewise for the private sector workers, there is one mandatory retirement regime which is the National Social Security Fund (CNSS)[3]. It is to highlight that the deteriorated pension system situation is due directly to the number of assets deterioration in favour to that of retirees. In this situation, in a PAYG pension scheme, the financial situation is corrected using the reserves, but it should be noted that the annual consumption of the reserves will exhaust them.

As stated by recent reports of *Cabinet Actuariat* (2010) and of *Cour des Comptes* (2013), the Moroccan pension system is under considerable financial pressure, threatening its financial viability and its ability to honour commitments to current and future pensioners. According to the both reports, the most urgent financial situation to deal with is that of CMR's civilian pension regime. As claimed by the 2014 CMR actuarial projections, if keeping the current situation, the extinction of the scheme reserves is planned in 2022. Furthermore, the CMR's civilian pension system posted in 2014 a negative differential between contributions and benefits of nearly one billion Moroccan Dirhams (MAD). If the pension scheme is expected to maintain current levels of contributions and benefits, financial deficit would be unsustainable and income security of future retirees would be challenged. Analysing PAYG pension funds of the CMR's civilian pension regime, there is an important risk source to take into account: the risk related to future monetary cash flows to ensure payment of future pensions. To deal with this critical situation, the government promulgated in 2015 a parametric reform intended for the CMR's civilian pension regime.

The parametric reforms objective is the budgetary stability of the pension system. Moreover, this type of reform simply reduces the generosity of benefits or of the program in general, without changing the overall structure of the program (see Disney, 2003). The 2015 parametric reform covers all the calculation parameters, namely the retirement age, the contribution and the annuity rates, and finally the pension base. The parametric reform is targeting on one hand, the increasing of payrolls while in the other hand, decreasing benefits level.

It should be noted that during the last years, the Moroccan life expectancy increased form 48.45 years in 1960 to 75.52 years in 2015. In addition, the Moroccan fertility rates fall from 7.07 in 1960 to 2.53 in 2015. These demographic changes in the Moroccan population make it possible to increase the retirement age. This measure aims to contain the growth of pension

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[1] *Caisse Marocaine des Retraites*
[2] *Régime Collectif d'Allocation de Retraite*
[3] *Caisse Nationale de Sécurité Sociale*

expenditure due essentially to the increase in the old age dependency ratio[4]. For this reason, we will study the impact of changing one parameter and so increasing solely the retirement age.

Several methodologies are employed to study the PAYG parametric reforms and their several effects. To model pension reforms, the World Bank has developed special software, called PROST, for simulating pension reform options and analyzing their consequences. Using this tool, Ayed zamba and Ben hasan (2013) simulated some propositions for the Tunisian pension reform. Sayan and Kiraci (2000) used a computational investigation of alternatives for a PAYG based pension system to study parametric pension reform options with higher retirement ages using an optimization analysis. Furthermore, forecasting parametric reforms basically rests on forecasting the pension demography. For that, the Cohort-Component population projection method is used (e.g. Gonzalez *et al.*, 2009; Houssi, 2005). As presented by Romaniuc (1990), this method has three main applications of population projections[5], namely, prediction, prospective analysis and simulation. A stochastic version of the demographic cohort-component method of forecasting future population is also used (Alho, 1990) or a simple method for projecting pension deficits (Zeng, 2011). Moreover, a dynamic analysis can be used to analyze the effects of the different parametric reforms, oriented to reach the financial balance of public pension systems, on the individual retired population welfare (Peinado, 2011). Moreover, to estimate and analyze the effects of pension reforms and the trend of their liabilities, the method most commonly used is a computable general equilibrium model of an economy with a social-insurance pension system (Volkov, 2010). It can be used to study the effects of demography and fertility changes on pension schemes (e.g. Fanti and Gori, 2012; Abio *et al.*, 2004; Cipriani, 2013; Abdessalama and Chekki, 2016), to study the effects of reforms (e.g. Diaz-Gimenez and Diaz Saavedra 2008, 2016) or to argue that the so-called and old-age crisis is first and foremost a political problem (Cremer and Pestieau, 2000).

In this paper, we use the Cohort-Component population projection method to project the population present in 2014 in the civilian pension regime of the pension fund, and then we project its financial situation during the period 2014-2064. In this context, we propose to project during the same period of time the status quo situation before the parametric reform and an alternative scenario where we propose to increase solely the retirement age and then compare the results with those of the 2015 parametric reform.

Following this introduction, the remainder of the article is presented in four sections. The next section presents an empirical review of the parametric pension reform analyses in several countries. This is followed by the methodology used in the study. The main findings are presented and discussed. The final section summarizes the conclusions of the study.

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[4] The old age dependency ratio is the number of persons aged 65 or older as a percentage of the potentially active population.
[5] For more details, see the method's description in Chapters 8 and 9 in Burch (2018).

2. Empirical review

It is pointed out fairly often in the literature that financial imbalance of pension funds is often associated with demographic ageing. The latter results from increases in life expectancy and a fall in fertility rates, which tends to accompany economic development. The imbalance at the level of the age pyramid directly affects the retirement outlays as the part of pensioners is superior to that of contributors (see Disney, 2003). The researches increase about the future financial viability of pension systems, especially since the World Bank published its policy research report (World Bank, 1994) where it made its recommendations on social security, which still apply today (De Bustillo *et al.*, 2011). But before the World Bank report, Hagemann and Nicoletti (1990) discussed the effects of the demographic transition in four OECD countries, namely, Germany, Sweden, Japan and the United States. They also discussed the different solutions available to governments. Kings *et al.* (2007) explained that the main consequence of an aging workforce lies in the challenge of attracting and retaining capacity in the public service while a large number of experienced staff retires will only intensify in many countries members of the OECD.

Volkov (2010) explained that the economists usually use the demographic factor as the standard explanation. However, as some studies have shown, these phenomena are not always decisive. As he explained "It is interesting that although the age dependency ratio (ADR—the ratio of the number of dependent retirees to the total working population) rose for all European countries in the 1960s–1990s. The total dependency ratio (TDR—the ratio of the total number of dependents, including children, to the total working population) fell. According to forecasts, this trend will disappear in the next forty years, and the TDR will rise". For this reason, in France, the focus was essentially on parametric changes to adjust the financial imbalances of the French pension system without affecting the system's operating mode which is a PAYG mode. Every year the Pension Observation Council (COR)[6] publishes a report on the evolutions and prospects of pensions in the country, mission which it was attributed by the pension reform law of 2014. This report provides a return to balance in 2042 in the best Scenarios (COR, 2019). Otherwise, a number of papers lead evaluations studies of the Italian pension reforms process, which was adopted since the 1990s, and provide many recommendations (e.g. D'Amato and Galasso, 2002; Brugiavini and Galasso, 2004; Natali, 2011; Agudo and Garcia, 2011). In Spain, which has a public PAYG scheme providing defined benefits, has opted for parametric reform, involving gradual small-scale changes in benefits, and has also encouraged complementary but voluntary private schemes. In the mid-1980s and 1990s changes were introduced to contain pension's expenditure. In fact, the required number of contributions years used to calculate the value of the retirement pension was increased (see De Bustillo, 2011). De Bustillo *et al.* (2011) evaluated the impact of a parametric reform based on increasing the reference period used to calculate benefits. Vidal-melia (2013), evaluated the 2011 Spanish pension reform using the Swedish system as a benchmark. Altiok (2013) estimated the fiscal burden of the historical PAYG Social Insurance Pension Systems in North Cyprus and has also explored a number of possible parametric reforms to arrive at a long term solution to the financing of these systems.

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[6] *Conseil d'Observation des Retraites*

In MENA region, only a few studies are lead on pension reforms. Ben Braham (2009) studied the pension system generosity and reforms in Algeria, Morocco and Tunisia. Ben Braham *et al.* (2011) analyzed the impact of pension systems on the standard of living of the elderly in the Maghreb. Furthermore, Houssi (2003, 2005) presented a comparative overview between countries of MENA region and Boudahrain (2003) presented the social security system in both Morocco and Tunisia. Dupuis *et al.* (2011) are also mentioned, dealing with the impact of pension systems on the standard of living of the elderly in the Maghreb.

3. Methodology

We use the Cohort-Component Population Projection model to project the scheme population by age and sex. The procedure for making cohort-component population projections was developed by Whelpton (see Whelpton, 1936). This method is based on the fact that each year, the every member of a population becomes one year older. We divide the population of the baseline year into cohorts classified by age and sex and then we project the year-on-year transition of each cohort on the basis of different demographic and financial hypotheses (Appendix 1).   This method is used to simulate some way ahead the evolution of demographic and financial parameters of pension's schemes.   The Cohort-Component Population Projection model is considered like a guide to future intervention (Burch, 2018). We will use this method as a prospective analysis (Romaniuc, 1990) of the future financial and demographic situation of the CMR civilian pension regime. The latter is analysed under three scenarios: the unchanged legislation or the status quo, the parametric reform adopted since 2015, and an alternative parametric scenario that we proposed.

In this paper, we took the year 2014 as a basis of our projection of the CMR's civilian pension regime population. We divide this population into age and gender cohorts and we observe the demographic and financial evolution of this pension scheme until year 2064.

Each year, the number of contributors, retirees and survivors is projected using mathematical formulas. Thereby, the number of contributors of a year represents the assets of the previous one from which the deceased and disabled subscribers are subtracted. These new affiliates replace the deceased and disabled contributors of the previous year, spread over the different cohorts. Thus, to project the number of contributors we use the mathematical formula below:

$$A_{x+1}^{t+1} = A_x^t(1 - Q_x - T_V) + E_{x+1}^{t+1} , \quad (1)$$

where A_x^t and A_{x+1}^{t+1} represents the total number of contributors aged x and $x+1$ respectively in the year t and $t+1$ respectively, Q_x is mortality rate at age x , T_V is disability rate and E_{x+1}^{t+1} is the new entries aged $x+1$ in time $t+1$.

The number of retirees in a year represents the retirees of the previous year from which the deceased ones are subtracted and the new retirees are added. Each year, the number of the retirees is calculated with the mathematical formula below:

$$R_{x+n}^{t+n} = R_x^t(1 - Q_{x+n-1}) + NR_{x+n}^{t+n} , \quad (2)$$

where R_{x+n}^{t+n} represents the total number of retirees aged $x+n$ at the year $t+n$, R_x^t is retirees of the year t aged x, Q_{x+n-1} is mortality rate and NR_{x+n}^{t+n} is the new retirees aged $x+n$ in the time $t+n$. These new retirees are composed of the normal retirees aged 60 and early ones with minimum service years of 21 years for men and 15 for women. These conditions for an early retirement changed with the new reform, where they will be 24 service years for men and 18 for women and the retirement age increased to 63 years.

Each year, the successor's number represents successors of the previous year from which the deceased and remarried ones are subtracted and the new successors are added. The total number of successors is calculated according to the following mathematical formula:

$$S_{x+1}^{t+1} = S_x^t(1-Q_x-\tau_{(x,x+4)}) + NS_{x+1}^{t+1}, \quad (3)$$

where S_x^t and S_{x+1}^{t+1} represents the total number of successors aged x and $x+1$ respectively in the year t and $t+1$ respectively, Q_x is mortality rate, $\tau_{(x,x+4)}$ is the probability of remarriage between age x and $x+4$. NS_{x+1}^{t+1} represents the total number of new successors, aged $x+1$ in the time $t+1$, who are retirees' spouses and assets, with a difference of 10 years.

After performing the demographic projection of the pension fund's members, we simulate the average salary used to calculate contributions and also simulate the average pension paid, classified by the contingencies covered, on the basis of changes in their trends over time and multiplying these variables by the total number of member workers and the number of pensioners.

Each year, we calculate the actual payroll by multiplying the number of assets by the average wage. This payroll is multiplied by the rate of contribution to determine the amount of contributions (C_t) paid at time t:

$$C_t = \gamma \sum_{x=a}^{\tau-1} \overline{W}_{x,t}.A_{x,t}, \quad (4)$$

where γ is the contribution rate, $\overline{W}_{x,t}$ is the average income for a member aged x at time t and $A_{x,t}$ indicates the number of active members aged x at time t, α is the entry age of the scheme and τ is the retirement age.

Next, we multiplied each average pension with the relative number of pensioners to obtain the total expenditure for each pensioner's category. The latter are classified by the contingencies covered: retirement and survivors pensions. Subsequently, we added these different expenditures to the total expenditures of benefits to obtain the total amount of the pension (B_t) which is expressed as follows:

$$B_t = \sum_{x=\tau}^{\omega} P_{x,t}.\overline{B}_{x,t}, \quad (5)$$

where $\bar{B}_{x,t}$ is the average pension benefit and $P_{x,t}$ represents the number of pensioners aged x in the generic time t, ω is the extreme age and τ is the age of obtaining the first retirement or survivor pension.

Finally, the projection of cash flows comprise firstly the technical result which is defined as the difference between contributions and benefits, on the other hand, the amount of total assets belonging to the pension scheme at a specific time t represents the fund value (F_t). Excluding the fixed management cost, the evolution of the fund can be represented as follows:

$$F_{t+1} = (F_t + C_t - B_t).(1 + r_{t,t+1}) , \qquad (6)$$

where C_t and B_t represent respectively the annual contribution income and the pension benefits paid at the beginning of the year t, and $r_{(t,t+1)}$ indicates the global asset return related to the period between t and t+1.

Using the Cohort-Component population projection method, we simulated the evolution of financial and demographic parameters of the CMR's civilian pension regime, based on the assumptions mentioned below (*See* Appendix 1). The demographic and financial situation was projected according to 3 scenarios: The first one is the unchanged legislation (status quo), the second one is the pension reform promulgated by the government in 2015, and the last one is a proposed parametric reform which is based solely on increasing the retirement age.

Scenario 1: Status quo

In this projection scenario, we have considered that the system kept his working like before the 2015 parametric reform. We choose this scenario to study the effects of the ancient parameters and their effects on the financial situation of the pension scheme.

Scenario 2: The 2015 parametric reform

To prevent a public deficit from possibly growing out of control, the Moroccan government adopted a parametric reform that covers all the pension's parameters. So, the contribution rate, the retirement age and the basis for calculating the pension will rise progressively to attempt successively 28%, 63 years and the average of 96 months.

Scenario 3: reform proposal

Readjusting the totality of pension parameters seems like a right reduction of beneficiaries. So we study the impact of increasing the length of the individual's working career. This scenario seems acceptable by the system adherents and politically feasible because the years added before retirement will increase the level of the members' pension.

4. Results and discussion

Using the Cohort-Component population projection method, we simulated the evolution of financial and demographic parameters of the CMR's civilian pension regime, based on the

assumptions mentioned below (*See* Appendix 1). The demographic and financial situation was projected according to 3 scenarios: The first one is the unchanged legislation, the second one is the 2015 pension reform promulgated by the government and the last one is a parametric reform that we proposed which is based solely on increasing the retirement age.

Scenario1: Pension system perspectives under an unchanged legislation (status quo)
The analysis starts with studying, under an unchanged legislation, the fund's demographic and financial evolutions. We projected during the period 2014-2064, the total number of working contributing members and the pensioners' one. After the demographic projections, we will project then the fund's Cash flows.

The analysis of the fund's demographic situation is based on the analysis of the demographic ratio. The CMR's demographic ratio is the number of pensioners[7] as a percentage of the number of working people belonging to the scheme. It's used to study the effects of demographic trends of pension expenditure financed on the PAYG principle (Houssi, 2005). The evolution of the CMR's demographic ratio is described below (see Figure 1).

**Figure 1.** Demographic report projection of the civilian regime of the CMR
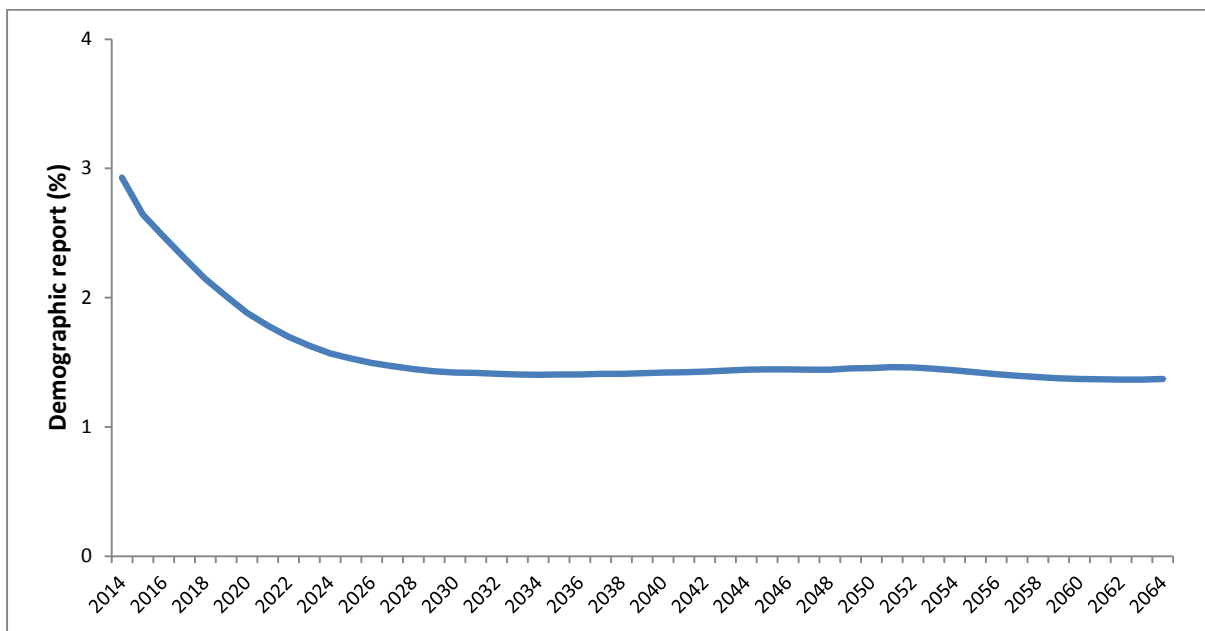
The projection of the demographic report showed the changes over time in the ratio of contributing members to pensioners belonging to this scheme. According to our results, the number of contributors will decrease compared to pensioners from 3 on 2014 to 1.37 on 2064 as shown in the graph below. It will fall nearly to one third of its current value, it will be less than one and half persons to finance the benefits paid to each pensioner by the end of our projection period. This negative exponential decline results in a deterioration of the demographic situation in this plan that the number of pensioners grew faster than that of the assets. This must be due the result of the public sector employment policy where new

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[7] The number of pensioners here is composed of the number of retirees and the half number of survivors

employees replace deceased, disabled and retired ones each year. The contrasting evolution between the numbers of contributors and retirees (see HCP, 2012) is reflected in the aging of the fund's population which is a most alarming prospect for a PAYG pension scheme. This critical situation will inevitably affect the pension schemes financial circumstance.

After projecting the demographic situation of the fund, we will project the financial one. A PAYG system needs equilibrium between revenues and outlays in each year, i.e. active members inside the scheme need to pay enough contributions to cover the benefit payments of retired members. Therefore we projected and analysed the evolution of the amounts of contributions and benefices (see Figure 2), the global result (see Figure A1) and the amounts of the reserves (see Figure A2). The financial projection will show us the changes in the income and expenditure of the pension scheme.

Figure 2. Projection of the CMR's civilian regime contributions and pension expenditure (Millions of Moroccan Dirhams)
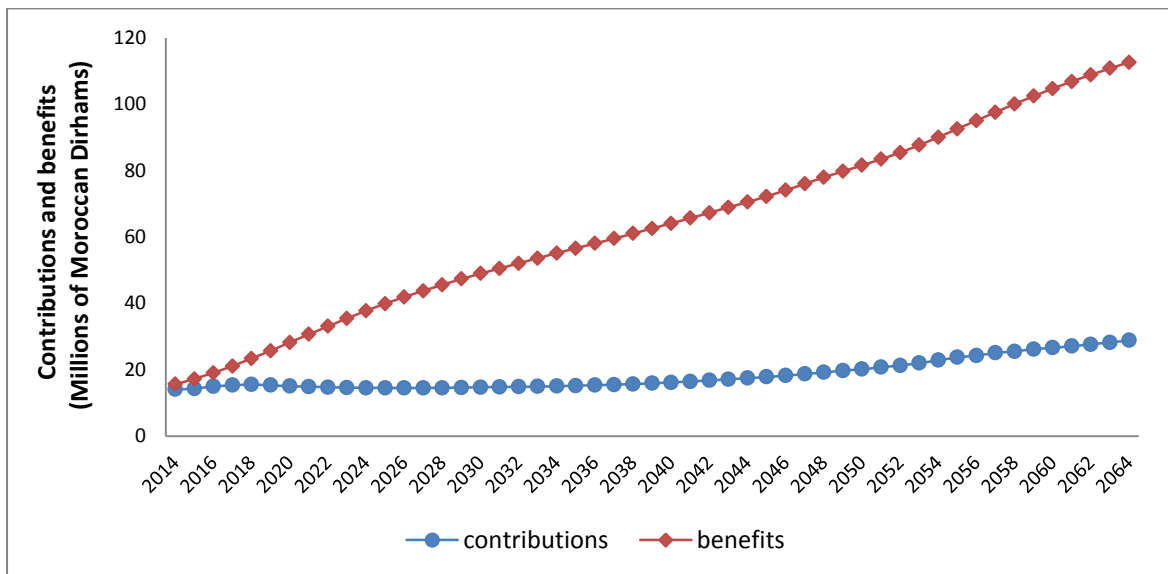
Based on the projection results, there is one thing that can be noted in Figure 2, there is an evolving gap during the projection period between contributions and benefits which represent for a significant portion of pension plan incomes and expenditures. This widening gap over the years must be due mainly to the contrast evolution between contributors and retirees numbers. The significant increase in the benefits must be the resulting to the average pension and the number of pensioners that are positively correlated and follow the same trend (Ayed Zamba *et al.*, 2006). The slight increase in contributions is due primarily to maintenance the contributing population growth throughout the projection period. Therefore, this mismatch between contributions and benefits will lead to deficit in the net result (see Figure A1) and a deep decrease in the reserves (see Figure A2) during the projection period.

According to the simulation, the global result of the CMR's civilian regime has recorded a deficit in the first year of the projection. Also, the deficit will accumulate from one year to another until the last projection period to reach 100.96 million Dirhams. The net result deterioration is due to the widening gap between the level of contributions and pensions

throughout the projection period. In addition to the deterioration of the pension fund global result (Figure A2), the reserves will totally expire in 2023.

The deterioration of the financial situation may be due to the low coverage rate which is the ratio of the amounts of contributions to that of pensions. Another factor can explain the situation; it is the changing demographic circumstances including the decline in fertility and the increase in life expectancy (see Ben Braham, 2009; Houssi, 2003, 2005). The deterioration of the financial situation can also be due to the generosity of the scheme. This latter is an ambiguous notion (e.g., Scruggs, 2006; Hassan *et al.,*2013; Kuitto, 2016) which can be measured either by the level of pension benefits as the level of annual pension (see Zaidi *et al.,*2006) or the level of replacement rate (Hachon, 2008). Furthermore, there are other causes of the financial problems worsening such as the deterioration of the economic situation, anticipated retirement, and the late entry of young people on the labor market due to the longer duration of the studies (see Ayed Zambaa *et al.,* 2013).

Scenario 2: Pension system perspectives under the 2015 parametric reform

The Moroccan government adopted in 2015 a parametric reform to extend and improve the financial viability horizon for few years for this PAYG based pension scheme. To prevent a public deficit from possibly growing out of control, this reform aims on the one hand to increase the pension scheme resources and on the other hand to reduce its expenses. This parametric reform covers all parameters, namely, the retirement age, the contribution and the annuity rates, and finally the pensions' base. Thus, according to laws number 71.14 and 72.14, the annuity rate will be reduced as of 2017 from 2.5% to 2% and the reference salary, on the basis of which the retirement pension is calculated, will be increased progressively from the last salary of activity to the average salary of the last 24 months of activity in 2017, 48 months in 2018, 72 months in 2019 to reach 96 months in 2020. Moreover, the contribution rate, which is 20%[8], will be increased from 2015 at a rate of 2% per year to reach 28% in 2019. The age of access to retirement will be increased to 63 years with an increase of 6 months for each generation from that born in 1957(see Table 1).

Table 1. The retirement age in 2015 parametric reform

Birth date	Retirement age
1957	60 years and 6 months
1958	61 years
1959	61 years and 6 months
1960	62 years
1961	62 years and 6 months

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[8] 10% employer contribution and 10% wage contribution.

Figure 3. Projection of the CMR's civilian regime contributions and benefits under the promulgated parametric reform (millions of Moroccan Dirhams)
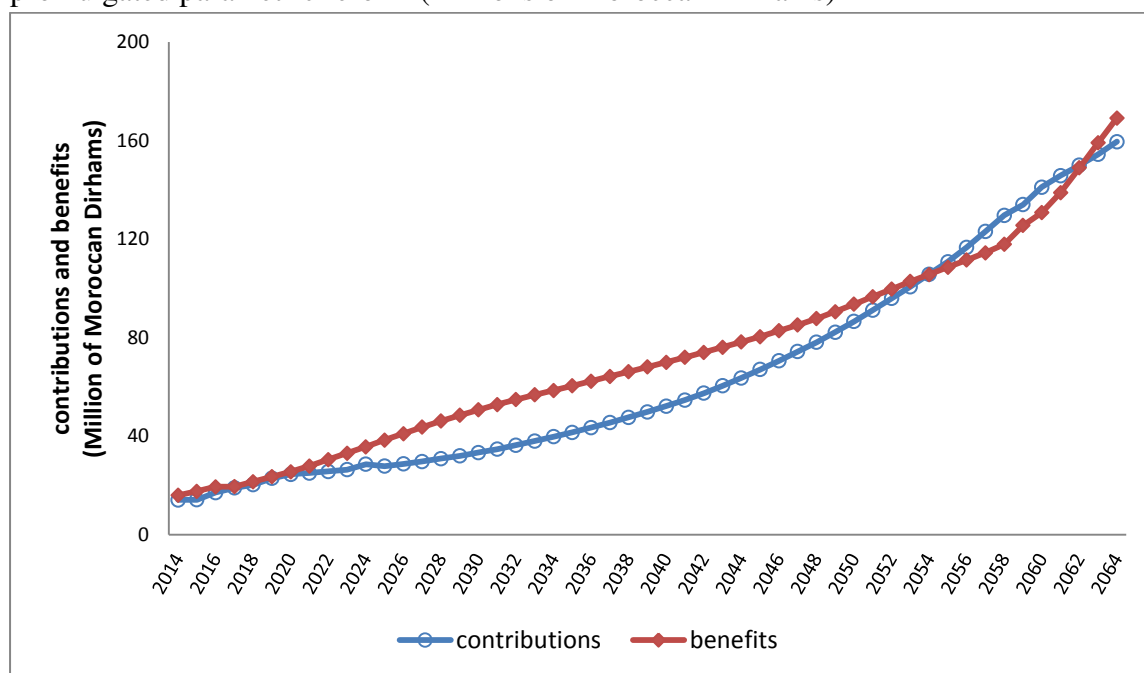
As can be observed in Figure 3 and compared with the situation where the parameters remain unchanged, the gap will be reduced between the amounts of contributions and benefits. Moreover, the reform targets will only be visible from 2054 where contributions will exceed benefits. According to our results, the impact of the parametric reform on the net result simulations stipulates a clear improvement in the reduction of budget deficit as compared to the net result in the case of unchanged legislation even if it remains negative (see Figure A1).

The projection of the financial situation under this scenario shows improvement of the scheme financial situation that will not be on the long run. Moreover, even if this parametric reform has narrowed the gap between income and expenditure, it can only delay by 10 years the entry into deficit of the social security system, setting it at 2033 (see Figure A2) instead of 2023 on the status quo scenario. So the reserves depletion is only temporarily postponed, but cannot be avoided in the near future.

Clearly, this parametric reform studied in scenario 2 induces a better financial performance comparing to the first scenario. Note that, during the last years, the Moroccan life expectancy increased form 48.45 years in 1960 to 75.52 years in 2015. In addition, the Moroccan fertility rates fall from 7.07 in 1960 to 2.53 in 2015. These demographic changes in the Moroccan population make it possible to increase the retirement age. For this reason, we propose in the section below, another parametric reform scenario based only on increasing the retirement age.

Scenario 3: Pension system perspectives under the parametric reform proposal

Pension funds operating in PAYG mode use three measures to rebalance reserves and adjust the pension system's resources to expenditures (COR, 2001). These measures are intended, on the one hand, to reduce pension fund expenditure by reducing the level of benefits paid, or

on the other hand to increase its resources through an increase in contribution rates or a creation of specific levies. A third measure is to increase the labour force and reduce the number of retirees. This measure is applied either by increasing the participation rate or by reducing the transition age of the activity at retirement.

In this paper we choose to study the effect of increasing the pension scheme's resources by increasing the retirement age only. We will increase the latter by one year each year to reach the age 65 years, because a sudden and flat increase in retirement age would likely be politically infeasible (Sayan and Kiraci, 2001). Increasing the number of contributions years is one of two elements that increase the contributivity of the system, which means an increase in the ratio of the active contributions to the resulting pension (De bustillo *et al.*, 2011). This article seeks to analyse the implications of such reforms for the pension scheme's financial situation.

Increasing contributions level by keeping a large number of labour forces in activity had a direct impact on changes in the amounts of contributions and benefits (see Figure 4). This scenario is politically feasible because the years added before retirement will increase the level of the members' pension. Thereby, we notice the increase in the level of contributions compared to benefits. This has a direct influence on the level of the overall balance (see Figure A1) and the reserves (see Figure A2). But this improvement is not at the same level as that observed at the level of the 2015 parametric reform.

Figure 4. Projection of the contributions and benefits of the civilian regime of the CMR under the parametric reform proposal (Millions of Moroccan Dirhams)
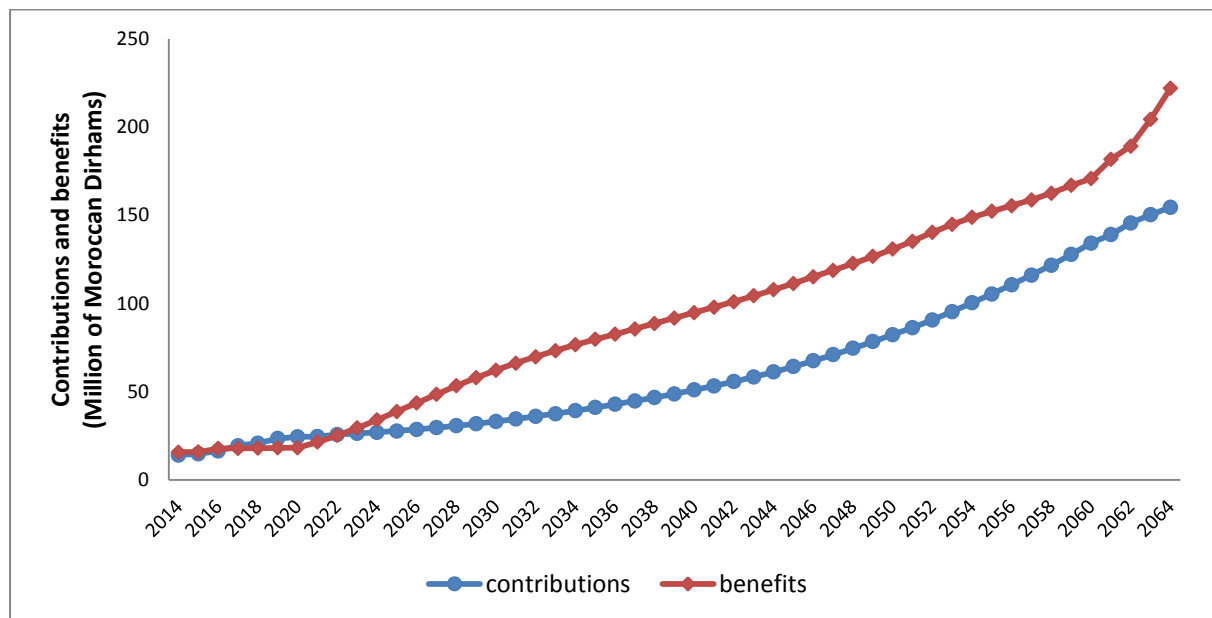
The gap between the amounts of contributions and pension expenditures is reduced in this reform proposition compared to the status quo (see Figure 2). In addition, the sum of contributions exceeds the pension expenditures one's during the period from 2017 to 2022. However, in the long run, the gain resulting from higher contributions is totally caught up by

the increase in the average pension; in other words, the system receives more but also generates more pensions. This situation has a direct consequence on the global result (see Figure A1). Even if this later remains negative, its amounts are higher than those recorded by the 2015 parametric reform from the start date of the projection up to 2034.

According to the third scenario projections, the gradual raising of the retirement age only has had a positive impact on the amounts of the reserves. Even if the reserves in the reform proposal and the 2015 parametric reform are consumed in the same year, the amounts of the first one are higher than the second before the date of consumption. Thought this reform proposal represents a good reform option but we should mention that the pension fund disequilibrium still not eliminated during all the projection's period. The projections results prove that the parametric reform is not sufficient to eliminate the existing structural problems but it only delays the pension fund's insolvency date. In fact, the CMR's has a positive balance until 2033 and will become insolvent in 2034, when the Social Security Reserve Fund runs out (Figure A2).

5. Conclusion

This study aimed to contribute to the debate on Moroccan pension reforms. This paper examines the CMR's civilian pension regime financial viability by using the Cohort-Component population projection method. Our approach was based on comparing the financial benefits of the 2015 parametric reform to those related to status quo situation and to a proposed alternative scenario based solely on increasing the retirement age. We projected cash flows of the civilian pension regime population during the period 2014-2064 under three scenarios: the unchanged legislation, the 2015 parametric reform, and the alternative scenario. The second scenario covers all the pension parameters, namely the retirement age, the contribution and annuity rates, and finally the pension base.

In this study, the financial projections under the aforementioned three scenarios prove that the parametric reform is a temporary solution for the scheme financial situation. Moreover, it is not sufficient to solve the problem and maintain financial balance in the pension fund. In fact, the restricted impact on the scheme financial situation can be attributed to the massive increase of pension scheme deficits. Indeed, by keeping the actual structure, the reserves are expected to run out in the year 2023, while it will be until 2033 under both the 2015 parametric reform and the alternative scenario. The results of financial projections point to the ineffectiveness in the long-term of the parametric reforms to stabilize the financial situation of the pension fund. Moreover, the efficiency of this type of reform will be limited even in the short-term. We should note that changing only the system parameters is not sufficient to eliminate the existing structural problems neither to avoid the future financial deficit of the pension system. In fact, in the 2015 parametric reform scenario and in the alternative scenario, the pension scheme will become insolvent in 2034, when the social security reserve fund runs out. Based on the projections results, both scenarios are offering this scheme roughly ten years of additional time to correct its important underlying unbalances. Nevertheless, after this brief period, the structural problems will resurface.

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Appendices

Appendix 1: Projections hypothesis

In this paper, we took the year 2014 as a basis of our projections. We divide this population into age and gender cohorts and we will observe the demographic and financial evolution of this pension scheme until year 2064 according to the assumptions below.

The demographic hypotheses on which we have based our projections are as follows:

- The life table on which we based is the mortality table TD88-90 to estimate the number of men deaths and the mortality table TV 88-90 to estimate that of women.
- Each year, we consider that the recruited staff replaces the deceased employees, the disabled ones and the new retirees of the current year.
- The disability rate used for our projections is 1%
- The difference in age between spouse and employee (or retiree) makes it possible to estimate the age of the spouse from the age of the employee (or the retiree). We took the difference of 10 years between them.
- The remarriage probabilities used are from the study by the INSEE on widows and widowers remarried between 1951 and 1952.

**Table A1:** the remarriage probabilities

	Age at widowhood								
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Women	---	0.86	0.78	0.77	0.66	0.50	0.42	0.33	0.25
Men	---	0.87	0.69	0.48	0.32	0.20	0.13	0.07	0.03

The financial hypotheses on which we have based our projections are as follows:

- The rate of wage developments and the discount rate are 4.5%
- Family allowances are projected in terms of weight relative to the main expenses. The rate used is 2%
- The reserve placement rate is 4.25%
- Pension revaluation rate is 1%

Figure A1. The CMR global result and reserves projections under the parametric reform proposal
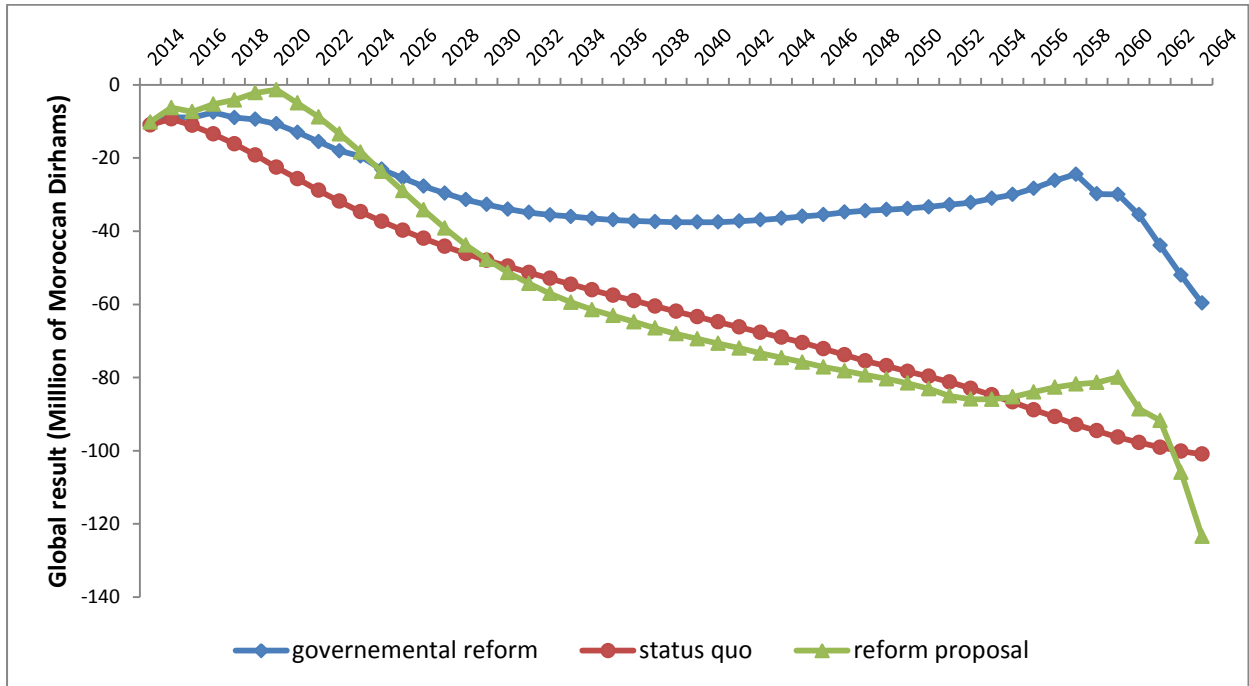
Figure A2. The CMR global result and reserves projections under the reform parametric reform proposal