

What are the impacts of *re-retirement*? A study for the contribution time retirement of Brazilian National Pension System

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Abstract

This study aims at evaluating *re-retirement* impacts in the Brazilian pension system. *Re-retirement* is a term applied to define a Social Security National System pensioner who despite retire, remains in the job market. After a few years, the pensioner requests the value of the benefit to be recalculated, due to an increase in the contribution time. There is a relevant trade-off though: the longer it takes the pensioner to ask for the *re-retirement*, the higher the increase on the amount of the pension will be. However, the period of this increased earnings will be shorter. On the other hand, the earlier the *re-retirement*, the smaller the increase in the pension and the longer the period to make use of it will be. The theoretical foundation of this paper is the concepts of actuarial fairness and actuarial neutrality. Four indicators usually adopted in social security literature were used: *Replacement Rate*, *Internal Rate of Return*, *Required Rate* and *Effective Rate*. Results show optimal time for the *re-retirement*: at least 4.83 years (men) and 7.83 years (women). If the return of pension is mandatory before the recalculation, there are no advantages in the *re-retirement*.

1. INTRODUCTION

In Brazil, private sector workers must compulsorily contribute to the Social Security General Regime (RGPS), the national pension scheme. After 35 (30) years of contribution, men (women) have reached the minimum sole condition of eligibility to obtain the Retirement by Length of Contribution (RBLC), paid monthly and for life. In the end of 2014, there were in this national pension scheme 5,254,911 RBLC benefits, representing 18.9% of the 27,818,973 benefits paid by the RGPS. Since RBLC is the highest value benefit (US\$ 580 per month, compared to the average US\$ 363), it represented close to 28% of the RGPS expenditures.

RGPS is pay-as-you-go (PAYG) defined benefit pension scheme. The value of the pension benefit is calculated based on the wage average of the pensioner and on the *Social Security Factor* (section 3 will present further details about the calculus formulas). This formulation was adopted in 1999, in the aftermath of a huge fiscal crisis in the country, in order to introduce a stronger degree of actuarial balance to the relation between contributions and pensions. Its logic is rather simple: it intends to encourage people to postpone retirement, by reducing the amount of pension of those who decide to retire earlier, if they obviously fulfil the minimum contribution time requirement.

There is a very interesting combination of features in the Brazilian pension system. A non-insignificant part of retired individuals even when receiving social security pension, remains in the job market and contributes for the RGPS. After some years in such situation, the pensioner's age and the contribution time are longer, so the eligibility condition, theoretically speaking, is maintained. In view of this, the pensioner requests pension recalculation, i.e., as if requesting a pension review, with an increase in the amount received. Such recalculation over the social security pension, due to a new contribution time, is known in Brazil as *re-retirement*.

In the RGPS, there are aspects, which end up perversely encouraging the *re-retirement*. The first one is the fact that the social security pensions are not *means tested*, as it occurs, for example, in the USA. It means that the amount of the social security pension is independent from the existence of other income sources. Thus, the labourer has a major encouragement to retire early (if compared to other countries) by contribution time, to stay in the job market and to seek further the *re-retirement*. In other words, for some years, a person benefits from the condition of, at same time being a worker and retired, which is against the logic of the social security systems, especially the PAYG regimes. By acting this way, the social security pension ends up working quite distortedly, as an insurance against inherent risks to the job market, such as unemployment. If the current retired labourer temporarily loses the job, she/he will have a guarantee of income, for life and with continuous pensions given by the social security system. Thus, the worker is somehow shifting the risk of income generation to the social security entity, while the person is seeking to obtain, without additional costs, the condition to request the social security pension review. The term *without additional costs* means that if the request for re-retirement succeeds, the bonus of this decision will be received. However, if the re-retirement is denied, there is no charge associated.

The second aspect is the absence of a minimum age to obtain the RBLC. The only eligibility condition for this benefit is the minimum contribution time. As this requirement is not rigorous (35 or 30 years of contribution for men or women), young individuals obtain the RBLC, but do not leave the job market, and further request the *re-retirement*, object of the study of this article. It is important to emphasize that this study does not take a favourable position, as it can be mistakenly understood. The objective is mainly to approach a particularity (or of a distortion, according to the viewpoint) of the Brazilian social security

system leading to a behaviour of expected income optimization by the pensioners. As such, it deserves to be a target for a study, which seems to be original in literature, even taken into consideration that *re-retirement* seems to be a particular feature of the Brazilian pension system.

This study comprehends four sections in addition to this introduction. Section 2 discusses the theoretical foundations upon which the subject of *re-retirement* applies. In section 3, a sample applied at work is presented as well as the social security indicators. The following section shows the results. Finally, section 5 presents the final considerations.

2. Theoretical Foundation and Empirical Evidences

2.1. Economic and Actuarial Aspects

The theoretical foundations to study *re-retirement* come from the actuarial-economic literature. The main point is, at first, the moment when retirement starts to be received. In view of that, two concepts are crucial. First concept is the *Actuarial Fairness*, presented in the studies of Queisser and Whitehouse (2006, p. 7-8) and Börsch-Supan (2006, p. 50). According to the authors, a social security system might be labelled as actuarially fair if the expected present value of contributions and pensions received by the pensioner are similar. The second concept is the *Actuarial Neutrality*. In this case, the concept is linked to the marginal earnings (in terms of pensions) and costs (in terms of contributions) associated to a diversion in relation to a given decision of retirement, i.e., a postponement or an advance of that date. In other words, the actuarial neutrality is convenient if the net marginal benefits (difference between benefits and contributions) are not altered due to a change in the retirement date. Based on Hassler and Lindbeck (1996), it is possible to argue that the actuarial neutrality of a social security system is related to the optimal decision of the labor supply of the pensioner.

Literature about neutrality and actuarial fairness offers few contributions. Breyer and Kifmann (2002) can be mentioned among the theoretical papers, highlighting the relevance of nonlinearities, brackets and adjustment mechanisms. Fisher and Keuschinigg (2010) confirm such results. Among empirical studies, Reznik, Weaver and Biggs (2009), Forteza and Ourens (2012) and Shoven and Slavov (2012a e 2012b) can be mentioned. In general terms, it may be indicated that literature results are rather inconclusive. As far as it is known, no national studies approach this subject. Therefore, the original contribution of this study intends to be a pioneer analysis of *re-retirement*, grounded in the actuarial-economic literature.

2.2. Legal Aspects

Taking into account the Brazilian legal context, it can be affirmed that there is not a clear consensus whether *re-retirement* is legitimate or not. It is possible to interpret that the first legal mark dealing with the matter, though indirectly, was the Social Security Legislation (Decree 3048/1999) “Retirement by age, contribution time and special granted by the social security as per this legislation, are irreversible and irrevocable”. Further, Decree 3265/1999, ratified this determination. The only possible exception, though indirectly, was incorporated in the terms of Decree 6208/2007:

Sole paragraph: the pensioner can give up the request for retirement if s/he shows intention to do so, and that s/he requires the definite filing of the request before the occurrence of the first of the following acts:

I – receipt of the first payment of pension; or

II – withdrawal of the corresponding Guarantee Fund for Length of Service (FGTS) or of the Social Integration Program (PIS).

It is possible to argue that the Federal Constitution is the legal defence in favour of the *re-retirement*. *Caput* of article 195 mentions that, “The social security is financed by the entire society, directly and indirectly, in the terms of the law, upon resources coming from budgets from the government, States, Federal District and Cities, and from the following social contributions:”. Among those social contributions is included the social security over the income of the workers. Thus, a retired worker, who is still in the job market, keeps contributing to the social security as any other pensioner. On the grounds of this argument, the pensioner would be fit to request a new retirement in the future. In addition, as the above article mentions “the entire society”, the standard for classification is reassured, considering that the individual has previously achieved the eligibility condition.

In one of the few legal references on the matter, Ibrahim (2011) affirms that, despite not having an express legal provision, the *re-retirement* could exist in any social security system, if there were some kind of economic advantage for the pensioner. The argument is supported by the fact that the service of *re-retirement* instead of violating rights just enlarges them. Moreover, the author is clear on distinguishing the term to be used: to retire is the “act able to produce a change in the social security status of the pensioner, from active to inactive”. As to the retirement, it is the “new legal status assumed by the person”. Therefore, *re-retirement* is the terminology to be used.

2.3. Some Empirical Evidences

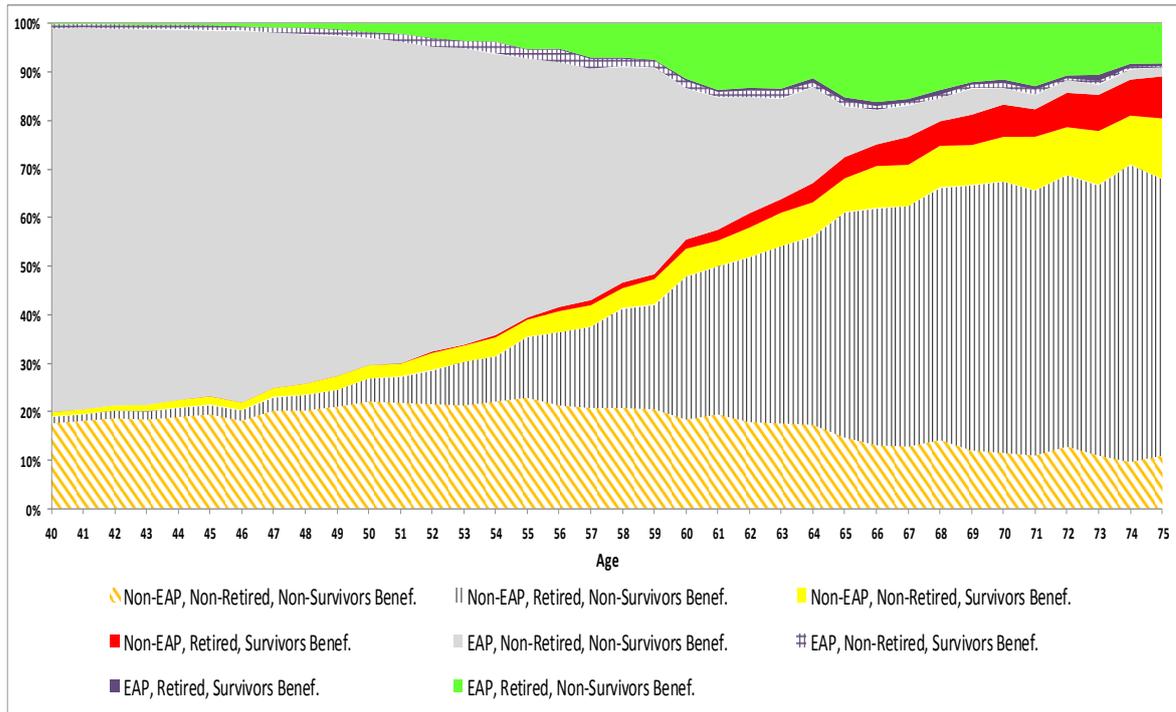
Based on the arguments presented, we should ask about the relevance *re-retirement* might have. Graph 1 shows some evidences that there is an expressive number of people at advanced age who could request *re-retirement*. In the graph, individuals are ranked according to three non-exclusive characteristics, listed below (excluding statutory civil servants, militaries, workers in the production for own consumption, workers in construction for own use and unwaged labourers):

- To take part or not in economically active population (EAP);
- Receipt of retirement benefit;
- Receipt of survivors benefit.

It is important to emphasize that according to Brazilian law, a person does not need to leave the job market to start receiving the social security pension. Similarly, a person can be simultaneously retired, receive survivors benefit and still keep on working.

For the purposes of this study, individuals with the most relevant characteristics are those in the two top strips: who take part in the economically active population (EAP), receive pension benefit and survivors benefit (part in dark blue, very thin, between the light green and the crosshatch) and, mainly, who take part in the labour force and receive pension benefit, but do not receive survivors benefit (light green). For the age groups presented in the Graph, 141,259 and 3,136,061 people are included in those groups, respectively. The sum of both numbers comprises the universe of possible claimants for *re-retirement* with the RGPS. It must be noted that when these individuals are around 65 years old, they represent almost 15% of the total population shown. There might be a small overestimation on this number, considering that the micro data from Brazilian National Household Survey (PNAD) does not allow the identification of the social security pension origin. Thus, the amounts shown include a group of retired and survivors benefits beneficiaries of the Social Security General Regime (RGPS), who obviously will not be able to obtain the re-retirement.

Graph 1 – Distribution of individuals according to their insertion in the labour force (EAP) and the pensioner or survivors beneficiary



Source: Authors' calculations based on Microdata from PNAD 2011.

For the purposes of this study, individuals with the most relevant characteristics are those in the two top strips: who take part in the economically active population (EAP), receive retirement and receive pension (part in dark blue, very thin, between the light green and the crosshatch) and, mainly, who take part in the labour force and receive retirement, but do not receive pension (light green). For the age groups presented in the Graph, 141,259 and 3,136,061 people are included in those groups, respectively. The sum of both numbers comprises the universe of possible claimants for *re-retirement* with the RGPS. It must be noted that when these individuals are around 65 years old, they represent almost 15% of the total population shown. There might be a small overestimation on this number, considering that the micro data from PNAD does not allow the identification of the social security pension origin. Thus, the amounts shown include a group of retired and pensioners of the Social Security General Regime (RGPS), who obviously will not be able to obtain the re-retirement.

3. The Simple Model

This section introduces the simple model used in the empirical part. It must be emphasized that the study focuses on the Retirement by Length of Contribution Benefit (*RBLC*), according to the rules of the Social Security General Regime (RGPS) for the urban wage workers from the private sector. The first part of this section is about contributions and the second about pensions.

3.1. Contributions

RGPS is a PAYG defined benefit regime. It means that the benefits are financed by the workers' contributions, without generating a reserve fund or assets accumulation. Contributions from the urban wage labourers are done on unequal terms between employers and employees. For employers, the contribution rate is of 20% of the employee pay, without

an upper limit. One exception are the employees from the finance and insurance sectors, to which the rate is 22.5%. For the employees, the contribution rate varies according to the gross income of the labourer, with a maximum limit of incidence as presented in Table 1. Pursuant to the Ministry of Social Security, the *contribution salary* corresponds to the income of the labourer, up to the upper limit. For example, if the labourer's income is of US\$ 2,462.45, the contribution rate of the employer is levied at that total, while the labourer's contribution is limited to 11% and is levied at US\$ 2,048.26. All monetary amounts of this paper were converted from Brazilian currency (BRL) into dollars (US\$) using the exchange rate (2.03) prevailing in January/2013, date when data were initially collected.

Table 1 – Employee's Contribution Rate (as from January 1st, 2013)

Contribution Salary (US\$)	Contribution Rate (%)
Up to 614.48	8
From 614.48 to 1,024.13	9
From 1,024.14 to 2,048.26	11

Source: Ministry of Social Security (MPS).

The first step to calculate contributions is to predict the evolution of income of a pensioner with a W_0 initial income. A constant growth rate r is expected throughout pensioner's working period. Therefore, the monthly wage W_t at the moment t can be expressed according to W_0 and of the number of t periods, as presented in Equation 3.1.

$$W_t = W_0 \times (1 + r)^t. \quad (3.1)$$

This way, as shown in Equation 3.2, at each time of time t the amount of social security contributions is given by the multiplication of the wage by the contribution rate a_t (sum of the rates of the employer and of the employee, the latter given according to the income bracket, as per Table 1).

$$VC_t = W_0 \times (1 + r)^t \times a_t. \quad (3.2)$$

Equation 3.3 gives the present value of the contributions, whereas Im is the age of joining the job market, Ia is the age of retirement and Tx is the real interest rate. It must be highlighted that there are 13 contributions each year due to the 13th salary.

$$VPC = \sum_{n=Im}^{Ia} \frac{VC_n}{(1+Tx)^n}. \quad (3.3)$$

3.2. Benefits

The condition of eligibility for the *Retirement by Length of Contribution* from the RGPS are 35 years of contribution for men and 30 years for women, no minimum age required. Pensions are paid monthly for life. Its ending occurs when the pensioner dies, unless there are dependents alive. In this case, the benefit is converted in survivors benefit. Since 1999, the amount of the *Retirement Benefit (RB)* has been calculated by the result of the arithmetic mean M from the 80% highest contribution wages by the *Social Security Factor* f , as presented in Equation 3.4.

$$RB = M \times f. \quad (3.4)$$

The social security factor f , showed in Equation 5, is an *ad-hoc* formulation presented in Decree 3265/1999. In this expression, Lc and Ag , are respectively the contribution time and the age when of the request for retirement is made, a is the contribution rate (of similar value

of 0.31 for all the pensioners) and Es is the life expectancy for both sexes, calculated yearly by the Brazilian Institute of Geography and Statistics (IBGE).

$$f = \frac{Lc.a}{Es} \cdot \left(1 + \frac{(Ag + Lc.a)}{100} \right) \quad (3.5)$$

By combining Equations 3.4 and 3.5, there is the expression for the calculation of the amount of the Retirement Benefit RB given by the expression 3.6. The amount of the Retirement Benefit is subject to the same limit of the Contribution Salary (US\$ 2,048.26), as per Table 1.

$$RB = M \cdot f = M \cdot \frac{Lc.a}{Es} \cdot \left(1 + \frac{(Ag + Lc.a)}{100} \right) \quad (3.6)$$

The social security factor aims at increasing the level of *actuarial fairness* (in the terms of Queisser and Whitehouse, 2006) for the retirements granted by the RGPS. The use of the Social Security Factor is mandatory for the Retirement by Length of Contribution and optional for the Retirements by Age. The more the pensioner postpones the retirement, the higher the factor will be and therefore, the amount of the pension. On the contrary, earlier retirements (fulfilling minimum requirements) imply on benefits of less value. The Social Security Factor can be understood as an Automatic Balancing Mechanism, as presented by Brown (2008) and Andrews (2008). It should be classified as a *soft* mechanism, because the pension adjustment only affects the flow of new benefits.

Four aspects deserve to be emphasized in the formulation of the *social security factor*. The first one is the distinction by gender. For women, there is an increase of five years in contribution time in equations 3.5 and 3.6, which helps to increase the pension amount. The second one is the influence of life expectancy: the values of Es (calculated and published every year by IBGE) modify in the course of time. These are non-linear changes. Thus, certain cohorts can be more affected by increases on life expectancy (which tend to reduce the benefit) than others. The third point is that it must be noted that there is no distinction by gender in the term Es : the values of the *Table for Both Sexes of IBGE* are applied. Women are benefited once again, because the average life expectancy adopted in the calculation is lower than the real expectancy. Finally, it is important to observe that the *social security factor* was only adopted when the government could not enable the adoption of a minimum age for the RBLC. Hence, the actual rule for calculating the pension value was implemented and not a stricter eligibility condition, as it was the initial intention. Moreover, implicitly, there was room for the low age retired individuals to evaluate later the possibility to obtain the *re-retirement*.

Similarly to the introduced for the contributions, Equation 3.7 gives the present value of benefits PVB . The *Retirement Benefit* RB is received immediately after the request for retirement is made ($Ia+1$), until Es life expectancy, using discount rate Tx .

$$PVB = \sum_{n=Ia+1}^{Es} \frac{SB_n}{(1+Tx)^n} \quad (3.7)$$

By combining Equations 3.6 and 3.7, there is Equation 3.8 expressing the present value of the benefits considering the remaining variables.

$$PVB = \sum_{n=Ia+1}^{Es} \frac{M \cdot \left\{ \frac{Lc \times a}{Es} \times \left[1 + \frac{(Ag + Lc.a)}{100} \right] \right\}}{(1+Tx)^n} \quad (3.8)$$

3.3. Assumptions and Hypotheses

Once the model is presented, the assumptions used for the calculations of *re-retirement* are explained. The object of analysis of this study are urban sector formal workers, who contribute to the Social Security General Regime. It is assumed that those pensioners have started their professional life and will be working throughout their active life in the private sector. This way, their *density of contributions* is 100%. Another assumption is made that those individuals strictly obey to the rules and minimum conditions of RGPS, i.e., they retire as soon as they fulfil the eligibility conditions. According to current rules, men can request RBLC with 35 years of contribution, while women with 30 years. Therefore, their variable of choice is the moment they request *re-retirement*. It is assumed that men and women join the job market when they are 20 years old. The period for receiving the pension is determined by the average life expectancy dissociated by sex, published yearly by IBGE. When this article was being finished, expectancy was of 70.60 years for men and of 77.70 for women.

All the inflows of contributions and of pensions are monthly and the values used in the calculations are expressed in real terms. In addition, we made the simplifying hypothesis that the income increases 2% per year for all workers. The discount rate applied in the calculations is of 3% per year. For an analysis of the sensibility of results for values different from those rates, refer to, for example, Giambiagi and Afonso (2009). Finally, it is important to point out that this study does not address issues related to survivors benefits. Although relevant, analysing that matter would mean making several hypotheses and analysis regarding the structure of family groups, escaping totally from the intended scope.

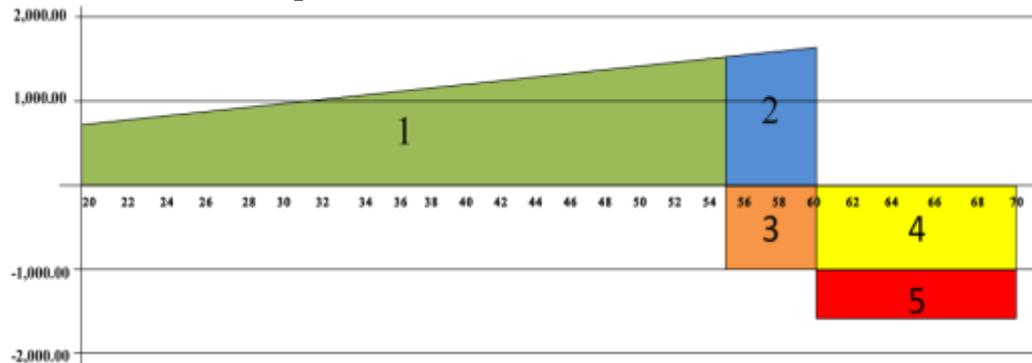
3.4. Schematic Representation of contributions and benefits flows

Graph 2 illustrates the problem, in which monthly flows of contributions (positive) and social security pensions (negative) of an individual throughout his life are presented. It is considered that this hypothetic male pensioner starts his active life with a monthly income of one minimum wage (MW) (US\$ 333.91), which increases monotonically. This person, having started his active life at the age of 20, retires for contribution time at the age of 55 and leaves the job market according to the current rules. Area 1 (green) shows his contributions for that period. The pensioner immediately starts receiving his Retirement by Length of Contribution for life. Areas 3 (orange) and 4 (yellow) represent the flow of RBLC benefits. In the case of lack of dependents, pension payment will occur until the age of 70.6, as per life expectancy prevailing today.

Now let us consider the possibility of *re-retirement*. The pensioner retires for contribution time and becomes an RGPS pensioner. However, differently from the other conditions mentioned in the previous paragraph, he remains in the job market and maintains the status of contribution payer to RGPS. Some years later, the pensioner requests a pension review in order to incorporate the contributions paid for the additional working time in the calculations of the pension. This is the *re-retirement*.

In the example of Graph 2, the request for *re-retirement* is made at the age of 60, 5 years after the original retirement. Area 2 (blue) shows the additional contributions corresponding to time the pensioner remained in the job market. Such ongoing of active life implies on an increase in wage and in the social security factor. Thus, the new flow of benefits corresponds to areas 4 (yellow) and 5 (red).

**Graph 2 – Flows of Contributions and Benefits
(Male pensioner – with or without *re-retirement*)**



Source: Authors' calculations.

3.5. Social Security Indicators

All the results obtained will be analysed on the grounds of four indicators commonly used in the social security literature: *Replacement Rate (RR)*, *Effective Rate (ER)*, *Necessary Rate (NecRate)* and *Internal Rate of Return (IRR)*. Two studies employing some of these indicators are Schröder (2012) and Forteza and Ouréns (2009).

Equation 3.9 shows the way to calculate the Replacement Rate *RR*, in which *WLP* is the wage in the last working period and *VFP* is the value of the first pension of the individual.

$$RR = \frac{VFP}{WLP} \quad (3.9)$$

The Effective Rate (*EffeRate*), presented in Equation 3.10, expresses the relation between the present values of contributions actually made (*PVC*) and of income (*PVI*) that the pensioner paid during contribution period.

$$EffeRate = \frac{PVC}{PVI} \quad (3.10)$$

The *NecRate (NecRate)* indicates which should be the contribution rate to assure the balance between present values of contributions and pensions (*VPB*). Equation 3.11 explains the formula:

$$NecRate = \frac{VPB}{VPR} \quad (3.11)$$

As for Equation 3.12, the Internal Rate of Return (*IRR*) equalizes the flows of contributions and pensions of the pensioner during his life. In this expression, the term F_t represents the contribution and/or pension (with opposite signal) at the moment t .

$$0 = \sum_{t=0}^{Es} \frac{F_t}{(1+IRR)^t} \quad (3.12)$$

Workers who will potentially request *re-retirement* (i.e., who will retire, but will not leave the job market), for some time are both contributors and beneficiaries. In this case, the term F_t represents the difference between the two cash flows. In Graph 1, areas 2 and 3 represent this situation.

4. Results

This section introduces the study results, calculating the social security factors described in section 3. First, values obtained in the *Baseline Scenario* are reported, the most common social security situation, when the *re-retirement* does not occur. Next, the sensibility analysis of the model is carried out, with a change in some variables of choice, especially at the moment when the *re-retirement* starts. Finally, the results supposing that there is a return of the pensions received during the time prior to the *re-retirement* request will be presented.

4.1. Baseline Scenario – Model without *re-retirement*

The *Baseline Scenario*, with results reported in Table 2, will be used as a standard to compare the results obtained for the analysed alternatives of *re-retirement*. First, a male and a female labourer who joined the formal sector at the age of 20 and obtained the RBLC after 35 years (men) and 30 years (women) will be considered. Life expectancy at birth is the one published by IBGE in 2011 (70.6 years for men and 77.7 years for women). All the cash values are updated by the real growth indexes (income growth of 2% per year, real interest rate of 3% per year). Finally, the initial minimum wage is the current one in 2013 (US\$ 333.91). Indicators are calculated for eight combinations of parameters: sex (male and female) and amounts of initial income (1, 2, 3 and 5 Minimum wages). The choice of the Minimum Wage (MW) was based in its importance in the Brazilian economy, particularly for the national pension scheme: the MW is the lower limit of the benefits. And close to 70% of the benefits paid are equal to 1 MW.

Table 2 – Social Security Factors – Baseline Scenario

			IRR (% a.a.)	RR	EfeRate (%)	NecRate (%)
Initial Wage (MW multiples)	1	M	0.79	0.56	28.10	16.30
		F	3.28	0.56	28.00	30.01
	2	M	0.54	0.56	29.66	16.30
		F	2.50	0.48	29.47	25.63
	3	M	0.39	0.56	30.87	16.30
		F	2.33	0.48	30.85	25.63
	5	M	-0.29	0.45	29.58	13.09
		F	1.86	0.41	29.92	21.81

Source: Authors' calculations

Results obtained are comparable to the ones presented in literature both national (Giambiagi and Afonso, 2009; Caetano, 2006; and Afonso and Fernandes, 2005) and international (Van Duijn et al. (2013) for the Dutch case, and Gustman et al. (2012) for the USA case), generally showing evidences of existence of implicit intragenerational subsidies for women. This can be noted by the highest values for *IRR*, *RR* and *NecRate* for the female group. As to the Required Rate, the values of women are always significantly lower than the current contribution rate (28 to 31%). Two points must be emphasized. The first one is the monotonic decrease in the amounts of *IRR* for the highest income bracket, which is an evidence of existence of intragenerational distributive principles, from the richest groups to the poorest. The second point is the large difference, both for *IRR* and for *NecRate*, among men. Apparently, this result is due to the use in calculations of mortality tables distinct for

both genders, unlike what RGPS does in the calculation of social security factor, where the IBGE table is employed for both genders.

4.2. Results with *re-retirement*

In this section, the social security indicators of section 3.5 are calculated, in case of *re-retirement*. Initially, it is assumed that by re-retiring there are two flows: the first is the receipt of the recalculated pension, according to the new parameters. The second corresponds to the return of the pensions received during the period of the original retirement, in instalments, to the RGPS (area 3 of Graph 1). The amount of the monthly instalment returned will be the difference between the value of the pension at retirement and at *re-retirement*. The required time, in years, will be measured to settle the last instalment of the debt (meant by *payback time*).

Results of *re-retirement* are divided in two tables. In Table 3, the values for individuals with initial income of 1 or 2 Minimum Wages (MW) are presented, and in Table 4, cases when the initial wage is of 3 or 5 MW. In both cases, several *times of re-retirement* (in years) are presented, i.e., the time it takes the pensioner to request a pension review.

Table 3 – Social Security Indicators with *re-retirement* (Initial Income: 1 and 2 MW)

		Initial Wage (MW Multiples)										
		1					2					
		IRR a.a. (%)	RR	EffeRate (%)	NecRate (%)	Payback time (years)	IRR a.a. (%)	RR	EffeRate (%)	NecRate (%)	Payback time (years)	
<i>Re-retirement time (in years)</i>	1	M	0.96	0.58	28.12	16.64	16.64	0.708	0.58	29.69	16.59	16.64
		F	3.18	0.55	28.00	28.58	*	2.660	0.51	29.51	26.13	17.55
	2	M	1.10	0.62	28.14	16.70	16.10	0.841	0.62	29.72	16.62	16.10
		F	3.08	0.54	28.02	27.04	*	2.801	0.54	29.55	26.40	17.03
	3	M	1.21	0.65	28.16	16.67	15.50	0.944	0.65	29.75	16.54	15.50
		F	3.22	0.57	28.05	27.41	*	2.927	0.57	29.59	26.62	16.44
	4	M	1.28	0.69	28.17	16.52	14.99	1.013	0.69	29.77	16.35	14.99
		F	3.35	0.61	28.07	27.77	60.86	3.036	0.61	29.63	26.76	15.95
	5	M	1.33	0.74	28.19	16.27	14.44	1.052	0.74	29.80	16.06	14.44
		F	3.47	0.64	28.10	28.08	37.73	3.133	0.64	29.66	26.86	15.41
	6	M	1.33	0.79	28.21	15.89	13.94	1.055	0.79	29.82	15.65	13.94
		F	3.57	0.67	28.12	28.29	30.06	3.214	0.67	29.69	26.89	14.94
	7	M	1.31	0.84	28.22	15.39	13.45	1.021	0.84	29.85	15.11	13.45
		F	3.66	0.70	28.14	28.42	25.90	3.282	0.70	29.72	26.85	14.46
	8	M	1.24	0.89	28.24	14.77	12.93	0.948	0.89	29.87	14.46	12.93
		F	3.73	0.75	28.16	28.50	23.10	3.341	0.75	29.75	26.77	13.96
	9	M	1.11	0.94	28.25	13.95	12.61	0.809	0.94	29.89	13.61	12.61
		F	3.79	0.79	28.17	28.49	21.10	3.385	0.79	29.77	26.60	13.49
	10	M	0.91	0.99	28.26	12.93	12.46	0.592	0.99	29.91	12.56	12.46
		F	3.84	0.84	28.19	28.43	19.49	3.421	0.84	29.80	26.40	13.00

* There is not time for payment of pension earned by retirement.

Source: Authors' calculations

Table 4 – Social Security Indicators with *re-retirement* (Initial Income: 3 to 5 MW)

		Initial Wage (MW Multiples)										
		3					5					
		IRR a.a. (%)	RR	EffeRate (%)	NecRate (%)	Payback time (years)	IRR a.a. (%)	RR	EffeRate (%)	NecRate (%)	Payback time (years)	
Re-retirement Time (in years)	1	M	0.56	0.58	30.87	16.59	16.64	-0.18	0.46	29.52	13.13	20.73
		F	2.49	0.51	30.85	26.13	17.55	1.98	0.43	29.85	21.96	21.90
	2	M	0.70	0.62	30.87	16.61	16.11	-0.09	0.48	29.45	12.97	20.20
		F	2.64	0.54	30.86	26.40	17.03	2.09	0.45	29.78	21.92	21.41
	3	M	0.80	0.65	30.87	16.53	15.58	-0.03	0.51	29.39	12.74	19.65
		F	2.77	0.57	30.86	26.62	16.44	2.18	0.47	29.72	21.84	20.88
	4	M	0.86	0.69	30.87	16.33	15.16	0.00	0.53	29.32	12.44	19.13
		F	2.88	0.61	30.86	26.76	15.95	2.26	0.49	29.65	21.72	20.40
	5	M	0.90	0.74	30.86	16.02	14.70	-0.01	0.56	29.26	12.03	18.97
		F	2.98	0.64	30.87	26.86	15.41	2.33	0.51	29.58	21.55	19.89
	6	M	0.90	0.78	30.84	15.59	14.30	-0.26	0.54	29.20	10.95	25.03
		F	3.06	0.67	30.87	26.89	14.94	2.39	0.53	29.52	21.34	19.42
	7	M	0.86	0.83	30.83	15.04	13.89	-0.54	0.53	29.13	9.93	32.68
		F	3.13	0.70	30.87	26.84	14.46	2.43	0.55	29.45	21.09	18.94
	8	M	0.78	0.87	30.81	14.34	13.56	-0.84	0.52	29.07	8.97	42.92
		F	3.19	0.75	30.87	26.75	13.99	2.47	0.58	29.39	20.80	18.45
	9	M	0.42	0.86	30.78	12.79	16.03	-1.16	0.51	29.01	8.06	58.24
		F	3.23	0.79	30.87	26.56	13.57	2.30	0.57	29.32	19.30	22.13
	10	M	0.04	0.84	30.76	11.33	18.77	-1.52	0.50	28.95	7.20	88.40
		F	3.26	0.83	30.86	26.31	13.15	2.14	0.56	29.26	17.89	26.41

* There is not time for payment of pension earned by retirement.

Source: Authors' calculations

It can be observed that the RR for men is always higher than for women. Two reasons explain such fact. The first is because men work five years more to retire, thus their social security factor is higher. The second is due to a model hypothesis. As the wages increase monotonically, the *contribution salary* for men at the end of the working period is higher. Therefore, the average of their wages is higher, the same happening with their pension. The only exception would happen if the *contribution salary* or pension reached the legal ceiling.

The values of IRR and NecRate are always higher and present a more pronounced growth for women, which is explained by the shorter time of contribution and longer life expectancy. Results in Tables 3 and 4 provide evidences of existence of a quite interesting outcome: there is an optimal moment to request *re-retirement*, i.e., according to what was mentioned in the introduction: if the *re-retirement* is requested too early, the earning is small. If there is a too large postponement, the period of receipt is rather reduced. Thus, there is a choice to maximize the product of the time of receipt by the value of the additional pension.

Graph 3 shows RR considering the time of *re-retirement*. It can be observed that RR is always higher for men, except for the wage floor of 1 MW, when there is equality among genders. In addition, it must be highlighted that there is not monotonicity in the values of RR. For men, there is reduction in the values of brackets over 3 MW, while for women this phenomenon happens only as from 4 MW. The explanation for this difference must be sought in the social security factor: as the factor is higher for men, they reach the retirement benefit

ceiling faster and this induces the falling to occur in the lowest income brackets and for shorter periods of *re-retirement*.

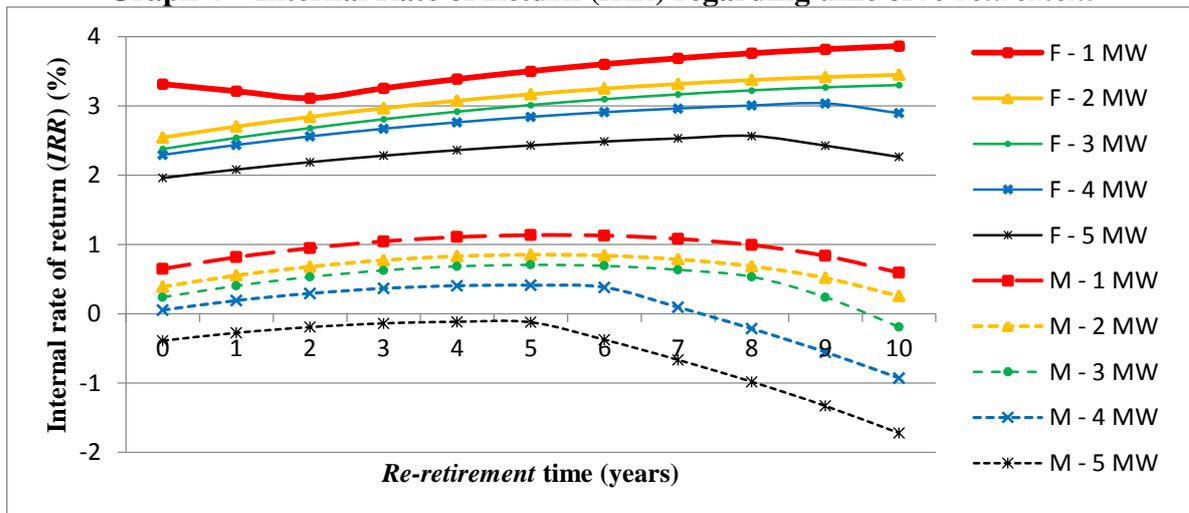
Graph 3 – Replacement Rate considering time of *re-retirement*



Source: Authors' calculations

Graph 4 shows the results for real *IRR* per year. For men, maximum points occur at least in 4 years and 10 months between retirement and the request for recalculation of pension, for all wage brackets. For the 5 MW bracket, there are only negative brackets, except for the maximum value, which occurs after 4 years and 10 months after the request for *re-retirement* is made. As to the *RR* behaviour for females, it is not clear as to the optimal time to request *re-requirement*. For instance, for an initial income of 1 MW the minimum value occurs 2 years after retirement and the maximum after 12 years and 10 months. As to the 5 MW bracket, the maximum point occurs at 8 years.

Graph 4 – Internal Rate of Return (*IRR*) regarding time of *re-retirement*



Source: Authors' calculations

IRR has an increasing behaviour until reaching the maximum at 5 years and 10 months after retirement for men, and at 7 years and 10 months or more for women and then it decreases. Therefore, as there is a maximum point for *IRR* for both genders and all income brackets, it is proved that there might be an optimal time for *re-retirement*, according to the summary elaborated in Table 4. The ideal period for *re-retirement* is of minimum 4 years and 10 months after retirement for men from all income brackets. For women, optimal times for *re-retirement* are always higher.

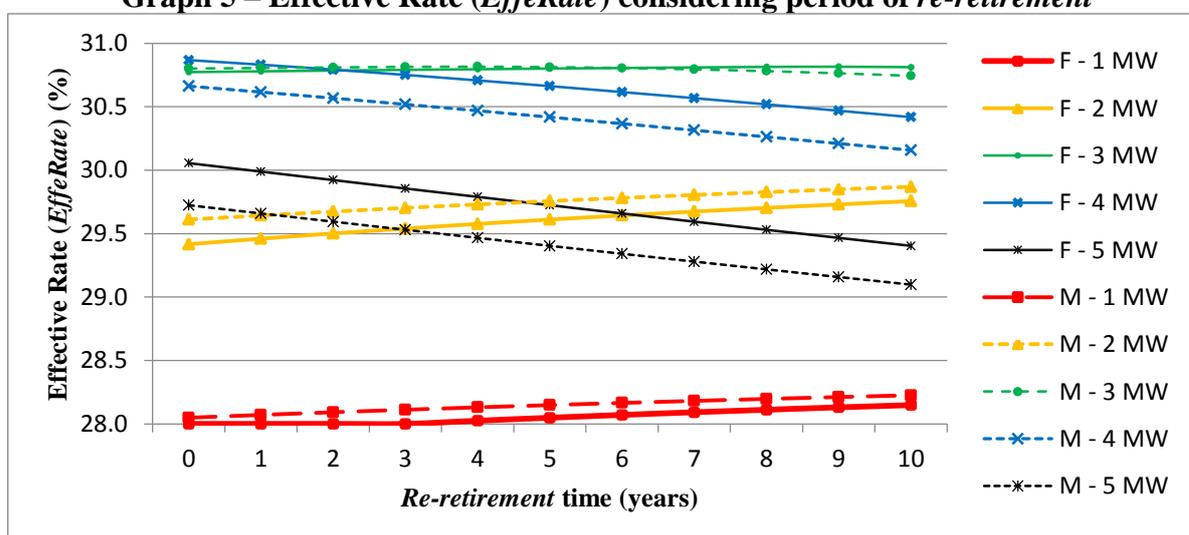
Table 4 – Perfect Timing for *re-retirement* in years (maximum *IRR*)

	Initial Income (MW multiples)				
	1	2	3	4	5
M	5.83	5.83	5.83	4.83	4.83
F	12.83	12.83	10.83	8.83	7.83

Source: Authors' calculations

Graph 5 introduces Effective Rate (*EffeRate*) considering the number of years of *re-retirement*. It can be inferred that for all levels of initial income, *EffeRate* for men is higher than for women. For combinations of income over 3 MW and over 5 years of *re-retirement*, the effective rate of women is higher than for men. It seems to be possible to affirm that the increasing behaviour found for initial incomes lower than 2 MW is explained by the own rule of contribution, which defines different and increasing rates for higher income levels.

Graph 5 – Effective Rate (*EffeRate*) considering period of *re-retirement*



Source: Authors' calculations

Graph 6 presents values of Necessary Rate (*NecRate*). This indicator is quite important because it expresses the social security rate that should apply over the wage of individuals (without discontinuities or limits of contribution) so that the pension and contribution flows were similar for each individual. This Graph provides evidence about three relevant aspects:

- a) The longer the payers postpone the retirement (or even the *re-retirement*), the lower the Necessary Rate should be;
- b) Gender differential: men should have a lower rate than women;
- c) Income differential: the higher the initial income, the lower the charged rate should be.

The aspects b) and c) reinforce the evidence about distributive characteristics in the rules of RBLC of the Brazilian pension system, from men to women and from the richest to the poorest individuals.

Graph 6 – Necessary Rate (*NecRate*) considering period of *re-retirement*



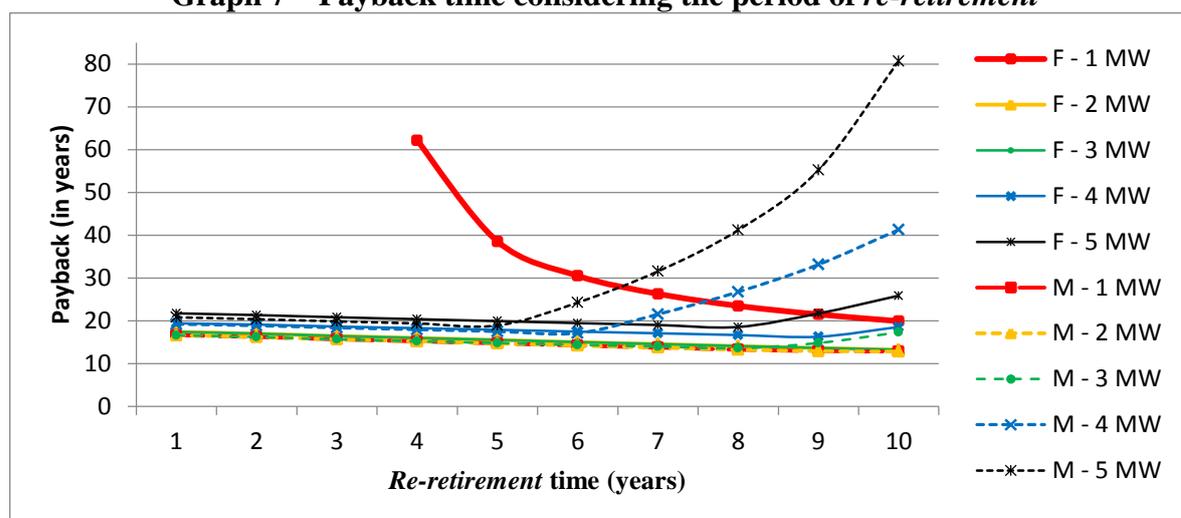
Source: Authors' calculations

4.3. Model with *re-retirement*: an extension

Considering the hypothesis of pension return received during the retirement, the payback time, showed in Graph 7, suggests that this mechanism can create a barrier to the *re-retirement* request. Such would occur for both genders and for the four initial income brackets, because the required time for the settlement of the debt with social security coincides with the life expectancy of the insured citizens. In practice, the return mechanism of the pension would induce the increase of pension to be deferred at least 12 years, i.e., the *re-retirement* would only be beneficial for the pensioner if s/he lived, at least, between 13 to 22 years after the *re-retirement* request.

However, for two groups there is clear disadvantage in this aspect, once they would need to live over 40 years after the *re-retirement* request to settle the difference of the pension received: women with initial income of 1 MW and men with 4 to 5 MW. The first situation happens due to the reduced difference between retirement pension and *re-retirement* pension. Such happens because the pension reaches a value closer to the minimum and therefore, remains approximately constant for a 3-year *re-retirement*. In other words, this female pensioner will not have a relevant increase in pension and will stay close to the wage floor. As to the case of men with higher initial income, the pension should be higher. Moreover, the later the individual requests the recalculation, the closer to the legal ceiling he will be as well as his life expectancy is smaller. Thus, the *payback time* is higher and therefore, the disadvantage of *re-retirement* is larger.

Graph 7 – Payback time considering the period of *re-retirement*



Source: Authors' calculations

5. Final Comments

This study focused the impacts of *re-retirement* for the Retirement Benefit for Length of Time in the Brazilian pension system, as from the perspective of optimal individual choice of the pensioner. This is evidenced by the existence of a maximum *IRR* value in the *re-retirement* period. *IRR* increases until it reaches the maximum value at 4 years and 10 months after the retirement (men) and 7 years and 10 months (women), dropping right after.

These results provide strong evidence about the existence of an ideal moment to request the recalculation of the social security pension. This period is of 4 years and 10 months after the retirement for men of the highest income brackets and 5 years and 10 months for men of the lowest brackets, because they will receive a larger return between contributions and pensions. In the women's case, this time decreases as the income bracket increases, because a person with an initial bracket of 5 MW will have the maximum return after 7 years and 10 months. On the other hand, if the initial income is of 1 MW, the highest return will be reached at 12 years.

Considering the scenario for the retirement pension return to keep the actuarial fairness and using the same hypothesis adopted, it is observed that the *re-retirement* is not beneficial for most of the income brackets and time of *re-retirement*, because the raise obtained by pension recalculation would be totally consumed for the payment in instalments of the retirement pension. As life expectancy for men is smaller, male pensioners who would have to return the amount received in retirement would be favoured, because in thesis they would finish the returning only after their death.

For women, some situations would be beneficial to request pension recalculation, when it is considered the scenario in which makes it necessary to return the pensions received. Women with 2 to 3 MW of initial income would be favoured, for any moment of *re-retirement* request up to 15 years. For an initial income of 1 MW, no woman would have an increase in the *re-retirement* pension in that she would be able to pay for the entire amount due. The same happens for 4 MW and *re-retirement* time higher than 10 years and for the ones that are in a 5 MW bracket and *re-retirement* time for over 9 years. Moreover, it is noted that the existence of the obligation in the return of the pensions could mean a barrier to the requests of pension recalculation for most of the pensioners, once the trade-off between the

increase in the pension amount and the return of the amount previously received would not be favourable to them.

It is worth to mention the existence of non-monotonocities in several of the indicators calculated, especially *IRR*, as reported for example in Tables 3, 4 and 5. This characteristic is due to the non-linearities existing in RBLC, both in relation to the contribution time and to the pension calculation, especially by the existence of the Social Security Factor. Those results also show that contemporary indicators, as *RR*, sometimes are not able to comprehend properly the complexity of PAYG regimes, particularly as to distributive aspects. This complexity is the reason to calculate intertemporal indicators, as *IRR* and *NecRate*. *IRR* calculation has still another advantage, which is the non-impositions of a discount rate for a PAYG regime, a still little consensus point in the literature, as reported by Comprix and Muller (2011) and Brown and Wilcox (2009).

Finally, *IRR* calculation brings the *actuarial fairness* concept implicit, considering that this rate is the one equalizing the values present in pensions and contributions flows. *NecRate* shows a similar characteristic, expressing the relation between the values present both in the pensions and in the income. Therefore, the highest amounts of *IRR* indicate a higher implicit return in a PAYG regime. As the return rates are different (higher for women and individuals with lower income) it must be noted that the actuarial fairness does not mean *per se* the existence of similar *TIRs* for distinct individual profiles. Similarly, as throughout the situations presented, the values of *IRR* and *NecRate* showed changed, meaning that the benefit of RBLC from RGPS cannot be characterized as actuarially neutral. In other words, the current set of rules most likely offer money incentives and disincentives to the change on the retirement date, once the minimum legal requirements are fulfilled.

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