ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية
2016

working paper series

DETERMINANTS OF CONTRIBUTION DENSITY OF THE TUNISIAN PENSION SYSTEM: A CROSS SECTIONAL ANALYSIS

Mehdi Ben Braham and Mohamed Ali Marouani

Working Paper No. 1005

DETERMINANTS OF CONTRIBUTION DENSITY OF THE TUNISIAN PENSION SYSTEM: A CROSS SECTIONAL ANALYSIS

Mehdi Ben Braham and Mohamed Ali Marouani

Working Paper 1005

May 2016

Send correspondence to:
Mohamed Ali Marouani
Université Paris 1-Panthéon-Sorbonne, DIAL and ERF
marouani@univ-paris1.fr

First published in 2016 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

This paper presents an analysis of pension coverage in Tunisia based on density contribution. This approach is justified by the fact that coverage rates usually used do not give a clear indication on effective contribution and particularly could not explain the low level of pensions in the private sector. Using administrative data, we compute the contribution densities for the private sector most important regimes. We then use an ordered PROBIT model to identify the determinants of this ratio. Results show that contribution density of the most vulnerable groups is very low compared to other workers. Women are more likely to contribute to the pension system and contribution density decreases with firms' size.

JEL Classification: H55, J14, J26

Keywords: Pension coverage, Elderly welfare, Social security

ملخص

تقدم هذه الورقة تحليلا لتغطية معاشات التقاعد في تونس على أساس الكثافة. ويبرر هذا النهج من خلال حقيقة أن معدلات التغطية المستخدمة عادة لا تعطي مؤشرا واضحا على المساهمة الفعالة وبشكل خاص لا يمكن أن يفسر انخفاض مستوى المعاشات التقاعدية في القطاع الخاص. وباستخدام البيانات الإدارية، نقوم بحساب كثافة مساهمة القطاع الخاص للأنظمة الأكثر أهمية. ثم نستخدم نموذج الاحتمالية للتعرف على محددات هذه النسبة. وأظهرت النتائج أن كثافة مساهمة الفئات الأكثر ضعفا تكون منخفضة جدا بالمقارنة مع غيرهم من العمال. والنساء أكثر عرضة للمساهمة في نظام التقاعد و تتناقص كثافة المساهمة مع حجم الشركات.

1. Introduction

In Tunisia, the financial disequilibrium of the pension system is the subject of major concern. Many factors could explain the difficult situation of the Pay-as-you-go (PAYG) retirement system. These include the demographic evolution at the global level (decrease of the dependency ratio[1]) as well as bad governance and inefficient legislation. The contribution rates increase recently implemented have not been sufficient to cover growing expenditures. Currently, the debate is focused mainly on a gradual raise of the retirement age from 60 to 62 years.

The issue of financial sustainability has sidelined other weaknesses of the system such as the low level of pensions in the private sector. As Roffman and Oliveri (2012) remind us, a retirement system performance is based on three dimensions: coverage, adequacy and sustainability. Official statistics based on coverage rates present relatively good results for Tunisia in comparison to other North African countries. How then do we explain the low level of pensions?

Contribution density may help explaining the inadequacy of pension levels in the private sector for a significant category of workers. Contribution density has been defined as "the share of earnings in the active phase of life on which the individual contributes to some contributory pension system for old age" by Ribe et al. (2012). Theoretical and empirical research on this issue is very limited. It has only been analyzed in Latin America and more particularly in Chile in order to understand the gap between affiliates (definition) and real contributors in the Chilean pension funds. The lack of research s on this issue can be explained by the difficulty of obtaining individual data.

Valdes Prieto S. (2008) showed that density contribution is endogenous and depends on certain variables such as taxation, the financial return of the pension system and other subsidies from the social protection system.

The objective of this paper is to define the main characteristics of the density rate of the PAYG pension system in Tunisia and to identify the determinants of this rate at the individual level. For this purpose, we use the administrative database of the private sector contributors. This helps better understand the contributor's behavior in terms of effective contribution and leads to some ideas of reform of the system. We also assess the annual financial loss for the different regimes due to unpaid contributions.

The rest of the paper is organized as follows: section 2 gives a general overview of the Tunisian pension system. Section 3 highlights the importance of density coverage and the main theoretical and empirical results obtained by previous research. Section 4 presents empirical analysis on the Tunisian case. Section 5 gives concludes and gives policy reform options.

2. The Pension System in Tunisia: Organization and Statistical Context

The design of a pension system is extremely important since it influences contributor's behavior and the regularity of contributions. The legislation and enforcement capacity are essential to facilitate a smooth functioning of the system. In Tunisia, these two factors are not always playing their entire role to increase coverage in both quantitative and qualitative terms.

2.1 The pension system organization

The retirement system in Tunisia works as a defined benefit PAYG system. Pensions in a period "t" are financed by contributions made during the same period. In addition, there is no clear actuarial relationship at the individual level between a worker's contributions and her pension.

[1] This ratio decreased from 9, 2 in 1985 to 4, 9 in 2009.

Thus, the financial sustainability depends strongly on the demographic evolution (dependency ratio) and on workers' behavior in terms of contributions.

In addition, in the Tunisian social security system, contributions to the pension and health systems are not separated since workers contribute at the same time to both. Linking the access to the health system with contribution to pensions should lead to a regular contribution to the pension system since workers behavior in the face of health risk is not impacted by time preference since it can happens at any time.

The Tunisian pension system is composed of two main pillars. Public sector employees contribute to the CNRPS[2] regime and working for the private sector workers contribute to the CNSS[3]. Coverage problems of the retirement and health systems in the private sector triggered reforms which aimed to create specific systems depending on the status of workers, whether they are salaried/self-employed or belonging to the agricultural sector or not. The prevailing ideology was to create adapted regimes for specific professional categories in order to improve coverage. This approach explains the creation of a pension regime for low wageworkers in 2002 and another one for artists and intellectuals in the same year. But, creating specific regimes does not automatically increase coverage.

The mandatory contribution in the CNRPS is perfectly regular. Therefore, there is no problem of contribution density. This paper covers only workers in the private sector where contribution can be irregular, depriving the regime of financial resources in the short term and leading to low pensions in the long term. We focus in this research on a specific category of workers: those who work in the formal sector but who do not always respect mandatory contributions. We make here a clear distinction between informal employment and the informal sector. Informal employment exists in the formal sector as well as when workers do not contribute to social security.

So we present in what follows (Table 1), the characteristics of the different regimes of the CNSS by presenting contribution rates, the weight of each regime in terms of contributors and the coverage rate as it is calculated by the CNSS.

The regime of non-agricultural employees (RSNA) is the most important in terms of contributors (55.7%) and presents a relatively high coverage rate (79.8%) despite a high rate of contribution. Self-employed in the non-agricultural sector regime occupies the second rank in terms of contributors. This regime seems to present good a coverage rate as well (80%). Coverage in the agricultural sector should be analyzed with some caution given that its two regimes (RSA and RSAA) are characterized by very different coverage rates (11.5% for the RSA and 82% for the RSAA; see Table 1).

As we have noted above, a specific regime was recently created for employees with very low incomes such as smallholder farmers and domestic workers. This strategy led to the creation of a regime representing 13.3% of CNSS total contributors. The coverage rate for this regime is not available.

In light of these results, coverage does not seem a serious concern for Tunisia. But, in developing countries, the analysis should not be limited to coverage rates only, since their calculation presents sometimes a certain number of limitations.

In the Tunisian context, the coverage issue presents a good example of quantitative data hiding a less favorable reality, despite the existence of a mandatory PAYG system. Good coverage

[2] CNRPS: caisse nationale de retraite et prévoyance sociale created in 1976.

[3] CNSS: Caisse nationale de sécurité sociale created in 1960.

rates presented in Tunisia (compared with other North African countries), do not perfectly reflect the effective contributions for the following reasons:

- In Tunisia, contributions are made quarterly. As a result, workers should contribute four times a year. But, in the official calculations, even if we contribute once a year, we are considered as covered. This is why coverage rates do not reflect well effective contributions and should be completed by the contribution density indicator.
- We should also note that coverage concerning self-employed is biased upward since statistics take "affiliates" into account rather than "real contributors".

Despite its importance, contribution density has not been examined at all in Tunisia. This issue could explain in part the low level of pensions in the private sector.

2.2 Pension level in the private sector

The Tunisian PAYG system pension works as a defined benefit (DB) system. For the RSNA regime for example, according to the legislation, the return of each validated quarter is equal to 1% for the first ten years of contribution and 0.5% thereafter. Therefore, the pension is calculated according to the following formula:

Pension = replacement rate * reference wage (1)

Replacement rate = 1%* NVQ[4] (for the first 10 years) + 0.5%* NVQ(for the remaining period). (2)

with NVQ representing number of validated quarters.

Reference wage = arithmetic mean of the last ten years (3)

Illustration: An employee who worked 25 years with an average income of 1000 Tunisian Dinars during the last ten years before retirement age. We assume that contributions are perfectly regular. Hence, 25 years correspond to 100 validated quarters.

In this case, the employee's pension will be: P= (1%*40 + 0,5%*60).1000 = 700

with a replacement rate equal to 70%.

The pension system does not apply an actuarial relation between contributions and pension levels since the return on each validated quarter is fixed by public authorities.

We present in Figure 1 the pension distribution for the RSNA and RINA regimes.

The results show that pension levels are low in comparison with the minimum wage. In the RSNA regime, 60% of retirees receive a pension lower than the 2012 minimum wage (300 TD= 150US$) and 80% receive a pension lower than the median wage. The result is worse for the RINA regime with 80% of retirees receiving a pension under the minimum wage. This is partly explained by the low level of declared wages. In this regime, self-employed must choose one class of contribution classified from one to ten. Table 2 gives the distribution of contributors through the different classes. It shows that 84% of contributors declare the minimum wage which corresponds to class 1 when they contribute to the social security system. This leads to serious doubts on wage under-declaration behavior.

This issue is particularly important in analyzing the purchasing power evolution during the transition from work into retirement. The sharp fall in revenue could negatively impact the standard of living of a large number of retirees especially when pensions are their only source of income and can lead to an increase of poverty in old age.

As predicted by equation 2, the low level of pensions could be explained by two main elements:

[4] Contribution is not validated if the wage is < (2/3) Minimum wage even if it is accepted.

1. The low level of replacement rate: the replacement rate is affected by a short career which means a small number of validated quarters or a small contribution density resulting from the irregularity of contributions. This will have a significant impact on the future adequacy of retirement income. Or worse, some workers may not reach the minimum period of contribution required to receive the minimum contributory pension.
2. The low level of declared wages: the low reference wage level could be explained by the existence of low productivity jobs or it could be the result of wages under-declaration. It is important to note that in Tunisia, in the RSNA regime, employers are responsible for declaring their employees to social security institutions. In many cases, employees are not informed about the declared wages which could be significantly lower than actual wages. Sometimes, employees and employers agree to lower the declared wage or not contribute at all. The existing legislation encourages this practice of wage under-declaration since the declared wage in the beginning of the career of a contributor does not count towards the calculation of the pension amount. It is only necessary to declare a minimum wage to validate the quarter. This is a good example where the legislation leads to negative strategic behavior from contributors. This is in line with the findings of Ribe & *al* (2012) who show that the design of the social insurance system itself can affect contribution densities.

3. The Contribution Density Determinants: Insights from the Literature

Roffman and Oliveri (2012) analyze the coverage evolution for a large number of Latin American countries. Data collected from household surveys for the period 1990-mid-2010 give a certain number of insights concerning pension coverage in Latin America.

Firstly, despite many reforms conducted during the investigated period, contribution density among active workers remained low in most countries. Less than 40% of the labor force made regular contributions to pension systems in 11 among the 15 countries considered in the mid 2000s. Secondly, workers in the primary sector and small firms are those who suffer the most from coverage problems since contributions are almost nonexistent. Third, coverage is particularly low for women, workers in rural areas, the poor and the less educated. The same result is obtained by Hibe S. & al (2012) on a sample of three Latin American countries (Chile, Argentina and Uruguay). Finally, the coverage rate in the public sector which is theoretically equal to 100% is far from this level in some cases, showing that compliance problems also affect the public sector which is supposed to set an example for the private sector.

These results highlight the coverage issue as the central point in the debate on pension reforms.

Valdes Prieto S. (2008) uses a two periods model (active and passive phases of life) where individuals have the choice between contributing in the pension funds system or in other voluntary savings products, he finds interesting results on contribution density determinants. Individual's choice is based on a clear distinction between jobs where contribution is mandatory and those where it is not. He also argues that uncovered jobs are, in emerging countries, a significant and massive job option and not a marginal exception. Valdes Prieto considers that the State cannot easily enforce mandatory contributions in jobs with very low productivity mostly held by the poor.

According to Valdes Prieto, several factors guide worker's behavior in terms of contribution density:

- Taxation: unlike uncovered jobs, income of covered jobs is taxed. In addition, benefits from a formal pension system are more easily taxed than liquidation of voluntary savings. These differences often encourage workers to choose uncovered jobs with no savings for old age. This is particularly true for low wageworkers. The model concludes that there exists a trade-off between job choice and savings only if uncovered jobs are productive enough to yield

more income in the active phase to compensate total earnings obtained from covered jobs during active and retirement period.

- Illiquidity: this factor is important as well since saving for old age is illiquid while pure savings could be used when needed. This could affect the choice to contribute especially when income is low. This factor impacts only the choice of the type of savings.
- Financial return: this is an important point, which could influence the decision to contribute. The individual will compare between financial return of contributory retirement system with the returns obtained from saving products on the financial market.
- The non-contributory subsidies for the poor create a crowding out effect with a low density trap. As mentioned by Prieto, this trap "punishes", through subsidies withdrawals, those who contribute regularly and increase their contribution density. This is especially the case for the "proportional" minimum pension like the Switzerland model. Hibe S. & *al* (2012) confirm this result by considering that social protection policies strongly impact contribution density. Indeed, the system design can provide more or fewer incentives to contribute. These incentives are linked to three factors: the workers perception of the social security system, the level of payroll taxes and social security contributions and finally the non contributory system.

Contribution density has also been analyzed through empirical research. Using household surveys for 1992-2000, De Mesa & *al* (2004) have analyzed the characteristics and determinants of contribution density in Chile. The authors consider the contribution density of an individual i (d_i) as " the number of months with contributions (ci) as a percentage of the total number of months in which individual i was 15 years old or older (mi)". this definition could be written as follow:

$$d_i = \frac{c_i}{m_i} = \frac{c_i}{l_i} * \frac{l_i}{m_i}$$

with l_i total worked months.

Finally, individual density is defined as the product of two terms: pension coverage of individual i in the months worked (ci/li) and the percentage of months in the adult working history in which individual i was working (li/mi).

De Mesa & *al* used a Probit model with heteroskedasticity corrections to estimate the probability of contributing. Several socio-demographic variables were tested to explain the individual behavior of Chilean workers. The model distinguishes between core variables (age, gender, education, head of household, marital status, disability) which are used in all regressions and other variables which are sequentially included in other specifications like poverty in childhood, intergenerational progress, military services, smoker, bad health, labor market experience, income, knowledge of social security system, risk aversion, propensity to consume.

The results show that the sign of the coefficient for certain variables could change with the specification. Men have a higher contribution density than women except when employment experience is taken into account. This result is the same for the variable head of household. Education level and age have a positive but decreasing significant association with the density of contributions under all specifications. Marital status is not significant under any specification. Workers who declared poverty in childhood tend to have lower contribution density. This is also the case for workers suffering from disability. Labor market experience is positively correlated with contribution density. As might be expected, knowledge of social security system and risk aversion have positive impacts on density contribution.

3.1 Empirical analyses

3.1.1 Data

The focus of this paper is to measure the contribution density ratio and identify its determinants. To help address this issue, we have analyzed a large administrative database of three pension regimes in the private sector for the year 2012: the non-agricultural employees regime (RSNA), the non-agricultural self-employed regime (RINA) and the specific regime for low wage employees (RTFR). We have selected these three regimes in the private sector according to their weight in terms of contribution, knowing that RSNA is the most important with 56% of total contributors in the private sector. (See Table 1)

We have to note that, compared to the different studies on Latin America, we differently define contribution density. This ratio is calculated during one year and is defined as the number of validated quarters divided by the number of quarters that should be validated by a worker during one year. We do not consider here informal sector but only informal employment in the formal sector, since we noticed in Tunisia that even in the formal sector, workers do not contribute regularly to the pay-as-you-go retirement system. This is particularly interesting since official statistics, by presenting coverage rates, do not take into account this issue. In addition, we consider the hypothesis that workers should regularly contribute during the whole year. We take into account the cases of retirement departures and regime change. But, we do not have any information on workers who may have stopped working during the year.

Hence contribution density can take five values between 0 and 1: D1=0; D2=0.25, D3=0.5, D4=0.75 and D5=1.

The database analysis gives many relevant insights. As Figure 2 reveals, women have much lower participation rates in the labor force than men in the private sector. The gap is particularly high for self-employed and low-wage workers where 80% of contributors are men.

In addition, firm size distribution in the RSNA (non-agricultural employee) regime shows that 43% of contributors work in large firms, which are supposed to be well organized.

As shown by Figure 4, density of contribution distribution varies from one pension regime to another, with a particularly low level of density in the RTFR regime. The type of employment is an important factor in explaining effective contribution. We remind here that density contribution is only calculated for the year 2012 as the ratio between validated quarters and quarters to validate. This ratio can be considered as the share of quarters during which an affiliate has actively contributed to the pension system. Figure 4 gives a precise measure of contribution density for each regime.

In the RSNA regime, only 60% have validated all their quarters (density contribution =1). Self-employed in the non-agricultural sector (RINA) have the same distribution in terms of density. As we have already noted, contribution to the health and pension systems are made in the same time. For this reason, workers often contribute at least once to receive the healthcare identification card, issued for one year. This is why we did not find any case of zero density in these regimes. However, a large part of low wage workers do not contribute at all since they are often eligible to assistance programs and obtain free medical cards from the non contributory system.

The low level of contribution density in the RTFR regime is interesting to analyze since contributors have specific characteristics, which could explain their very low level of effective contribution. The population of this regime has very low levels of income and education, which generates a limited access to information and difficulties to understand it the pension system. This result confirms those obtained by Valdes Prieto (2008) and De Mesa & *al* (2004), concerning the impact of income, education level and access to information previously presented.

3.2 Methodology and model

As the density ratio can be considered as an ordinal variable, ordered Probit models have been used to explain the probability to contribute regularly during one year by different variables from the individual database.

$$P(dens = i) = P(y_{i-1}^{*} < X_i'\beta + \varepsilon < y_i^{*}) = \varphi\ (y_i^{*} - X_i'\beta)\ -\ \varphi\ (y_{i-1}^{*} - X_i'\beta)$$

with i = 0; 0.25; 0.5; 0.75; 1.φ is the standard normal cumulative distribution function.

In addition, vector β is estimated by the maximum likelihood method.

Table 3 presents the variables used, their different modalities and the reference in each case. We use different types of variables discrete and continuous, available in the administrative databases.

3.3 Econometric analysis

For each database, we outline aberrant values for the different variables used. Table 4 presents the size of each database. The majority of private sector workers are employed in the non-agricultural sector.

The results show that women have a higher probability to reach high contribution density in the RSNA and RTFR regimes (Table 4a). This may suggest that women are more sensitive to the old age issue. This variable is not significant for self-employed workers. This result is confirmed in Table 4b since the marginal effect shows that being a woman increase by 5.3% the probability to reach the best modality of contribution density.

Being married has also a positive impact on contribution density compared to single workers.

Table 4.A shows that firm size (for the RSNA regime) is significant to explain contribution density. Big firms are associated negatively with density contribution comparing to micro firms and small firms. This result may be surprising given our assumption that big firms are better organized than others and declare more regularly their employees.

Compared to Tunis, all the regions are associated with better contribution density in the RSNA and RINA regimes. The high concentration of employment in Tunis and insufficient control encourages irregularity in contributing to social security. The result is reversed in the RTFR regime. Domestic workers who should contribute to this regime are better paid in Tunis, more informed and more aware of the advantages of contributing to social security.

Age has a positive but decreasing significant association with the density of contributions in the RINA and RTFR regimes. Self-employed who compose the bulk of these two regime seem to give more importance to the retirement period with aging. The result is reversed in the RSNA regime. According to marginal effect in the RSNA regime table 4.B, each year of age decreases chance of reaching the highest contribution density level by 0.8 percentage points. Young workers who could be more educated than previous generations contribute more than older workers. Documents, which prove the contribution to social security system is often asked in administrative operations.

Experience has also a positive but decreasing significant association with the density of contributions in the RSNA and RINA regimes.

As initially expected, income is positively associated with contribution density for the three regimes. High incomes are often associated with better jobs in term of stability and higher education level. This result could be paradoxical if we take into account the fact that low wages benefit from high financial return. In this context, Ben Braham and Hmidi (2012) simulations show that the pay-as-you-go retirement system financial return in Tunisia is much higher than returns obtained from "pure savings" products. In addition, this result is more pronounced for

low wage workers. Based on actual legislation, simulations are controlled by career length and wage level (see Table 5).

With: IRR:

- instantaneous replacement rate= first pension/last wage
- D: pay-back period: Number of required years to recover the capitalized contribution.
- G: recovery rate: Ratio between the received pensions and capitalized contributions during the whole career.
- J= actuarial rate of return: Average annual return of contributions

By crossing career length and wage level, the authors obtained six cases. The minimum financial return is obtained in the case of "long career/high wage" where j is equal to 11.46%.

Low wageworkers obtain a higher return which can reach 14.79% in the case of short careers. All these returns are clearly higher than those obtained on the financial market, which varies from 2 to 4%. Others indicators show the relatively high return of contributions since a low wage worker with a short career recover its contribution only after 2,74 years of retirement knowing that today life expectancy at 60 years is over 19 years (19,6).

This result should lead to a high-density rate but low-wage workers are those who contribute the least for old age. This behavior could be explained by several reasons:

- Contribution effort: Wages are often not sufficient to allow a contribution to social security.
- Information: Many workers have no information about the legislation and their rights. This could be explained by a lack of interest in long-term issues or by a low education level, which lead to a limited understanding of legislation and researching of information.
- Difficulty to make long term strategy and neglect old age: this is due, in general, to a strong preference for the present.

We calculate in what follows the gap between actual financial resources of RSNA, RINA and RTFR and resources they could have obtained in 2012 if the contribution density was equal to one for all workers. We simulate here a regular contribution during one year in order to estimate precisely the amount of the lost for the retirement system. Simulations are based on declared wages, which could be lower than real wage.

To calculate theoretical payroll (with d=1) we use certain hypothesis:

- In the RSNA regime, in the case where the declared wage is always lower than two third of the minimum wage, we consider a theoretical declared wage equal to 2/3 of the minimum wage. When worker validate at least one quarter, we take the mean wage as a theoretical wage for non validated quarters.
- For the RINA regime, self-employed must declare at least the minimum wage since the system works with class choice between 1 and 10. For this reason, as for the RSNA, we take the mean wage as a theoretical wage for non validated quarters.
- We do the same thing for the RFTR regime.

The results are presented in Table 6.

The results obtained from the three databases show that the loss in the RSNA regime explained by unpaid contributions during 2012 represents 12.1% of total contributions. This amount is higher for the self-employed regime (RINA) where financial losses reach 194% of total contributions. The situation is more problematic for RTFR where contribution density is particularly low. The financial loss in this regime represents 76.5% of total contribution.

As an illustration, the amount of contribution lost due to unpaid contributions in the RSNA (964*25.75%[5]= 248MD) largely covers the total deficit of the CNSS regime as a whole which has reached 91,5MD in 2013.

This result shows precisely the importance of control in order to limit the number of unpaid contributions during one year. We should also note that we have only worked on the contributions number considering that workers should contribute four times in one year. The data available do not allow us to deal with wage under-declaration which induces financial losses as well.

4. Conclusion and Policy Recommendations

This paper presents quantitative and qualitative evidence on social security coverage issue in Tunisia. Instead of using simple coverage rates, this paper uses the contribution density which is increasingly used in research concerning Latin America. This indicator is more relevant to measure the regularity of contribution to the pension system. This is an important point since effective contribution has a direct impact on pension levels and therefore, on the long-term economic well-being of the elderly.

In this context, results show an important gap between official coverage rates and computed contribution densities for the Tunisian private sector. This may be partly explained by the legislation which encourages strategic behavior and under declaration. Other variables could explain the contribution density level.

We used an ordered PROBIT model in order to explain the contribution density level in Tunisia, relying on the pension system administrative database concerning the most important regimes (in terms of affiliates) in the private sector. The results confirm that socio-economic variables such as age, gender, experience, marital status are significant in explaining contribution density. In addition, wage, firms' size and regional component also explain individual behavior in terms of effective contribution. Contrary to the traditional wisdom, workers from larger firms seem to have lower contribution densities. This finding suggests including more controls on large firms. Despite high financial return on contribution, low-wage workers with limited ability to pay are less likely to contribute to the pension system which is a serious threat to secure them a decent life in retirement.

The RTFR regime is a good example, which shows that creating a specific regime for low wage workers is not sufficient to improve coverage and especially contribution density. An analysis of the global incentive system (including social protection for the poor) is needed.

Finally, legislation should be reformed in order to make it more effective to improve contribution density. This includes first, the creation of a link between pension level and earned income declared throughout the working life. In addition, non-contributory social protection must be carefully thought to avoid a potential crowding-out effect with the contributory system. This paper shows the importance of contribution density in term of financial losses in the short term. This loss reaches 12.1% of total contribution for the most important regime in the private sector (RSNA).

This study is based on administrative database for 2012 which limits the number of variables used and do not allow for time-series analysis. An obvious extension therefore would be to integrate household surveys for different periods in order to better understand worker's behavior in terms of contribution density.

[5] 25, 75% represents the total contribution the rate.

References

Ben Braham M. and Hmidi M. (2012), **"**Les indicateurs de rendement des systèmes de retraite en Tunisie une comparaison CNSS/ CNRPS, mimeo.

Valdes Prieto S. (2008), « a theory of contribution density and implication for pension design", SP Discussion Paper N°0828, The World Bank.

CNSS (2014), « Statistical Yearbook ».

A.A. de Mesa, J. Behrman, and D. Bravo (2004), "Characteristics and Determinants of the Density of Contributions in a Private Social Security System", Working Paper, 2004/077, University of Michigan Retirement Research Center.

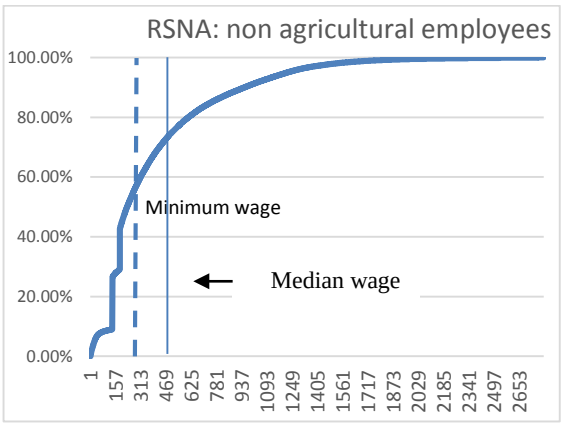
OECD/IDB/The World Bank (2014), "Policy issues: Coverage and adequacy", in Pensions at a Glance: Latin America and the Caribbean, OECD Publishing. http://dx.doi.org/10.1787/9789264224964-5-en

Ribe H., Robalino D. andWalker I. (2012), " From right to reality: incentives, labor market and the challenge of universal social protection in Latin America and Caribbean", The World Bank.

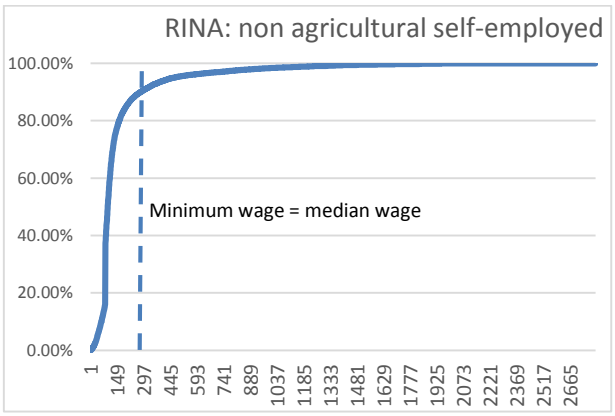
Rofman, R. and Lucchetti, L. (2006), "Social Security in Latin America: Concepts and Measurements of Coverage," Social protection Discussion paper Nº 0616, The World Bank.

Roffman R., Oliveri M.L. (2012), "Pension coverage in Latin America: trends and determinants", Social Protection Discussion Paper, n°1217, the World Bank.

Figure 1: Cumulative Function of Pension Levels (2012)

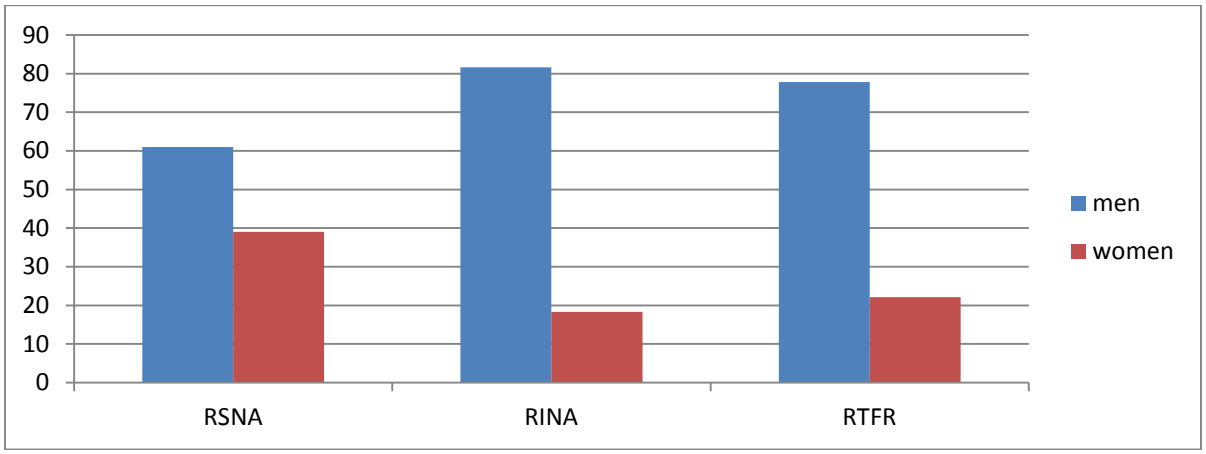


Source: Authors' calculations based on the CRES database



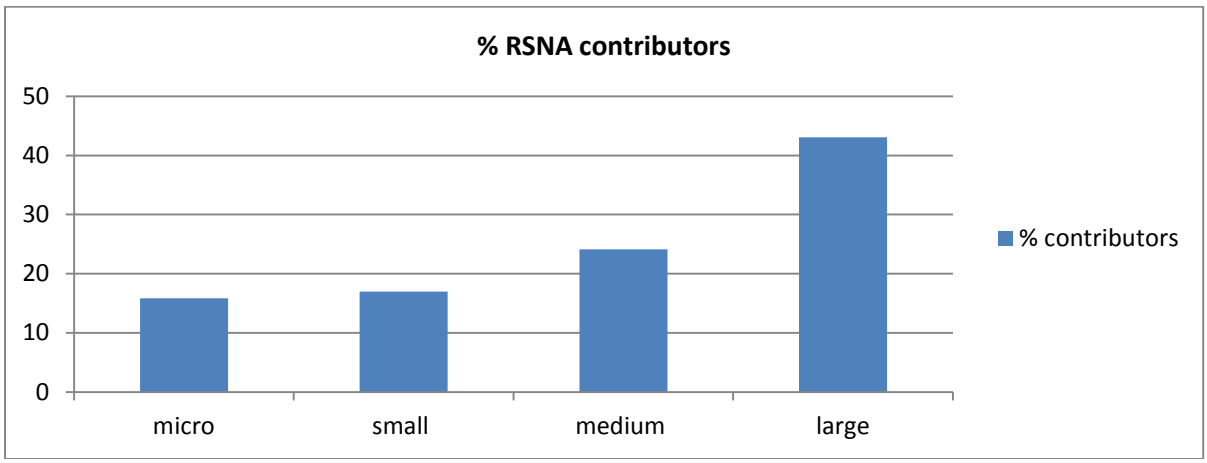
Source: Authors' calculations based on the CRES database

Figure 2: Gender Distribution in the Three Selected Regimes



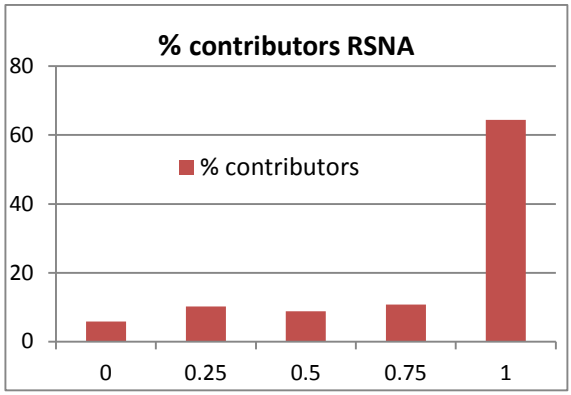
Source: CNSS database (2012)

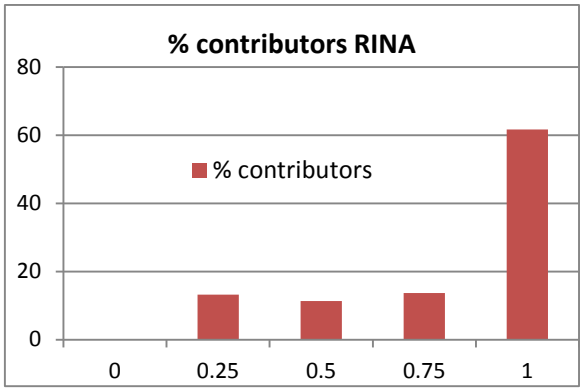
Figure 3: Firm Size Distribution (RSNA)

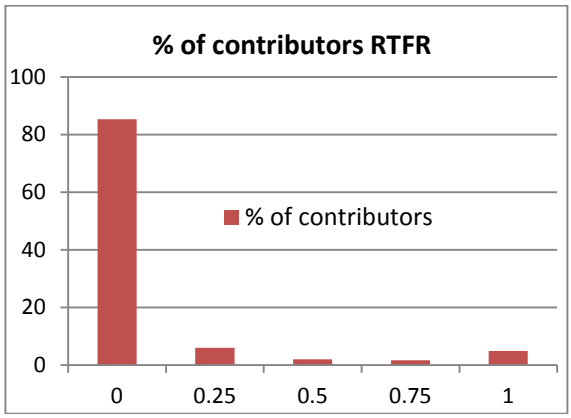


Source: CNSS database (2012)

Figure 4: Density Ratio Distribution (2012)







Source: authors calculations based on CNSS database

Table 1: CNSS Regimes

CNSS beneficiary categories	Date of creation	Contribution rate[6] (%)	Weight % of CNSS contributors (2013)	Coverage rate (2013)
RSNA (non-agricultural employees regime)	1974	25.75	53%	79,8
RSA (agricultural employees regime)	1981	12.29	0,5	11,05
RSAA(new agricultural employees regime)	1989	19.47	6,9	82
RINA (self-employed, non-agricultural sector)	1995	14.71	20.8	80
RIA (self-employed, agricultural sector)	1995	14.71	5.4	91
RACI (artist and intellectual regime)	2002	9	0,01	nd
RTFR (low wage employees)	2002	7.5	13.3	nd
CNSS			100	79.2%

Source: CNSS data (2014)

Table 2: Self-Employed Distribution According to Declared Wage (2012)

class	wage (expressed as a multiple of the minimum wage)	Frequency (%)
1	1	84,08
2	1,5	4,08
3	2	6,13
4	3	1,38
5	4	2,92
6	6	0,42
7	9	0,68
8	12	0,09
9	15	0,05
10	18	0,17
Total		100

Source: authors' calculations

Table 3: Variables and Modalities

Variables	Modalities	Reference modality
Gender	Men / Women	Men
Status	Single / married / divorced / widower	Single
Firm Size	Micro / small / medium / Big	Big
Region	Tunis / Northeast / Northwest / Center East / Center West / South	Tunis
wage	log (declared wage)	Continuous variable
Age	16-65 years	Continuous variable
Experience	1-40 years	Continuous variable

Table 4: Databases Size

Test	RSNA	RINA	RTFR
Number of Observations	1010974	211688	141755
Missing Values	1201	5	8

[6] Total contribution rate: pension + health system (employer + employee contribution).

Table 4.a: Regressions for the Density of Contributions (RSNA, RINA, RTFR) (Dependent Variable: d= Density of Contributions)

	RSNA		RINA		RTFR	
	Estim. value	Standard error	Estim. value	Stand. error	Estim. value	Stand. error
Intercept 1	-17.226 ***	0.032	-21.011 ***	0.090	-9.934 ***	0.115
Intercept 0.75	-16.439 ***	0.031	-20.158 ***	0.089	-9.714 ***	0.115
Intercept 0.5	-15.416 ***	0.031	-18.807 ***	0.087	-9.5 ***	0.115
Intercept 0.25	-13.389 ***	0.029	-17.203 ***	0.086	-9.073 ***	0.115
Women	0.306 ***	0.003	Ns	0.008	1.053 ***	0.010
Status : Reference single						
Married	0.069 ***	0.004	-0.018 ***	0.006	-0.109 ***	0.011
Divorced	Ns	0.018	-0.08 ***	0.031	Ns	0.031
Widow(er)	-0.067 ***	0.025	Ns	0.054	-0.425 ***	0.054
Size of company : Reference Big						
Micro	0.438 ***	0.004				
Small	0.055 ***	0.004				
Medium	-0.008 **	0.004				
Region: Reference Tunis						
North East	0.264 ***	0.004	0.285 ***	0.010	-0.338 ***	0.016
North West	0.328 ***	0.007	0.36 ***	0.013	-0.965 ***	0.018
Center East	0.242 ***	0.004	0.219 ***	0.008	-0.464 ***	0.013
Center West	0.235 ***	0.008	0.245 ***	0.014	-0.87 ***	0.016
South	0.063 ***	0.006	0.306 ***	0.011	-0.953 ***	0.016
log (wage)	2.153 ***	0.003	2.570 ***	0.009	1.032 ***	0.013
Age	-0.039 ***	0.001	0.031 ***	0.003	0.042 ***	0.003
Age^2	0.0004 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000
Experience	0.014 ***	0.001	0.026 ***	0.002	-0.017 ***	0.004
$Experience^2$	-0.0004 ***	0.000	-0.001 ***	0.000	0.001 ***	0.000

Test of the null hypothesis: BETA=0	**Khi-2**		
Test	**RSNA**	**RINA**	**RTFR**
likelihood-ratio	1020895.74	134823.455	31978.2765
Score	638533.258	91861.8202	31151.9001
Wald	545327.828	84824.4983	25686.6739

Table 4.b: Estimated Marginal Effect on Probability to Have Density=1

Marginal effect	**RSNA**		**RINA**		**RTFR**	
	Estim. Value	**Stand. error**	**Estim. Value**	**Stand. error**	**Estim. Value**	**Stand. Error**
Women	0.053	9.23E-14	0.001	1.52E-16	0.190	4.55E-14
Married	0.013	1.93E-14	-0.004	1.15E-15	-0.018	2.38E-15
Divorced	0.006	3.00E-15	-0.007	0	0.003	1.01E-15
Widow	0.004	5.32E-15	-0.005	6.68E-16	-0.095	2.24E-14
Micro	0.088	9.91E-14				
Small	0.027	2.99E-14				
Medium	0.014	2.12E-14				
North East	0.060	7.85E-14	0.044	2.12E-14	-0.080	1.10E-14
North West	0.067	9.91E-14	0.054	9.39E-15	-0.136	0
Center East	0.053	5.59E-14	0.035	4.49E-15	-0.083	0
Center West	0.046	5.03E-14	0.034	1.23E-14	-0.125	1.80E-14
South	0.017	3.59E-14	0.046	9.25E-15	-0.131	0
log (wage)	0.260	3.14E-13	0.273	0	0.105	3.70E-14
Age	-0.008	1.86E-15	0.005	1.26E-15	0.009	0
Experience	0.005	8.78E-15	0.006	8.35E-16	0.004	0

Note: For the dummy variable. dy/dx is for discrete change from 0 to 1.

Table 5: Financial Return of the Retirement System in the Private Sector

		Short career	Intermediate career	Long career
Private sector	High wage	IRR =31.6%	IRR =43.8%	IRR =40.8%
		D=5.11	D =4.53	D =4.61
		g = 7.0	g =7.9	g =7.76
		j =12.03%	j =12.01%	j =11.46%
	Low wage	TRI =61.2%	TRI =65.2%	TRI =69.1%
		D = 3.10	D =2.72	D =2.74
		g = 11.53	g =13.16	g =13.03
		j = 14.79%	j =14.75%	j =13.81%

Source: Ben Braham M.. Hmidi M. (2012)

Table 6: Contribution Lost from the Retirement System (2012)

	Total payroll (MD)	Simulated Total payroll with D = 1 (MD)	Lost in total payroll(MD)	Total lost in contribution (in %)
RSNA	7963.092	8927.518	964.426	12.1
RINA	956.6723	1142.742	186.0697	19.4
RTFR	198.2	349.8	151.6	76.5

Source: authors calculations with CNSS database

Annex 1: Private Sector Retirement System Legislation

	RSNA	RSA	RSAA	RTNS/RTTE	RTFR/RTC	RACI
Retirement Age	60 years	60 years	60 years	65 years	60 years	65 years
Minimum contribution period	5 years	10 years	10 years	10 years	10 years	10 years
Reference wage	Mean of the last 10 years (max 6 Minim. wage)	Mean of the last 5 years (max 2 Minim. wage)	Mean of the last 5 years (max 6 Minim. wage)	Mean Income pondéré des coef. de classe de revenu	2/3 of minim wage for the first 10 years et 1 Minim. Wage thereafter.	Rev.moyen pondéré des coef. de classe de revenu
Annuity rate	4% for the first ten years. 2% thereafter	4% for the first ten years. 2% thereafter	4% for the first ten years. 2% thereafter	3% for the first ten years. 2% thereafter	30% of minim wage for the first ten years. 2%/year thereafter.	200dt for 10 years. 2%/year
Maximum replacement rate	80%	80%	80%	80%	80%	80%
Minimum Pension	2/3 of min.wage .	40% min.wage	50% mini. wage	30% min.wage	30% of min.wage	200dt
Pension Revaluation	MG Indexation	MG	MG indexation	MG Indexation	MG Indexation	MG Indexation