Labor market effects of Pension Reform : an overlapping generations general equilibrium model

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Abstract

This article develops an overlapping general equilibrium framework to capture the interactions among pension reform, labor market and inter-generational distribution issues in Tunisia. The three reform scenarios implemented to reduce the social security deficit consist in increasing social security contributions, reducing the replacement rate and postponing the retirement age. The main result obtained is that increasing contribution rates is the worst solution in terms of welfare and unemployment, particularly for the youth. The best option is postponing the retirement age. Contrary to the traditional wisdom, it does not entail an increase of youth unemployment. However this scenario increases substantially the implicit tax for older workers as well as for the youngest. The middle-aged are those that benefit the most from the replacement rate and retirement age reforms in terms of welfare increase.

Keywords : Pensions, Overlapping Generations, Unemployment, Tunisia

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1 Introduction

The problem of the sustainability of pay-as-you-go systems is becoming a serious concern for developing countries characterized by rapid demographic transitions and this problem will grow exponentially if nothing is done in the near future. Tunisia is a good example since its pension system has been in deficit since 2000 for the public sector fund and 2002 for the private one. According to the Tunisian National Statistical Institute (2009), the share of retirees in the population will increase from 10% in 2010 to 20% in 2034 due to the rapid aging of the population. The increase in the dependency rate puts a heavy pressure on the financial viability of the social security system. This issue is becoming highly sensitive in the Tunisian public debate.

Reform scenarios are generally concentrated on three options, or some combination of the three : higher social security contributions, increasing the retirement age or reducing pension levels. The three options have an impact on the welfare of generations (Breyer and Straub, 1993; Brunner, 1994; Huggett and Ventura, 1999) on saving (Feldstein, 1995), growth (Corsetti and Schmidt-Hebbel, 1995) and on the labor market (Devine, 1997). Actuarial studies have been conducted in Tunisia to assess the financial effect of increasing the retirement age, increasing the contribution rate or reducing the replacement rate, but these models are not able to tackle labor market issues.

The first option increases labor costs and puts a higher burden on labor demand. Higher levels of contribution rates also produce negative effects on the labor market due to their distortionary character (Kotlikoff, 1998). The second can reduce opportunities for new entrants on the labor market. The third one reduces the purchasing power of retirees and thus can lead them to seek for jobs to get complementary incomes. It can also have an impact on their consumption, particularly on the products they demand relatively more than the average such as health products. This can affect the labor market through general equilibrium effects.

While technically and politically the easiest to implement, there is a consensus among economists that increasing the pension contribution rates has negative effects on labor demand and thus on unemployment. However, given the relatively high level of under-declarations, especially for the youth, there is a margin of improving the enforcement of the law.

The official age of retirement in Tunisia is sixty years. However if we take into account early retirement programs, the average age is fifty eight years. Increasing the effective retirement age is becoming consensual among economists and the business community, especially with the increase of life expectancy. The risk of lower jobs opportunities for the youth if older persons stayed longer in the active population did not get empirical support until now (Gruber and Wise, 2010). However, the reform is not politically easy to implement given the context of transition and relative weakness of the State in many Arab countries.

The third option is to reduce the generosity of the pension system by reducing replacement rates and/or modifying the formula of computation of the reference wage. If this modification involves a closer link between contributions and benefits, it could also be an incentive for workers to put a higher pressure on employers for reducing under-declarations.

The novelty of this article consists in integrating pension sustainability issues with labor market modeling to capture interactions among pension reform and unemployment issues in an overlapping general equilibrium framework. Our first objective is to explore the economic impact of the three reform scenarios with a focus on the impact on unemployment by generation and on inter-generational equity. The idea is to explore for a given level of financial sustainability in the long run, the outcomes of the different scenarios in terms of the main variables of interest for policymakers. It is important to notice that the financial effectiveness of the different measures is not equivalent in the short run. For example increasing the retirement age gives immediately more resources tor the pension system, while reforming the reference wage formula will take more time to have an impact on the reduction of the deficit. Highlighting the trade-offs allows policymakers to choose the best combination according to the political constraints.

Finally the gap between contributions and benefits in defined benefits schemes has an impact on labor supply, especially for younger generations who often perceive contributions as an almost pure tax. Analyzing the impact of the different reform scenarios on this implicit tax would also help identify the winners and losers.

The rest of the article is organized as follows. Section 2 present a brief literature review on the impact of pension reforms on the labor market. Section 3 presents our model, its database and calibration procedure. In section 4 we briefly present the Tunisian pension system as well as some labor market indicators. Section 5 is devoted to the simulations and discussion of the main results and section 6 concludes.

2 Pension reform and labor markets : a brief literature review

2.1 Contribution rates' reforms

Using a segmented labor market model (formal and informal), Edwards and Edwards (2002) show that the reduction of contribution rates has a positive effect on wages in the informal sector. Simulations based on the case of Chili show that the social security reform induced an increase in the informal sector wages by about 2%. Using a panel of Colombian plants, Kugler and Kugler (2003) show that the rise in payroll taxes over the 1980s and 1990s induced a decrease in formal wages and employment. Using a multinominal logit model, Vargas (2006) showed that increasing the contribution rate in Columbia had a negative impact on female wages (-5%)

and a positive effect on male wages (+2%) in the formal sector. The effects were positive on employment in the formal sector and negative on employment in the informal sector.

The impact of social security contributions on labor supply has also received attention of many scholars including Feldstein and Liebman (2002) who consider that payroll taxes entail deadweight losses due their impact on labor supply. The size of this loss is proportional to the difference between the PAYG implicit rate of return and the marginal return to capital.

For Kaplow (2015), the effect of social security contributions on labor supply must address the issue of individual myopia, one of the main rationales of mandatory social security systems (shortsighted individuals may not save enough for their old age). He shows that the impact of social security contributions on labor supply when individuals are characterized by myopic behavior depends on the curvature of their utility as a function of consumption. When their relative risk aversion is inferior to 1, labor supply decreases and when it is superior to 1 the marginal benefit of increasing labor effort increases, and thus labor supply increases.

2.2 The effect of postponing the retirement age on youth employment

Gruber and Wise (2010) study whether the departure of older persons from the labor force expands job opportunities for the youth in twelve OECD countries. They start from the flow of women into the labor force, which has increased the size of the labor force in many countries. Descriptive statistics from these data show that the smallest of the small declines were in countries with the largest increases in the women's employment rate. Then, they run regressions on the relationship between employment rates of persons from 55 to 64 on the one hand and employment and unemployment rates of youth between 20 to 24. They find a correlation among the series ; employment of youth is positively correlated with the employment of older persons. Moreover, the youth unemployment is negatively correlated with the employment of older persons. Panel regression estimations, confirm these primary correlations.

2.3 The effect of pension levels' reform on the welfare of elderly

Before the introduction of social security programs many individuals could not save enough for their retirement period because the market did not offer possibilities for small investors. Thus, pension benefits will increase consumption and welfare of retirees (Diamond, 1977). Based on early 1970's data for US households, the econometric study of Kotlikoff et al. (1982) leads to the same conclusion, showing that higher benefits lead to higher consumption at retirement period. In fact, according to Kotlikoff et al. (1982) the increase of consumption of the elderly is due to economic uncertainty rather than to myopic behavior. Hamermesh (1984) tried also to investigate the relationship between benefits and consumption during retirement. His study was

based on Retirement History Survey (RHS) providing data on consumption and saving of 4000 couples aged 58-63 years. This survey covers the period 1969-1975. It shows that elderly do not save enough to maintain the level of their consumption during the retirement period. Their savings are insufficient and the data shows that pension benefits offset partially this insufficiency. Following these conclusions we can say that parametric reforms that reduce pension benefits by decreasing the replacement rate may hurt the old-aged welfare.

2.4 PAYG reform, Implicit tax and Labor Supply

The implicit tax of the pay-as-you-go system is related to the link between contributions and benefits. A stronger link between contributions and benefits induces a lower implicit tax (Keuschnigg, 2016). When benefits are independent of contributions or are weakly related to them, workers view most of their contribution as a marginal tax that creates distortions on labor supply (Kotlikoff, 1998). The implicit tax is related to age. It is much higher for younger people especially for those whose contributions do not affect benefits (the replacement rate computation takes into account only the last ten years of the active live in Tunisia) (Feldstein, 1996). Older workers can face a negative implicit tax : they receive more in terms of benefits than there marginal contributions. Moreover, the complexity of the social security formula for computing benefits leads many individuals to consider the contribution to the system as a pure tax (Feldstein, 1996). Younger workers perceive less the link between benefits and contributions because they are in the beginning of their active life. However, considering the pension contribution as a pure tax is excessive (Gannon and Touze, 2014) . The implicit tax will depend on the way benefits are computed. Increasing the benefits links reduces the tax character of contributions (Keuschnigg, 2016).

In our paper, we define the implicit tax $\delta_{g,t}$ for the generation g as the difference between the present value of contributions and the present value of benefits reported to the inter-temporal revenue. This tax is borne only by active individuals, who are paying contributions.

$$\delta_g = \frac{\tau \sum_{t=g+ac}^{g+ac+R-1} \prod_{s=1}^{g+ac+R-t-1}(1+r_s)^{-1} w_{g,t} - \sum_{t=g+ac+R}^{g+Lexp} \prod_{s=g+ac+1}^{t}(1+r_s)^{-1} B_{g,t}}{\sum_{t=g}^{g+ac+R-1} \prod_{s=1}^{g+ac+R-t-1}(1+r_s)^{-1} w_{g,t} + \sum_{t=g+ac+R}^{g+Lexp} \prod_{s=g+ac+1}^{t}(1+r_s)^{-1} B_{g,t}} \tag{1}$$

where $(t-g)$ corresponds to the age of generation g at year t, ac the age of entry on the labor market, τ the social security contribution rate, R is the length of the active life, $Lexp$ is the life expectancy at birth, $w_{g,t}$ is the wage by generation, r_s the interest rate and $B_{g,t}$.the pension level by generation.

The pension reform of the PAYG system characterized by the increase of contribution rates, the reduction of benefits or the increase of the retirement age leads to an increase in the implicit tax of the retirement system. As the contribution rate increases, the effective tax on labor increases because there are no additional benefits in exchange of the additional contribution. The distortion on labor increases as well (Kotlikoff, 1998). The implicit tax increases also when the replacement rate decreases. In this case, the same contribution rate is associated to lower benefits. Postponing retirement age and keeping simultaneously the contribution rate constant increases the implicit tax rate on workers : they are supposed to pay contributions for a longer period and receive benefits for a shorter period. The implicit tax increases and contributions become more distortionnary. Consequently, labor supply is affected through three channels (Jaag et al., 2010). The retirement decision is considered as a labor supply response through earlier retirement ; a reduction in worked hours and through lower incentives for job search.

3 Description of the model

3.1 Household behavior

The model we developed is a dynamic life-cycle overlapping general equilibrium model with a finite horizon, following the seminal work of Auerbach and Kotlikoff (1987). Each individual maximize her utility over time choosing between present and future consumption. A labor leisure choice allows to take into account the impact of pension reform on labor force participation. The model has 55 overlapping generations. The individual enters the labor market at age 20, retires at age 60 (in the reference scenario) and lives until age 75. The model is run from 2012 to 2070. We chose a sufficiently large value for the terminal period to allow the model reaching a new steady-state after a policy shock. In 2012, the oldest generation supposed alive (last year pensioners) corresponds to people born in 1937. The youngest generation are people born in 2050 (those that should enter the labor market in 2070).

The consumption behavior is given by the inter-temporal utility for each generation :

$$\text{Max}U_{g,t} = \sum_{t=g}^{g+R-1} \left(\frac{1}{1+\rho}\right)^{(t-g)} \frac{z_{g,t}^{1-\theta}}{1-\theta} + \sum_{t=g+R}^{g+Lexp} \left(\frac{1}{1+\rho}\right)^{(t-g)} \frac{C_{g,t}^{1-\theta}}{1-\theta} \tag{2}$$

where R is the retirement age, $Lexp$ is corresponds to life expectancy at birth, $c_{g,t}$ corresponds to goods' consumption, ρ is the discount rate, θ the inverse of the inter-temporal elasticity of substitution and $z_{g,t}$ is full consumption, given by the following equation :

The utility function takes into account the trade-off between consumption and leisure :

$$z_{g,t} = [\alpha {c_{g,t}}^{\sigma} + (1-\alpha) l_{g,t}^{\sigma}]^{\frac{1}{\sigma}} \tag{3}$$

where $1/(1-\sigma)$ is the elasticity of substitution between leisure and consumption of goods.

The budget constraint is given by :

$$\begin{aligned} \sum_{t=g+R}^{g+Lexp} \prod_{s=g+1}^{t} (1+r_s)^{-1} c_{g,t} = {} & [w_{g,g}(1-\tau)(\omega_{g,g} - l_{g,g}) - c_{g,g}] \\ & + \sum_{t=g+1}^{g+R-1} \prod_{s=g+1}^{t} (1+r_s)^{-1} [w_{g,t}(1-\tau)(\omega_{g,t} - l_{g,t}) - c_{g,t}] \\ & + \sum_{t=g+R}^{g+Lexp} \prod_{s=g+1}^{t} (1+r_s)^{-1} B_{g,t} \end{aligned} \tag{4}$$

where $w_{g,t}$ is the wage by generation, $\omega_{g,t}$ is total time endowment, $B_{g,t}$ correspond to pension benefits by generation, τ is the social security contribution rate, $z_{g,t}$ is full consumption and r_s is the interest rate.

3.2 Production and labor market modeling

A production block is added to the model to capture the labor demand effects of the different scenarios.

The production function is a nested constant elasticity of substitution (CES) function. At the first level production is a CES function of labor L and capital K.

$$Y_t = [\beta {L_t}^{\gamma} + (1-\beta) K_t^{\gamma}]^{\frac{1}{\gamma}} \tag{5}$$

where $1/(1-\gamma)$ is the elasticity of substitution between capital and labor.

At the second level, labor demand is a nested CES of labor demand by generation. This allows taking into account imperfect substitution between workers characterized by different age levels ($LG_{g,t}$) and thus the issue of youth unemployment.

$$L_t = [\sum_{g} \phi_{g,t} LG_{g,t}^{\epsilon}]^{\frac{1}{\epsilon}} \tag{6}$$

where $1/(1-\epsilon)$ is the elasticity of substitution between labor categories by generation.

The comparison of market wages by generation and the reservation wage determines the evolution of labor supply by generation.

Market wages and unemployment by age are both endogenous in the model. Wages' ($w_{G,T}$) growth decreases with unemployment rates ($u_{G,T}$) following a wage curve (Blanchflower and Oswald, 1995).

$$Ln(w_{G,T}) = \beta_1 + \beta_2 \cdot Ln(u_{G,T}) \tag{7}$$

with β_1 the intercept for the wage curve and β_2 (<0) the elasticity of the wage curve with respect to unemployment.

3.3 Pension system modeling

Following the Tunisian PAYG pension system*, contributions COT_t represent a share of labor income. This share τ corresponds to the effective contribution rate, which is equal to the statutory contribution rate multiplied by the coverage rate and the density of contribution of each generation.

$$COT_t = \sum_{g=t}^{g=R-1} \tau * w_{g,t} * LG_{g,t} \tag{8}$$

Aggregate pension benefits BT_t depend on the number of retirees $NR_{g,t}$, the reference wage $wref_{g,t}$ and the replacement rate μ. The reference wage corresponds to the average wage of the last ten years. The replacement rate depends on the number of contribution years and the density of contribution.

$$BT_t = \sum_{g=R}^{g=lexp} \mu * wref_{g,t} * NR_{g,t} \tag{9}$$

The balance of the pension system E_t increases the stock of assets or debt every year.

$$E_{t+1} = (1 + r_{t+1})E_t + COT_{t+1} - BT_{t+1} \tag{10}$$

3.4 Terminal conditions

Terminal constraints are added to the model to ensure that the economy remains on a steady-state path, even after a policy shock. Following Rasmussen and Rutherford (2004), the value of terminal assets are modeled so as to ensure an inter-temporal equilibrium between resources and demand (including consumption and leisure). The consumption and leisure demand profiles of

∗. The system will be discussed in detail in the next section.

individual living beyond the terminal period are also intertemporally balanced to ensure their steady-state evolution.

Following Lau et al. (2002), investment grows at the steady-state rate in the last model period, which ensures a steady-state rate of growth for capital. Finally, we balance the social security budget period by period through a flat-rate tax imposed on all generations' inter-temporal incomes at a given period.

3.5 The data

To calibrate the overlapping general equilibrium model we use various sources of data : economic data, labor force survey data, demographic data and data on pensions and pensioners from the National Fund of Social Security (CNSS).

An aggregated social accounting matrix has first been built from national accounts data for the year 2012. Current wages, labor force, employment and unemployment data by age are from the 2012 Tunisian Labor Force Survey. The number of contributors and retirees by age as well as total contributions and benefits are from the CNSS. Effective contribution and replacement rates have been computed on the basis of the previous.

3.6 Calibration of the model

The calibration of a computable general equilibrium model consists in setting exogenously values for the model's parameters while respecting the consistency of the whole database. The additional difficulty for OLG models is that this consistency needs to encompass the behavior of any generation at any given point in time. We follow the procedure developed by Rasmussen and Rutherford (2004) and extend it to a situation where the life-cycle of each representative agent of each generation is split in two parts : a working period and a retirement period.

The authors start by developing a calibration model which determines the optimal profile of a reference generation, while using aggregate variables levels as constraints. The model is run with the simplifying assumption that the economy is on a steady-state growth path. In a second step, a baseline reference path is set up for all the exogenous variables (the aggregate ones and the variables by generation).

4 The Tunisian context

The Tunisian social security system is managed by two public structures : the National Social Security Fund (CNSS) for private sector employees and the National Pension and Social Insurance Fund (CNRPS) for public sector employees.

In 2013 the CNSS affiliates represent 75% of the total affiliates to the social security system. These affiliates are covered by 7 different regimes according to their professional categories. The most important regime is the RSNA for the non-agricultural employees which represents 53% of the total contributors to the CNSS in 2013. The agricultural employees with low revenues contribute to RSA regime and those with higher revenues contribute to the RSAA regime. The self employed contribute to the RTNS regime. Since 2002 two additional regimes were introduced in the CNSS : the RACI, regime for the artists and intellectuals and the RTFR for the low wage employees.

In spite of the increase of the contribution rate from 5% in 1974 to 11.5% in 1996, by 2002, the CNSS had become an insolvent pay-as-you-go regime. While the contribution rate continue to be increased reaching 18% the financial insolvency of the CNSS has not been resolved till 2013. Many factors can explain this situation.

First, the contribution rate is the only parameter that was changed until the creation of this fund. Despite of its high level, the amount of the contributions remains low. In fact, a large fraction of the contributors declare a level of wage below the minimum wage level. This fraction was estimated at 85% in 1993 (Vittas and Mundial, 1993). This phenomenon is due to the absence of link between contributions and benefits. The amount of benefits depends only on the ten last year's average wage and on the number of contribution years. Moreover the contribution density in Tunisia is below unity which results in a loss of the amount of contribution estimated at 12% for the RSNA regime in 2012 (Ben Braham and Marouani, forthcoming). Second the replacement rate remains at its high level at about 80% for 30 years of contribution. Moreover, the retirement age is still at 60 years old while the demographic structure of the Tunisian population has been changing. The life expectancy at birth has increased from 60 years in 1974, when the CNSS was created, to 75 years in 2013. At the same time the number of people aged over 60 years in Tunisia has increased while the number of those below 60 years has decreased. As a result the dependency ratio has increased and according to the INS projections it will continue increasing. Its level estimated at 14.8% in 2009 will reach 31.4% in 2030. The dependency ratio of the CNSS regime is higher. Its level will reach 36% in 2030 according to the CRES projections. The demographic evolution of the Tunisian population puts a heavy pressure on the pension system finances.

Postponing the retirement age increases the contribution period and thus the amount of contributions. It also reduces the the amount of benefits by reducing the retirement period. According to Abdessalem and Cherni (2011), a five years increase in the retirement age can ensure the Tunisian pension system balance in the long run, with a contribution rate of 21.7%. However increasing the retirement age can affect the labor market as discussed earlier. In Tunisia, the unemployment rate was estimated at 16% in 2013 and at 27.9% for the youth (20-24 years old)

and only at 3% for people aged 45 years old and above (David and Marouani, 2015). Given the labor market context of Tunisia, especially after the revolution, it is particularly relevant to investigate the impact of the different pension reforms on unemployment rates by age group.

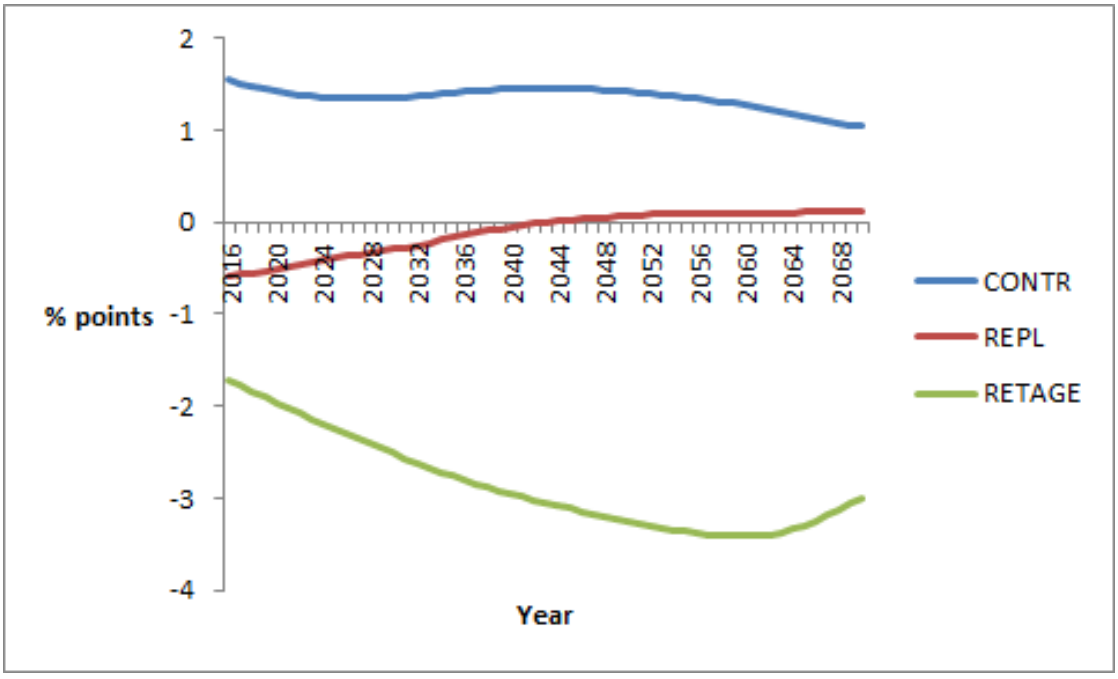
5 Experiments and results

The first experiment consists in increasing contribution rates by 30%, the second in decreasing replacement rates by 20% and the third in increasing the retirement age by two years. The simulations are implemented in 2016. The first two rates have been chosen on the basis of decreasing the deficit by 40% in the medium run, while the third is a policy proposal from the Government. The results of the simulations are presented in comparison to the baseline scenario (without simulation).

5.1 Aggregate Results

In terms of financial sustainability, none of the three reforms alone is enough to absorb the whole deficit. While the second and the third have immediate effects (reducing respectively the deficit by 40% and 60%), increasing contribution rates has a progressive impact (from 20% in the short run to 40% in the medium run). Increasing the retirement age is the most efficient in terms of financial outcome because it increases resources and decreases spending at the same time. Although important, this issue is not the focus of this article. We now turn to the comparison of the effects of the three alternative policy scenarios on the labor market.

FIGURE 1: Impact on aggregate unemployment rate of the three reform scenarios



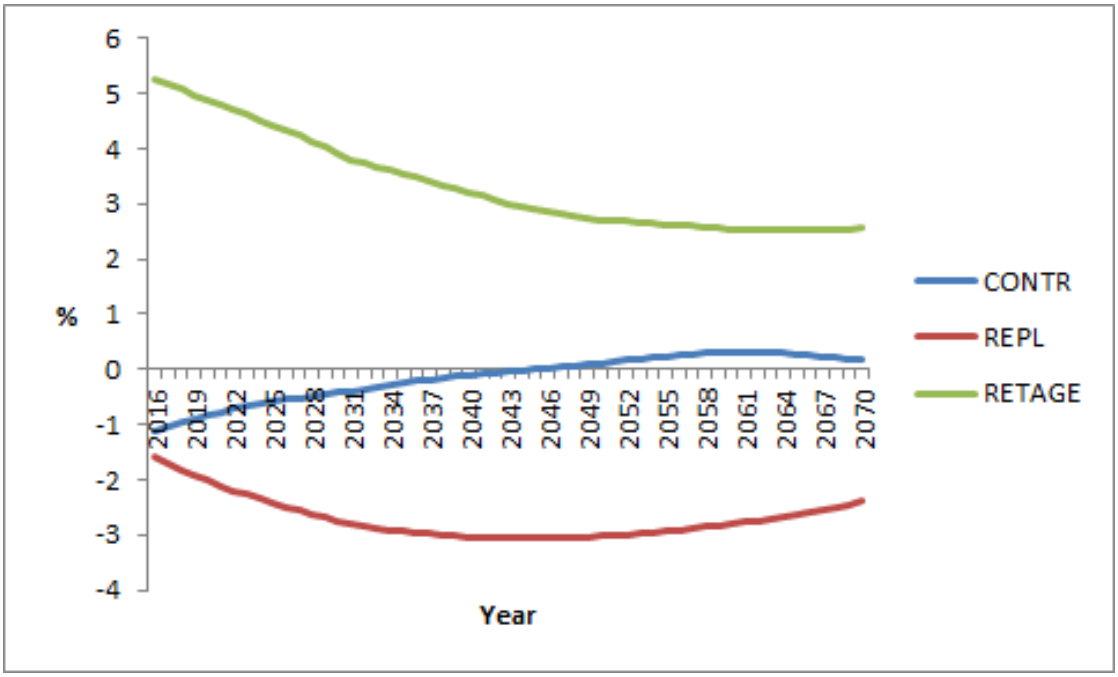
As expected the increase of contribution rates has a negative impact on the labor market.

According to figure 1, the aggregate unemployment rate increases immediately by 1.5 percentage points. This effect persists in the long run, entailing an increase by 1 percentage point of structural unemployment in Tunisia. By distorting the labor-leisure choice, the increase of the contribution rate has also a negative impact on labor supply which decreases by 1% in the short run (figure 2). This result is similar to the conclusion of Rasmussen and Rutherford (2004).

Decreasing the replacement rate has a limited effect on the aggregate unemployment rate. It is reduced by 0.4 percentage point in the short run and increases by 0.1 percentage point in the long run (figure 1). This limited effect is due to the fact that labor costs are not affected by the reform. Transfers to retirees (pensions) are reduced but also the income tax that finances the deficit. The slight positive effect on unemployment reduction is due to the decrease of labor supply (figure 2). This decrease is due to lower marginal rates of returns to contributions (given the decrease of pension rates), which increases the distortionary impact of contributions on the labor-leisure choice (they become closer to taxes than to contributions).

As shown by figure 1, increasing the retirement age gives the best results in terms of unemployment reduction (-3.5 percentage points on average). This is due to the increase of the labor force (figure 2) that puts a downward pressure on wages, which entails an increase in labor demand.

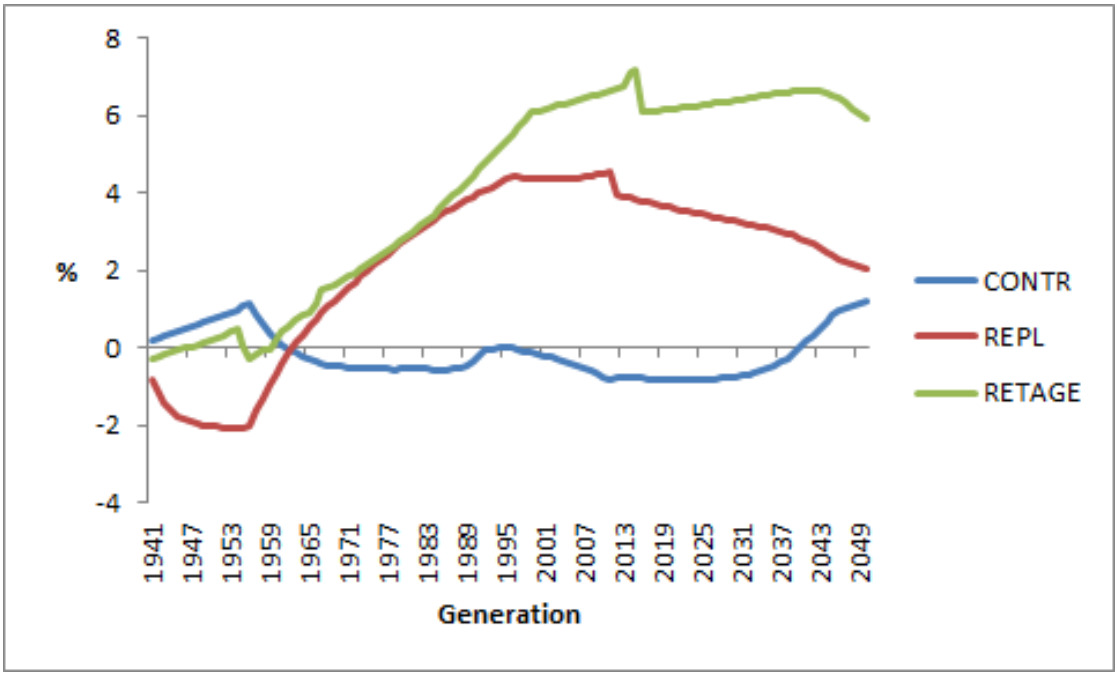
FIGURE 2: Impact on aggregate labor supply of the three reform scenarios



5.2 Impact on welfare by generation

We compute the Hicksian equivalent variation by generation for the three scenarios. For the first scenario the aggregate impact on welfare is negative due to the distortionary effect of contributions. For the two other scenarios, the aggregate effects are positive, but the impact is much larger for the retirement age reform (figure 3). Lower unemployment rates are the main explanation behind higher intertemporal incomes observed in the two scenarios and particularly in the third.

FIGURE 3: Impact on welfare by generation of the three reform scenarios



Increasing contribution rates has a negative impact on the welfare of all generations except for two groups (figure 3). The first group is composed of current retirees in 2016 (generations 1941 to 1957) who pay lower income taxes and do not contribute anymore to the social security system. The second group is composed by the generations 2040-2050 who start working in 2060 (while the model horizon is 2070). Given that the wage is lower in the first working period, these generations will be better off if they pay more social security contributions and lower income taxes (the income includes also capital gains).

The replacement rate reform scenarios has a positive impact on all generations born after 1963, but with a larger impact on the middle-aged (figure 3). The generations that lose the most are current retirees and particularly young pensioners. There is a reduction of welfare for generations

at the end of their working lives because the benefits of lower taxes does not cover the costs of lower pensions. The generations that gain the most (about 5%) are born between 1996 and 2010. Individuals born in 1996 will enter the labor market in 2016, year of the implementation of the reform. They will reap more benefits than older generations because they will spend their forty working years under the new policy setting. Similarly, individuals born in 2010 will enter the labor market in 2030, and will thus be the last generation that will spend forty working years in the model's horizon (2070).

The retirement age reform has a positive impact on welfare for all generations but current retirees who are not affected by the increase of the working life length. The effects of the reforms are very similar with those of the previous scenario for the 1960s-1980s generations, then the difference between the two scenarios increases progressively . The maximal gain for the middle-aged reaches about 7% and the gain for the last generations is about 5.5% (figure 3).

5.3 Impact on unemployment by age

5.3.1 Higher contribution rates

The first conclusion we can draw from figure 4 is that the negative impact of higher contribution rates on unemployment is decreasing with age. The youth (20-30 years old) unemployment rate increases by more than 2 percentage points on average during the period of investigation. This is first due to the structural characteristic of the Tunisian labor market where youth unemployment rates are much higher than older categories of the population rates. It is also due to a differentiated impact of increasing contribution rates on labor supply (figure 5), that we will discuss in the next paragraph.

Moreover, we notice that for the youngest group (20-25) there is a first phase from 2016 to 2036 where there is an acceleration of the unemployment rate increase (reaching 3 percentage points), then the rythm of increase becomes progressively lower, reaching 1.5 percentage points at the end of the period. The explanation lies in labor supply effects (figure 5). In the first period the increase of youth labor supply can be explained by a substitution effect. Given that older categories reduce their labor supply due to higher contribution rates (their opportunity cost of leisure is higher), substitution effects entail an increase in youth labor supply. In the second period, when the increase of contribution rates reaches its maximal effect on the pension deficit, the income tax starts decreasing and labor supply of all age categories returns to its initial levels.

FIGURE 4: Impact on unemployment by age

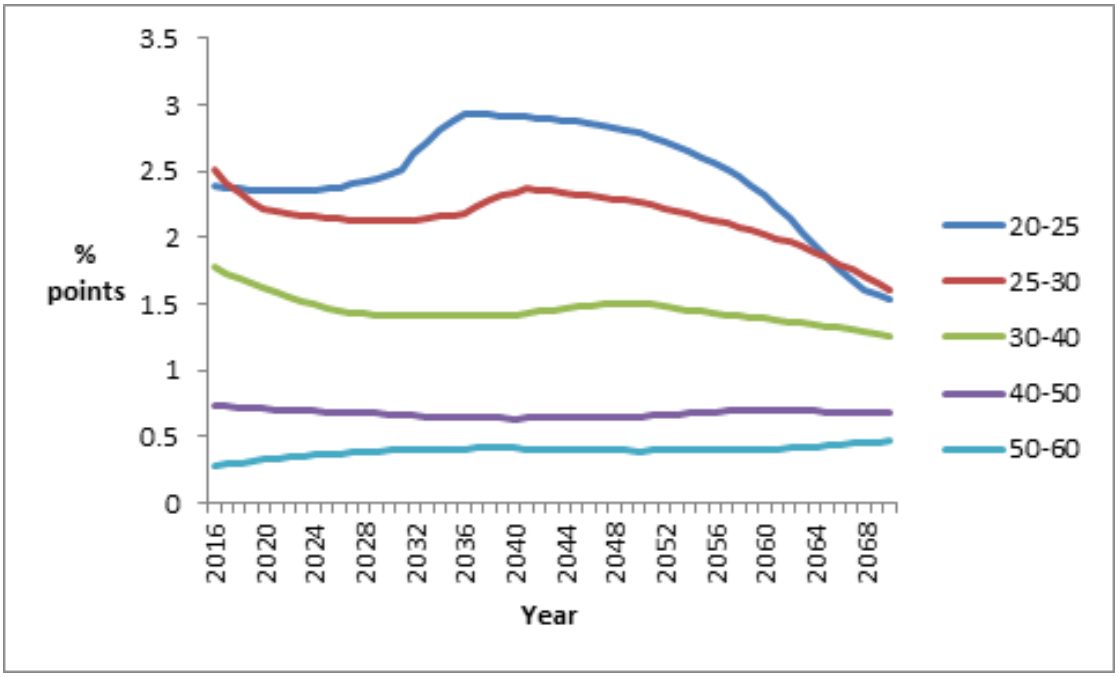
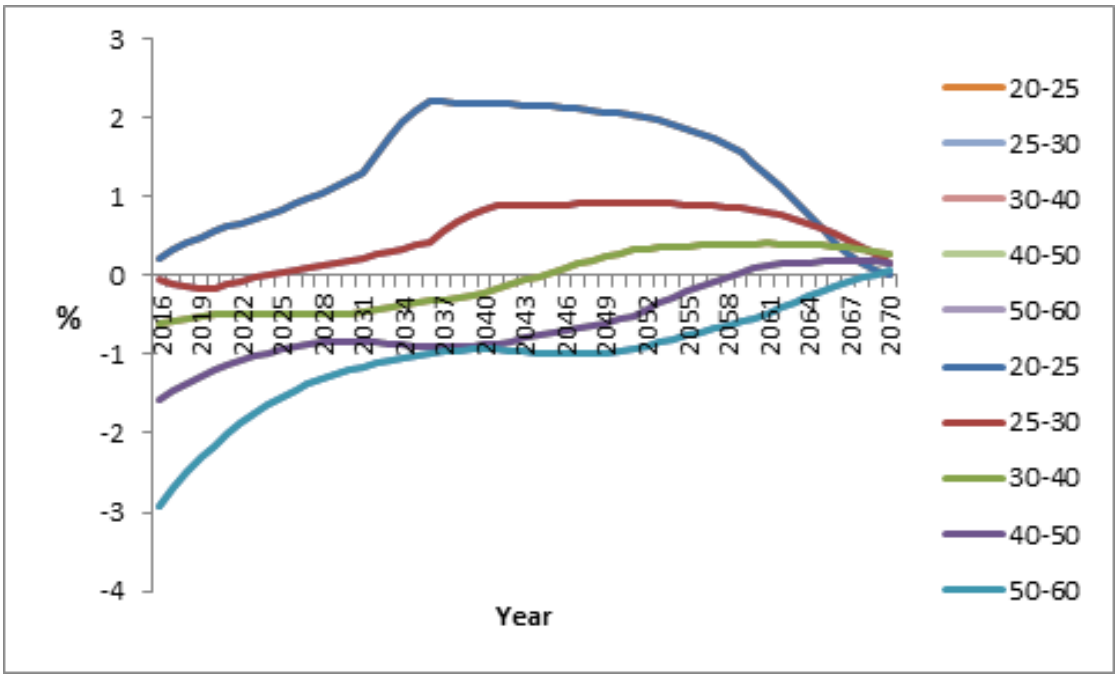


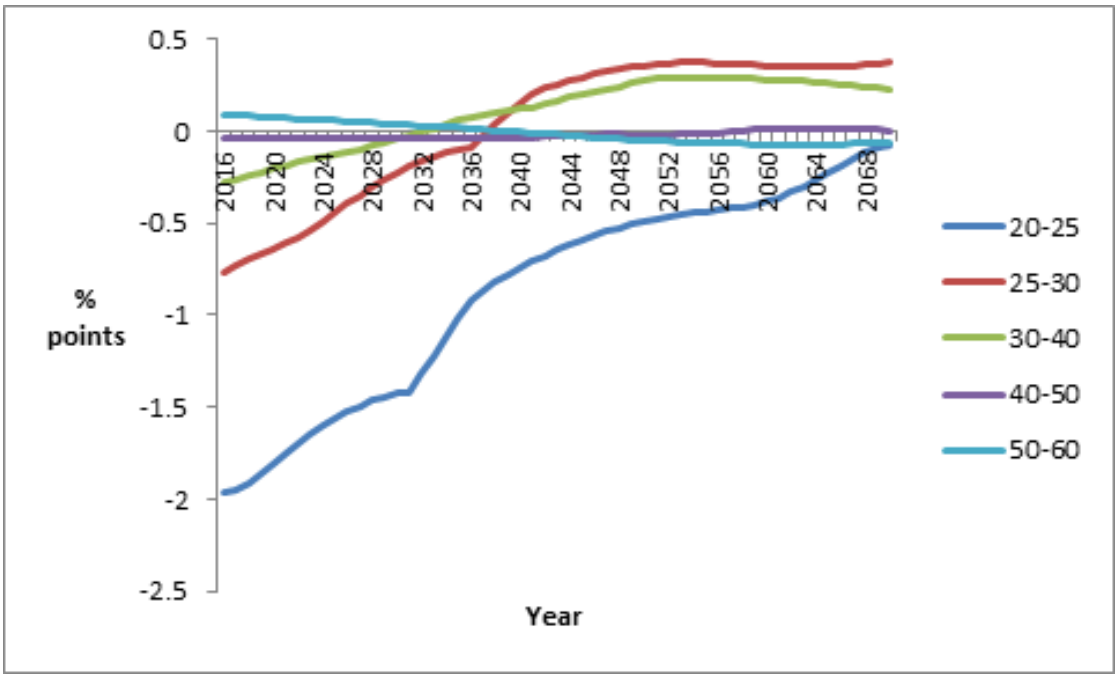
FIGURE 5: Impact on labor supply by age



5.3.2 Lower replacement rates

Reducing replacement rates has a differentiated impact on unemployment rates that varies with age but also with the time horizon (figure 6). There is no impact on older workers (40-60 years) for the whole investigation period. For the 30-40 years category, the impact is insignificant until 2032, than unemployment rates increase progressively, reaching 0.3 percentage point at the end of the period. For the 25-30 years age group, unemployment decreases initially by almost 0.8 percentage point, then the initial gains are progressively reduced, reaching a nil variation in 2032. From 2032 to 2070 unemployment rates increase, reaching almost 0.4 percentage point at the end of the period. Finally for the youngest age group (20-25), there is a reduction in unemployment rates over the whole period. However the initial decrease by 2 percentage points is progressively reduced to reach the reference scenario level at the end of the period.

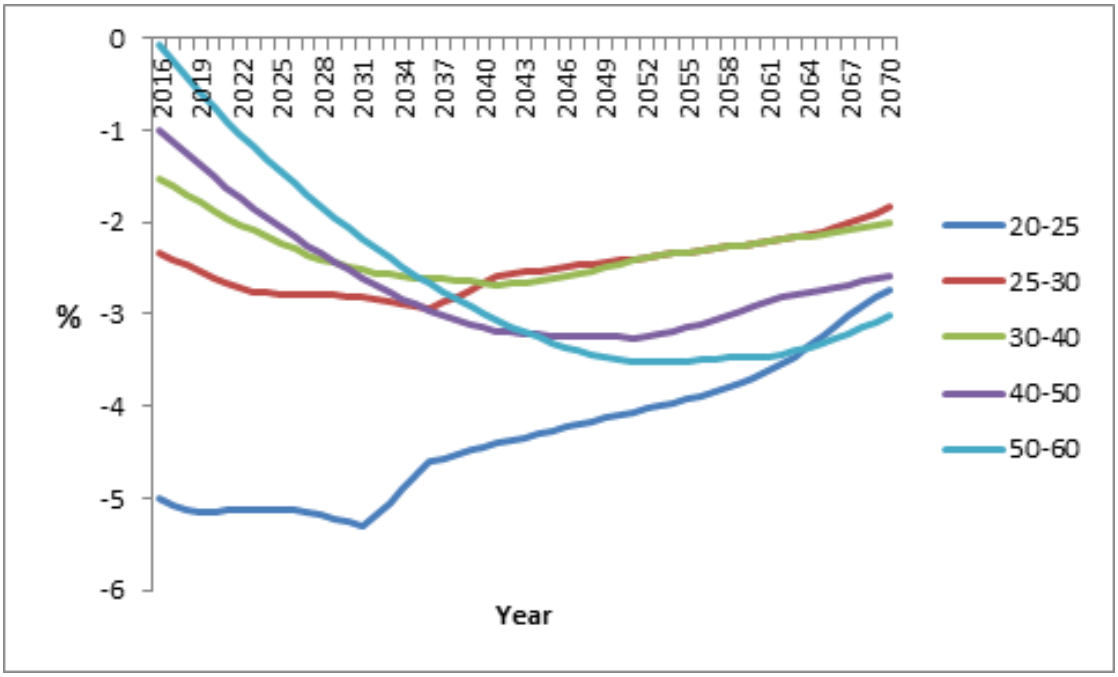
FIGURE 6: Impact on unemployment by age



These differentiated effects can be explained mainly by observing the impact of lower replacement rates on labor supply. Figure 7 shows that younger workers reduce their labor supply more than older ones (particularly the youngest age group). As explained in the "aggregate results" section, the reduction in labor supply is due to decreasing marginal returns of social security contributions (lower pensions with same contributions), which increases the distortionary impact of these contributions. The earlier in their carrier individuals know about the reduction in

pensions, the more they will adjust their intertemporal behavior. This explains why younger workers decrease their labor supply more than older ones.

FIGURE 7: Impact on labor supply by age



5.3.3 Increasing the retirement age

Increasing the retirement age has a negative impact on older workers' labor supply (figure 8). This is due to the increase of the number of years where they can earn a higher income, which allows them to devote less time to work and more time to leisure. This decrease of older workers' labor supply induces a substitution by the youngest workers who constitute the cheapest labor category †. This substitution explains the dramatic drop in unemployment (-5.3 percentage points initially) observed for the youngest age group (figure 9). Then, when youth labor supply starts increasing to meet the rising labor demand, the initial effects are progressively reduced (youth unemployment rates decrease by only 2.5 percentage points at the end of the period). Our results confirm those of the authors that find a positive impact of postponing the retirement age on youth employment (Gruber and Wise, 2010).

†. The elasticity of substitution between all age groups is assumed to be the same.

FIGURE 8: Impact on labor supply by age

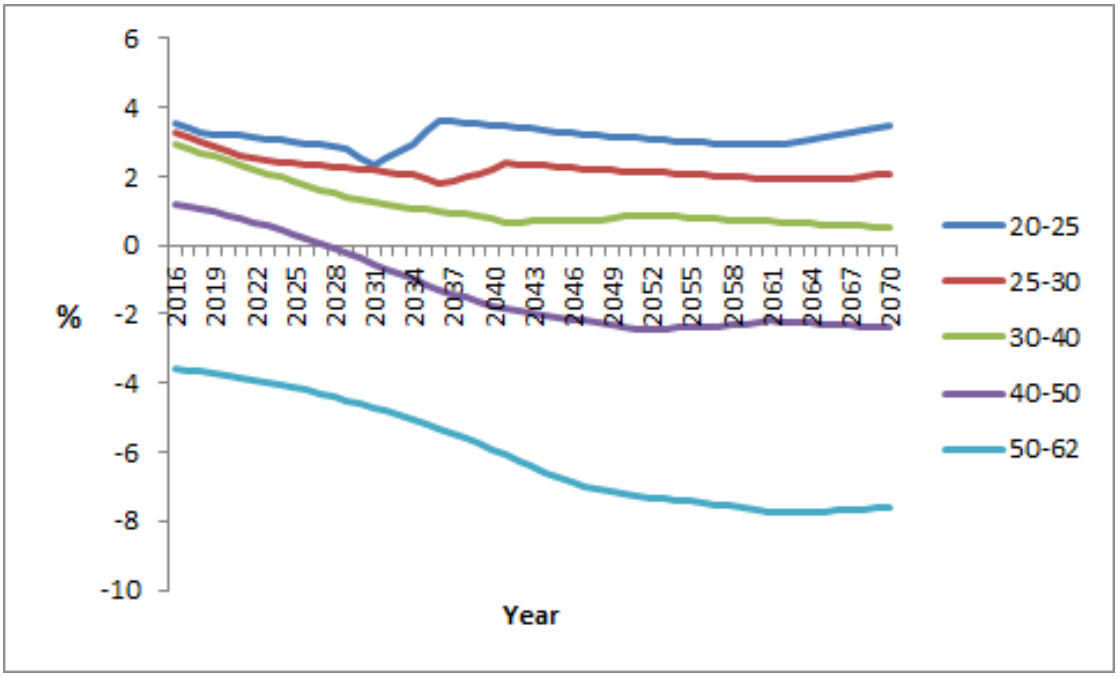
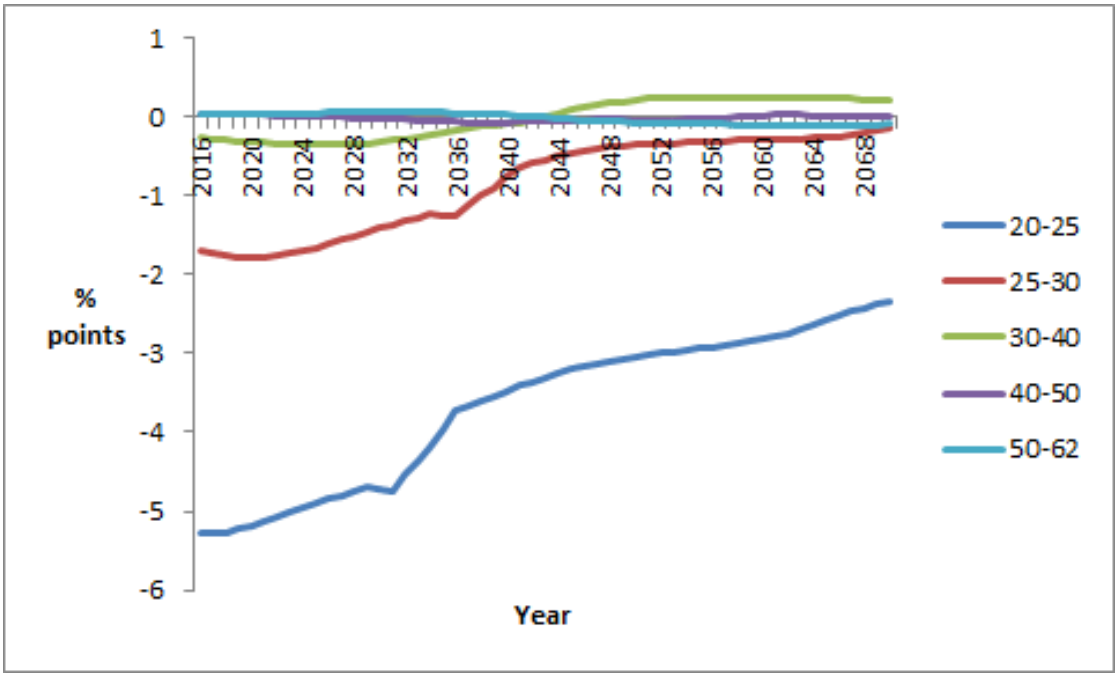
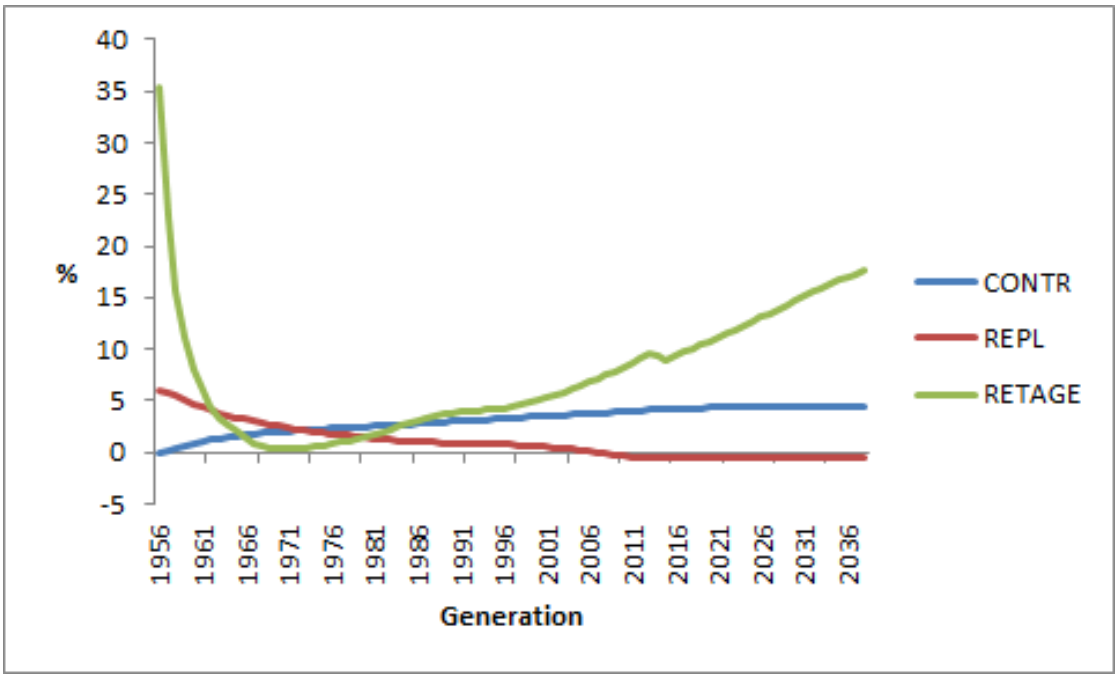


FIGURE 9: Impact on unemployment by age



5.4 Implicit Labor Taxation

FIGURE 10: Impact on implicit taxation by generation



Increasing the contribution rates has a lower impact on older workers implicit taxation who will bear the cost for a shorter period. Conversely, lowering replacement rates affects mainly the implicit taxation for older workers. The impact is negligible for the generations that are still not on the labor market.

As shown by figure 10, postponing the retirement age has the highest impact on implicit taxation. The cost is very high for those who were prepared to retire, as well as for the youth who are not yet on the labor market. Conversely the middle-aged generations bear a very low implicit tax increase. Equation 1 allows understanding this outcome : the wage increase due to the 2 extra-years of work leads to an increase in the denominator which offsets the increase in the numerator. For the younger generations the low present value of benefits can explain that the effect of the extra working years on the implicit tax is higher.

6 Conclusion

This article develops an overlapping general equilibrium framework to capture the interactions among pension reform, labor market and inter-generational distribution issues in Tunisia. The impact on the labor market is addressed at the aggregate level but also by distinguishing different age categories. We also investigate the impact of the reforms on workers' implicit taxation. The three scenarios implemented to reduce the social security deficit consist in increasing social security contributions, reducing the replacement rate and postponing the retirement age.

The main result obtained is that increasing contribution rates is the worst solution in terms of welfare and unemployment (particularly for the youth). The best option is postponing the retirement age. Contrary to the traditional wisdom, it does not entail an increase of youth unemployment. For the two scenarios where aggregate welfare increases, the middle-aged are those that benefit the most from the reform. However it increases the implicit taxation on the older and youngest generations while middle aged bear a much lower cost.

An extension of the current work could consist in introducing a Government in the model. This would allow the adoption of different closures than the current one where the deficit is financed on a year by year basis through a flat-rate income tax. Financing the deficit through Government debt can have a different impact on inter-generational equity for example.

Finally, one of the limits of the article is that we were not able to address the impact of the reforms on the labor force disaggregated by skill level. This is due to the absence of data on the education level of contributors in the Tunisian National Social Security Fund. This gap could be filled through another country-case study where such information would be available, or through a representative survey designed for such a purpose.

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