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Ageing, Longevity and Savings: The Case of Morocco

Ghizlan Loumrhari
Mohammed V – Souissi University, FSJES Salé, Morocco.
Email: lghizlan@gmail.com

ABSTRACT: In this paper we investigate empirically the relationship between population agings begins in Morocco and private savings. To do this, we use an overlapping generations model (OLG) using annual data from 1980 to 2010. Econometric estimates show that if the increase in the dependency ratio negatively affects the growth rate of savings, as predicted by the lifecycle theory, longevity to the contrary tends to stimulate the same savings. However, it seems that the first effect outweighs the second. Economic policies to promote private savings and incentives for households to have more children are needed to meet the challenge of severe aging population which will face Morocco in the coming decades.

Keywords: Population aging; private saving; OLG model
JEL Classifications: C13; E21; J11

1. Introduction

No one today disputes the importance of private savings to finance an economy and its long-term growth. Since the work of Solow (1956), savings are seen as the main engine of economic growth. Despite the increase of savings in developing countries thanks, reforms of financial systems and new savings products, it still seems insufficient to trigger a real growth through investment in education, health, infrastructure, etc. The ageing population also expected in these countries, and if the predictions of the theory of life cycle is believed, savings, may slow down if not in its wake causing a slowdown in economic growth.

Indeed, as in industrialized countries, developing countries would experience in the years and decades to come profound changes in demographic structures. The increase in life expectancy and the sharp drop in fertility lead to aging characterized, among other things, by an increase in the elderly dependency ratio. These demographic changes will constitute one of the main challenges of the various developing economies in the coming decades. Several studies have attempted to identify, list and assess the effects of these demographic changes especially on advanced economies through its effects on the financial sustainability of pension systems (Bouzahzah 2000, Rotehr et al. 2003 and De la Croix et al. 2012), private savings (Heijdra et Romp 2008), productivity (Skirbekk, 2008) and economic growth (Kelley and Schmidt, 2005; Bloom and Canning, 2008 and Song, 2013)[1]. These works in their majority are interested in one way or another to check the empirical validity of the life cycle model in the case of developed countries. With few exceptions, most of these studies conclude to the empirical validity of this model.

In this paper we restrict ourselves to analyze directly the link between demographics and savings in Morocco, and indirectly to the effect of aging on economic growth. Indeed, the relationship between savings and economic growth is well established today. On the theoretical level, and according to the theory of life cycle, population aging will have negative consequences on national saving and thus on economic growth. Indeed, in a model à la Arrow-Romer, where the accumulation of physical capital is the engine of growth, it is trivial that if the negative impact of population aging on savings is verified, economic growth will also negatively affected. Similarly, in a model à la Uzawa-Lucas, where it is the accumulation of human capital which is the source of economic growth, an ageing population leading to a decline in savings would increase the interest rate and make it more

[1] Over the period 1965 - 2009, Kelley and Schmidt (2005) and Song (2013) attribute much of the economic success of East Asia's countries to the favorable demographic structure of those countries during this period.

profitable investment in physical capital relative to human capital[2]. Nevertheless, and regardless of the model used, if the intuition of a negative effect of aging on savings is confirmed empirically, the negative impact on growth would be a simple corollary.

The objective of this work is to attempt to verify empirically the validity of the theory of life cycle in the case of the Moroccan economy. In particular, we wonder to what extent the demographic shock, severe, which will face the national economy, will affect savings and thus on economic growth.

To answer this question we used annual data from 1980 - 2010 to estimate a relationship between mainly the growth rate of savings and the share of elderly (60 + years). The results clearly show the existence of a negative relationship, as predicted by the life cycle theory between savings and ageing. However, we show that extending the life tends to stimulate savings. In total we are faced with two contradictory effects of aging where the first effect outweighs the second who would have very negative consequences for economic growth. Measures should be taken by the government now to encourage savings and fertility.

The rest of the paper is organized as follows. The first section presents a brief review of literature on the relationship between aging on one side and savings the other. The second section is devoted to a brief presentation of the evolution of the Moroccan population. The third section describes the theoretical model. The penultimate section, the fourth, summarizes the presentation of the empirical specification used and the results. The fifth and final section concludes.

2. Literature Review

Generally work in the literature on the relationship between savings and growth on the one hand and demographic changes on the other side can be divided into three classes (Ashraf et al., 2013). Simulation exercises, microeconomic studies and aggregate statistical or econometric studies (macroeconomic). Our work is in this third category.

The work focused on the issue of verifying the relationship between demographic phenomena and household savings have so far resulted in mixed results. The life cycle hypothesis has sometimes been rejected because of the shape of the heritage curves which show a slight decrease during retirement. Several international studies directly on the savings rate highlighted the importance of demographic variables on the matter. In most cases, this influence is revealed by using dependency ratios (inactive / active) or by determining proportions of age group in the total population. Thus, Heller (1988) shows the influence of aging for seven OECD countries. Coudert (1991) explains the major trends in savings rates in large areas (United States, Europe and Japan) by changes in the structure of the age pyramids. Callen and Thimann (1997) also found an influence of the age distribution of the population in the savings rate in twenty-one OECD countries. Also include interesting results for Sweden (Berg [1996]) and Coloumbia (Cardenas and Escobar [1998]). Work, examining the relationship between dependency ratios and aggregate savings and confirming the hypothesis of the life cycle are very numerous. Without being exhaustive include Leff (1969), Feldestein (1974), Kelley and Schmidt (1996), Edwards (1996), Borsh-Supan et al. (2006) and Horioka (2007). On the other side, other authors such as Adams (1971), Gupta (1971), Goldberger (1973) and Ram (1982, 1984), Jenkins (1988) and Oksanen (2009) find that the relationship is insignificant or even positive. As Ahmedova (2011) points out, these differences in the results find their justification in the differences in the choice of variables, the data used and considered theoretical specifications.

However, the aging of the population is not limited to higher dependency ratios but is accompanied by a lengthening of the life of individuals. This can dramatically change the results, at least on a theoretical level. Indeed, on one hand we have the negative effect of aging (increase in the proportion of older people) on aggregate savings as predicted by the life cycle theory but on the other hand, the elongation of the life expectancy would increase savings as individuals anticipate a longer life what drives them to save more. Thus, the final effect on savings is indeterminate.

Also, more recent empirical studies have attempted to test this intuition by examining the relationship between rising dependency ratios (aging) and extending the life of individuals in the savings rate. Li et al. (2007), for example, using an overlapping generations model as a theoretical framework and panel data, found that the effect of rising elderly dependency ratio is negative on

[2] See Bouzahzah et al. (2002).

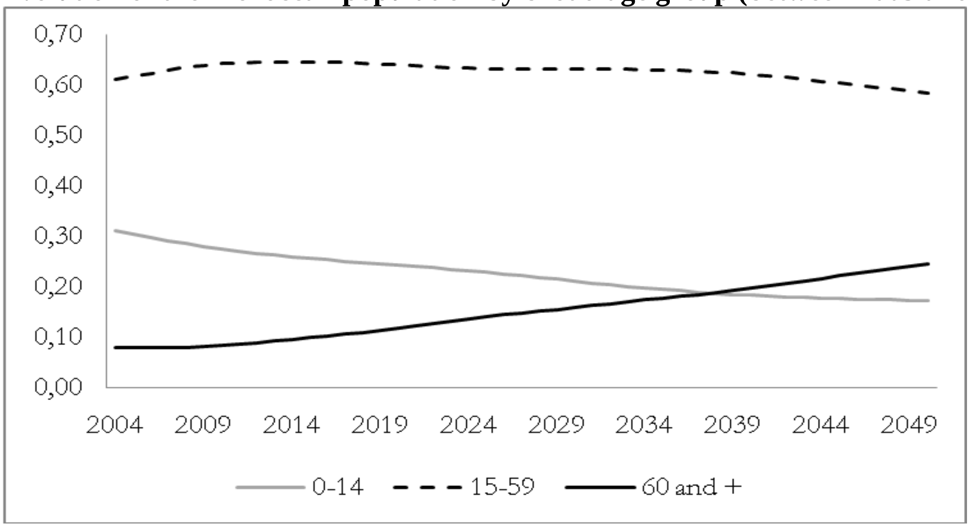
aggregate savings by against the extension of the life encourages people to increase their savings. Wong and Tang (2013) using panel data from 1961 to 2010 for 22 OECD countries found the same results i.e. a negative effect of age dependency ratio on savings but the lengthening of positively impact life savings. Song (2013) using the same techniques to some Asian countries the same results.

3. Moroccan Population

In less than a half-century, the Moroccan population has undergone profound changes. Between 1960 and 2004, the population was multiplied by 2.6, from 11.6 to 29.9 million[3]. It will, according to CERED projections 45 million in 2050. Under the combined effect of aging from the bottom of the pyramid (reduction of young population) and aging at the top follows the increase in life expectancy, Morocco experience, to like other countries, the demographic transition. While the life expectancy of a man at birth was 58.1 years in 1980, it is estimated at 71.6 years in 2009, an increase of 13.5 years in the space of 29 years. For women, the increase over the same period is 14 years; life expectancy is 74.2 years in 2009.

The demographic transition will begin in Morocco will be even more severe than that experienced by the developed world continues. This will lead to profound changes in the structure of the population by age. As Figure 1, drawn from the central scenario CERED shows the portion of people aged over 60 years increased from 8.2% of the total population in 2005 to 26.9% in 2060. At the same time, the labor force, those aged between 15 and 59 years would fall by 63.3% of the total population to 55.4%. The old-age dependency ratio, which measures the ratio between the number of retirees who normally dissave, and the number of people of working age will rise from 12% in 2000 to 14% in 2015 to 37% in 2050 according to forecasts of different pension funds (figure 2). This evolution of the dependency ratio portends significant challenges that will confront the pension funds in the coming years. In effect, this will create a worry for funds Moroccan retirement due to worsening an already fragile financial situation.

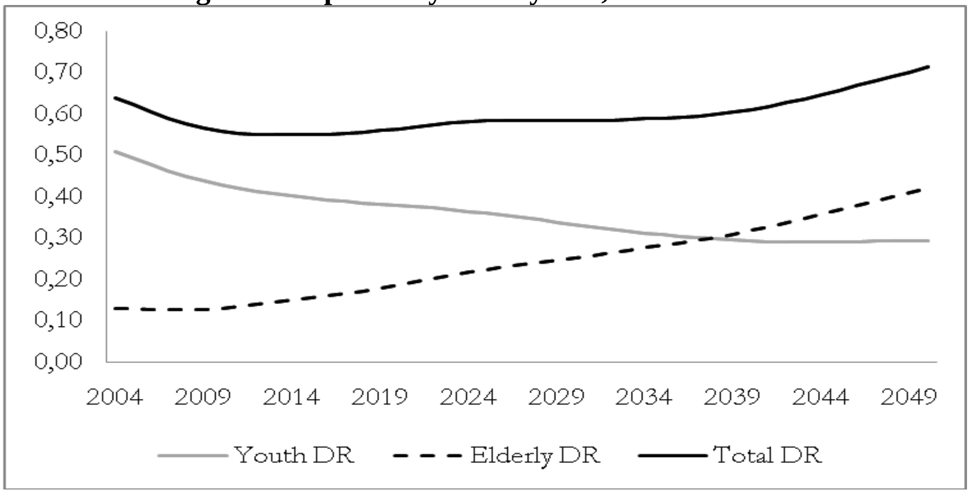
Figure 1. Evolution of the Moroccan population by broad age group (between 2005 and 2060)



Source: CERED

[3] 2004 is the date of the last general census of population and housing in Morocco

Figure 2. Dependency ratios youth, older and total



Source: CERED

3. The Theoretical Framework

Consider an economy in which individuals live two periods 1 and 2. They work during the first period (youth) and are retired in the second period (aged). Let N_t be the number of individuals in generation t and n_t the growth rate of N_t. It follows that for all *t* we have

$$N_t = (1 + n_t)N_{t-1}$$

During his first period of life the representative individual perceive a net salary noted ω_t, consume c_t^1 and save s_t. During his second period of life, in $t+1$, uses his savings in the first period to consume c_{t+1}^2. In this simple framework we assume that there is no public pension system [4]. If w denote r_{t+1} the interest rate between t and $t+1$, budget constraints of an individual born at time t will be given by

$$c_t^1 = \omega_t - c_t^1 \qquad (1)$$

$$c_t^2 = (1 + r_{t+1})\, s_t \qquad (2)$$

The representative individual of generation t maximizes a CES utility function, additively separable in time, throughout its life cycle.

$$U_t = \frac{(c_t^1)^{1-\sigma} - 1}{1-\sigma} + \beta\, \frac{(c_{t+1}^2)^{1-\sigma} - 1}{1-\sigma} \qquad (3)$$

where $\beta \in (0,1)$ is the relative weight given to the instantaneous value of the second period (a measure of time preference) and $\sigma \in \mathbb{R}_+$ is the intertemporal elasticity of substitution.

For given ω_t and r_{t+1} by substituting constraints (1) and (2) in the utility function (3) and by maximizing the latter with respect to s_t we obtain the following first order condition:

$$s_t = \frac{(1 + r_{t+1})^{\frac{1-\sigma}{\sigma}}}{\beta^{\frac{1}{\sigma}} + (1 + r_{t+1})^{\frac{1-\sigma}{\sigma}}}\, \omega_t$$

[4] To be more realistic we would have included pensions as an explanatory variable. Indeed, the existence of a public pension system could change the results. If children are seen as old-age insurance, the introduction of a mandatory pension system changes savings behavior and fertility in accelerating the aging population. In the case of Morocco, this assumption is not very harmful. Indeed, less than 30% of the active population has social security coverage and the share of pension expenditure to GDP does not exceed 6%.

Thus, the personal savings of the young is an increasing function of ω_t. It is an increasing function of r_{t+1} when σ is less than unity[5].

Of course, the total savings of the young is given by the personal savings of the representative young (4) multiplied by the number of young N_t

$$S_t = N_t s_t = N_t \frac{(1+r_{t+1})^{\frac{1-\sigma}{\sigma}}}{\beta^{\frac{1}{\sigma}}+(1+r_{t+1})^{\frac{1-\sigma}{\sigma}}}\omega_t \tag{4}$$

Old in period t are young in period $t-1$ and they are in number N_{t-1}. Their total savings is given by

$$S_{t-1} = N_{t-1} s_{t-1} = N_{t-1} \frac{(1+r_t)^{\frac{1-\sigma}{\sigma}}}{\beta^{\frac{1}{\sigma}}+(1+r_t)^{\frac{1-\sigma}{\sigma}}}\omega_{t-1} \tag{5}$$

Thus, it is possible to write the growth factor of total savings as follows:

$$\frac{S_t}{S_{t-1}} = \frac{N_t}{N_{t-1}}\frac{\omega_t}{\omega_{t-1}}\left(\frac{1+r_{t+1}}{1+r_t}\right)^{\frac{1-\sigma}{\sigma}}\frac{\beta^{\frac{1}{\sigma}}+(1+r_t)^{\frac{1-\sigma}{\sigma}}}{\beta^{\frac{1}{\sigma}}+(1+r_{t+1})^{\frac{1-\sigma}{\sigma}}} \tag{6}$$

Then, if we denote the growth factor of labor productivity g_t, the relation (6) can be rewritten

$$\frac{S_t}{S_{t-1}} = (1+n_t)(1+g_t)\left(\frac{1+r_{t+1}}{1+r_t}\right)^{\frac{1-\sigma}{\sigma}}\frac{\beta^{\frac{1}{\sigma}}+(1+r_t)^{\frac{1-\sigma}{\sigma}}}{\beta^{\frac{1}{\sigma}}+(1+r_{t+1})^{\frac{1-\sigma}{\sigma}}}$$

Finally, in this last equation the factor of population growth can be written in terms of the ratio of older people relative to the total population – SEP – (which is the measure of an aging population we have chosen). Thus, it is possible to express the growth factor savings as follows:

$$\frac{S_t}{S_{t-1}} = f(g_t, r_{t,} r_{t+1}, RPA_t) \tag{7}$$

Thus, the growth factor of savings depends on the rate of economic growth, present and future interest and the ratio elderly / total population. It is this equation (7) to be econometrically estimated in the next section.

4. Empirical Results

4.1. Data and variables

In previous work, the authors use cross-sectional data, time series or panel data. In our case, as we want to test the effect of aging on private savings in the case of Morocco, we used time series. The available data cover the period 1981-2010 and are an annual frequency.

In this paper and in light of the literature presented we will test two models. The first from the theoretical framework presented above, which is similar to test the link between private savings and aged dependency ratio. In the second model we add life expectancy to the list of explanatory variables to account for the lengthening of life.

According to the result of our theoretical model (equation 7) the dependent variable is the growth rate of private savings (GRS). Of course, the most important explanatory variable in this paper is the aging of the population. We use the share of elderly in the total population (SEP); the number of people aged 60 and over relative to the total population6. Then we introduce several other important explanatory variables for savings consistent with OLG model and equation (6), the growth rate of GDP (GRG), the inflation rate - INF - (approximated by the growth rate index of consumer prices, which is a good proxy for the interest rate) and life expectancy at birth (LEB).

The table 1 below summarizes the main characteristics (minimum, maximum, mean and standard deviation) of the variables used

[5] That is to say, when it is the substitution effect prevails. It is an increasing function of r_{t+1} when σ is greater than 1 (the income effect prevails) and does not depend on r_{t+1} when σ is equal to 1 that is to say when the effects of substitution and income offset what is the case of a logarithmic utility function.

[6] Other studies use the dependency ratio of the elderly or the total dependency ratio.

Table 1. Descriptive statistics of variables used

Variables	**Minimum**	**Maximum**	**Mean**	**Standard-deviation**
GRS	-0,33	1,36	0,12	0,42
GRG	-7,99	10,57	2,24	4,46
SEP	0,61	12,45	4,10	3,16
INF	5,75	8,28	7,12	0,71
LEB	59,00	72,00	66,51	3,83

The Moroccan economy is still characterized by high volatility of the rate of economic growth (over the period the standard deviation is 4.46% for an average growth rate of 4.10%). Although the agricultural sector has a share of less important, the alternations of good harvests and crop vary the growth rate of real GDP of Morocco in a wide range. As we have already mentioned above, Morocco is experiencing a demographic transition among the toughest in the world. Over the past 30 years the Moroccan won 13 years of life expectancy. Fertility has fallen sharply over the same period which increased the share of elderly 5.75% in 1980 to 8.28% in 2010.

A quick review of graphics series presented in Appendix casts doubt on the homogeneity of their dynamic properties. If the growth rate of savings, GDP and the price index for consumption (which are first differences) appear to be stationary it is not the case of other series. Also a more formal examination of the dynamic properties of all series proves necessary. Series on the part of older people and life expectancy seem to suggest trends. To avoid spurious regressions we must ensure that the series under consideration do not have a unit root. To do this, we propose to apply the Dickey and Fuller (1979, 1981) and Phillips-Perron (1988)[7] tests on all series considered. In cases where the two tests do not lead to the same conclusions, we adopt the procedure DF-GLS, generally considered more powerful, such as confirmation or results. Tables 2 and 3 summarize the results of the various tests. Despite the appearance of some series, the results of ADF and PP tests are clear. No series has a unit root.

Table 2. The augmented Dickey Fuller test (ADF)

	With C and T	With C	Without C or T	Results
GRS	-7,071	-7,207	-6,466	I(0)
GRG	-11,342	-10,575	-0,921	I(0)
SEP	-7,523	-3,316	1,900	I(0
INF	-3,957	-2,87	-3,207	I(0)
LEB	-2,434	-3,844	0,578	I(0)

Table 3. The Phillips Perron test (PP)

	With C and T	With C	Without C or T	Results
GRS	-7,071	-7,207	-6,348	I(0)
GRG	-11,691	-9,983	-6,806	I(0)
SEP	-6,593	-3,263	1,900	I(0
INF	-3,883	-2,816	-2,428	I(0)
LEB	-3,018	-3,542	6,232	I(0)

Notes: C: Constant, T: Trend

4.2. Specification and results

As the study of dynamic properties of the series considered revealed no unit root, it is possible to use OLS without this lead to spurious regressions. As we mentioned above, we used two specifications (models). In the first model we examine the effect of aging on the growth rate of private savings. In the second we add as an additional variable life expectancy at birth as a measure of longevity. Both models are written:

$$TCE = \alpha_0 + \alpha_1 TCP + \alpha_2 RDA + \alpha_3 TINF + \varepsilon \qquad \text{(Model 1)}$$

[7] Davidson and MacKinnon (2004) showed that the PP test is generally less efficient than the ADF test in the case of small samples as is the case in this work. To avoid choosing between the two tests we use both.

$$TCE = \alpha_0 + \alpha_1 TCP + \alpha_2 RDA + \alpha_3 TINF + \alpha_4 EVN + \varepsilon \qquad \text{(Model 2)}$$

The estimation results are summarized in the following table:

Table 4. The estimation results

Variables	Model (1)	Model (2)
Constant	3,1333*** [0,6770]	-0,6684 [1,6195]
GRG	-0,0198 [0,0193]	-0,0308* [0,0163]
SEP	-0,3486*** [0,0851]	-0,6341*** [0,1862]
INF	-0,1148*** [0,0241]	-0,0642** [0,0237]
LEB	- -	0,0850** [0,0410]
	R^2 =0,388 DW =1,700	R^2 =0,544 DW =1,96

***: Significant at 1%, **: Significant at 5%, *: Significant at 10%
The numbers in [.] denote standard deviation

A reading of Table 4 and in general the results of model 1 seems consistent with expectations and the theoretical model. Indeed, all variables, except the rate of growth of GDP have the expected signs. The sign of the coefficient of the rate of GDP growth is negative but is not statistically significant. Contrariwise, the sign of the coefficient of inflation is negative and significant at 1%, its value is -0.1148. Recall that the inflation rate was used as a proxy for interest rates, which means that as might be expected, the growth rate of savings depends positively and very significantly the rate interest. As a corollary, the intertemporal elasticity of substitution in Morocco is much less than unity.

Turning now to our variable of interest, the ratio of the population compared to the total population. Again, it is statistically highly significant (1%) and has the expected sign (negative). In addition it seems to be the most explanatory variable in the growth rate of savings since its coefficient is -0.3486. The aging of the population does affect the growth rate of savings which confirms empirically in the case of Morocco, the hypothesis of lifecycle model. Thus, all things being equal, population aging expected of seniors in the coming decades will have very negative consequences on savings and hence economic growth.

However, all things are not equal. As noted above demographic aging is accompanied by a longer life. This is what checks the model 2. Again, and in general, the results obtained for the model 2 are consistent with the theory. When life expectancy at birth is added to the explanatory variables in the model 1, the model makes the expected results and general statistics (R^2 and DW improves). The coefficients of the key explanatory variables have the expected sign. As for Model 1, the coefficient of inflation is negative and highly significant (1%). For Model 2, the coefficient of the rate of economic growth, however, is negative but is significant only at 10%. For our demographic variables, results confirm those obtained by other recent work. The coefficient of the ratio of elderly people is negative and highly significant (1%), which again confirms the empirical validity of the framework life cycle. In terms of amplitude, Model 2 indicates a more important role of population aging on the rate of growth of savings. The coefficient is now -0.63 while it was only -0.34 in Model 1. But on the other hand we show that as expected, longer life plays positively on the growth rate of savings but very moderately. The coefficient is, in effect, that of 0.08.

Thus, in total, demographic changes facing the Moroccan economy have two contradictory effects. The first related to the increase in the share of the elderly tends to reduce private savings and the second related to the extension of the life that stimulates savings.

5. Conclusion

Using time series from 1981 to 2010 and the life cycle framework we have shown that the aging population that began in Morocco will have important consequences for the private household savings and hence economic growth. In particular, we show that if, as predicted by the life cycle model, rising elderly dependency ratios will tend to contract private savings, increased life expectancy play a role in stimulating this savings. The first effect is more important is to be feared that the final effect is a contraction of private savings and economic growth. It seems necessary that government is aware of these demographics through public policies to promote private savings and recovery of the population by creating incentives for households to improve fertility.

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Appendix: Changes in selected variables