Independent Authority for Fiscal Responsibility

Opinion

Annex 1

25 November 2014

Determination of the 2015 Revaluation Pension Index

Annex 1

Calculating the Revaluation Pension Index (PRI), step by step

This annex analyses in detail the components of the Revaluation Pension Index (RPI) formula. As an example, the 2008 RPI is calculated since this does not require the use of any projected variable.

I. The RPI formula

Law 23/2013 of 23 December, which also sets the provisions on the Sustainability Factor, states that after the year 2015 pensions will be updated annually according to the RPI.

However, the regulation requires that, regardless of the formula result, pensions must not vary below a minimum annual percentage (0.25%) or above a maximum annual percentage (the change in the Consumer Price Index of the previous year + 0.50 percentage points).

The PRI for each year (t+1) is calculated according to the following formula:

$$PRI_{t+1} = \bar{g}_{I,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1} + \alpha\left[\frac{I^*_{t+1} - G^*_{t+1}}{G^*_{t+1}}\right] \qquad (1)$$

The Independent Authority for Fiscal Responsibility (AIReF) was founded with the mission of overseeing strict compliance of the budget stability and financial sustainability principles provided for in article 135 of the Spanish Constitution.
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In spite of its apparent complexity, the variables in the above formula are relatively simple and relate to the SSS revenue and expenditure. The PRI was designed to contribute to the achievement of balanced accounts over the medium to long term. The formula therefore takes the following factors into account: the change in the SSS revenue (g_I), the change in the number of pensions (g_P), the change in the average pension due to new pensions being higher than those who leave the SSS (the replacement rate g_{Se}) and the imbalance (if any) in the SSS measured by the difference between revenue (I) and expenditure (G) levels within its contributory segment (pensions, temporary disability, maternity, paternity and the risk of pregnancy and other contributory benefits). In addition, the formula sets the pace of adjustment at which imbalances are corrected (parameter α).

The variables in the formula therefore have the following meanings:

$\bar{g}_{I,t+1}$ the annual growth rate of SSS revenue,

$\bar{g}_{p,t+1}$ the annual growth rate in the number of contributory pensions in the SSS,

$\bar{g}_{s,t+1}$ the replacement rate (the change in the level of the average pension due to the difference between new pensions in the system and those corresponding to pensioners who die.

To prevent sudden changes due to the economic cycle, the PRI is calculated using moving averages with 11 years windows. These averages are centred, i.e. 5 years immediately before and after the year being calculated. These average values are shown with a swung dash above the growth rate of each variable $\bar{g}$. For example, to calculate the 2008 PRI (t+1), the one used in this annex, the years used run from 2003 (t-4) to 2013 (t+6).

I and G represent the following levels (measured in millions of Euros):

I^*_{t+1} is the SSS revenue in millions of Euros corresponding to the contributory segment.

G^*_{t+1} is the SSS expenditure in millions of Euros corresponding to the contributory segment.

An asterisk (*) means that the value used in the formula is the geometric average. As it was the case for the calculation of the previous variables, to

calculate the 2008 PRI (t+1), the example used in this annex, the years used run from 2003 to 2013 (t-4 to t+6).

A first step to understand the expression given in formula (1) is to split it into two parts. Thus to determine how much pensions should rise by the next year (t+1), the following factors are taken into account:

- The difference between revenue and expenditure (I*-G*). Therefore, in the case of a balanced budget (I*= G*) this term will not affect the result of the formula. In the case of an imbalance (deficit (I*<G*) or surplus (I*>G*)) it will contribute to reduce or increase the PRI, i.e., the annual change in pensions.

  The pace of adjustment between revenue and expenditure is determined by a parameter α. This parameter roughly reflects the number of years which are necessary to balance revenue and expenditure. Although the regulation currently sets a level of 0.25%, this can to be revised every five years and adjusted within a range from 0.25% to 0.33%.

$$\alpha\left[\frac{I_t^* - G_t^*}{G_t^*}\right]$$

  The inclusion of average expenditure over the period, dividing the difference between revenue and spending, is a procedure which has the aim of translating nominal wage into a percentage that fits uniformly with the second part of the formula.

- The second component includes the growth rates, which is given by $\bar{g}_{I,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1}$. It shows that in a situation in which revenue and expenditure are balanced, new revenue obtained in the year (at an annual rate in percentage terms) has to cover the increased in expenditure steaming from the increase in pensions (in number and in amount, due to the difference between new pensions and those of pensioners who die). In this way, a higher (lower) growth rate, given by $\bar{g}_{I,t+1}$, in expenditure, $\left(\bar{g}_{p,t+1} + \bar{g}_{s,t+1}\right)$, will contribute to increase (reduce) the PRI.

  The aggregate formula is therefore understood, in the event of an initial imbalance between variations in revenue and expenditure, to ensure that the variation in new revenue must cover variation in new expenses. However, it must also help to eliminate the imbalance between revenue and expenditure during the period of time determined by parameter α.

II. A practical example: calculation of the 2008 PRI

As an illustration, this practical exercise shows how the 2008 PRI would have been calculated using historical data. The year 2008 was selected because it is the most recent year for which no further projections are required to calculate the PRI. All of the necessary information is available in the data published by the Ministry of Employment and Social Security.

The information supplied look like what is shown in table 1. Had it been intended to calculate the 2008 PRI back in 2007, it would have been necessary to use the time series until 2013.

Table 1: Necessary information to calculate the 2008 PRI

	year	Revenue Million Euros	Expenditure Million Euros	Number of pensions	Average pension (Euros per month)	Annual updating of pensions (per unit)
t-4	2003	81,026.8	72,415.6	7,855,750	550.4	0.028
t-3	2004	87,378.8	76,504.3	7,920,695	581.6	0.035
t-2	2005	94,300.9	86,013.1	8,107,268	612.1	0.034
t-1	2006	102,700.9	89,916.3	8,231,379	647.0	0.026
t	2007	112,418.3	97,809.9	8,338,439	681.5	0.041
t+1	2008	119,459.6	104,834.9	8,473,927	725.9	0.024
t+2	2009	117,397.0	108,800.3	8,614,876	760.7	0.020
t+3	2010	116,458.2	113,646.1	8,749,054	786.5	0.023
t+4	2011	116,119.0	116,415.8	8,871,435	811.4	0.000
t+5	2012	113,081.3	119,029.8	9,008,350	837.0	0.010
t+6	2013	113,505.1	123,339.5	9,154,617	862.7	0.015

Below it is shown how each of the formula components is derived.

II. 1.- PROPORTION OF THE SSS BALANCE TO BE CORRECTED

$$\alpha\left[\frac{I^*_{t+1}-G^*_{t+1}}{G^*_{t+1}}\right]$$

Total revenue time series for the contributory segment: I^*_{2008}

Total revenue time series for the contributory segment: I^*_{2008}

The law states that calculation of revenue is included in chapters 1 to 7 of the Social Security budget, i.e.:

(C.1) Social Contributions for common contingencies, professional disease and industrial accidents,

(C.3) Taxes and other revenues,

(C.4) Current transfers to pay for contributory benefits, including additional sums due to minimum limits of pensions,

(C.5) Property revenue,

(C.6) The transfer of actual investments,

(C.7) Capital transfers.

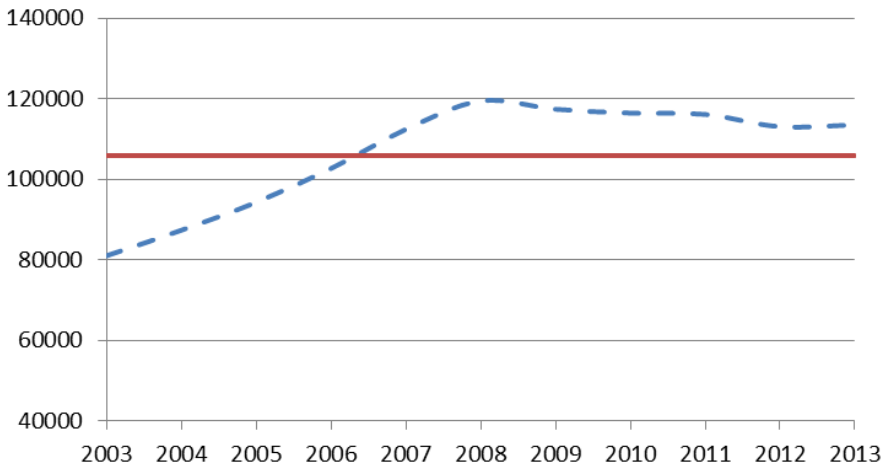
Entries which are not regular are deduced from this amount, i.e., extraordinary entries.

These values are obtained based on the information supplied by the SSS, including historical values – the years 2003 to 2006 – and future years which are necessary – from 2007 to 2013 (the third column in Table 1).

The following graph shows the variation in revenue used in the formula over the period considered for the calculation of the 2008 PRI, as well as its average value[1] (the continuous line), which is the one used directly in the formula and we have called I^*_{2008}

[1] This average was obtained by calculating the geometric average over the 11 years considered: 2004-2013.

Graph 1: Total revenue and its 2008 geometric average I^*_{2008}
(millions of Euros)



Note: The 2008 geometric average is shown as continuous line.

This graph shows a sustained increase in revenue up to 2008, the year in which the crisis started. In the following years it either remains stable or falls slightly. The average value (the continuous line) for this period stands at 105,888.2 million euros.

Total expenditure time series of the contributory segment G^*_{2008}

The law states that calculation of expenditure includes chapters 1 to 7 of the economic classification of the Social Security budget, i.e.:

(C.1) Personnel expenses,

(C.2) Current account expenses for goods and services,

(C.3) Financial expenses,

(C.4) Current account transfers,

(C.6) Actual investments, and

(C.7) Capital transfers.

The following items are deduced from the total of these entries of SSS expenditure:

-Irregular entries, i.e., those which are extraordinary in nature.

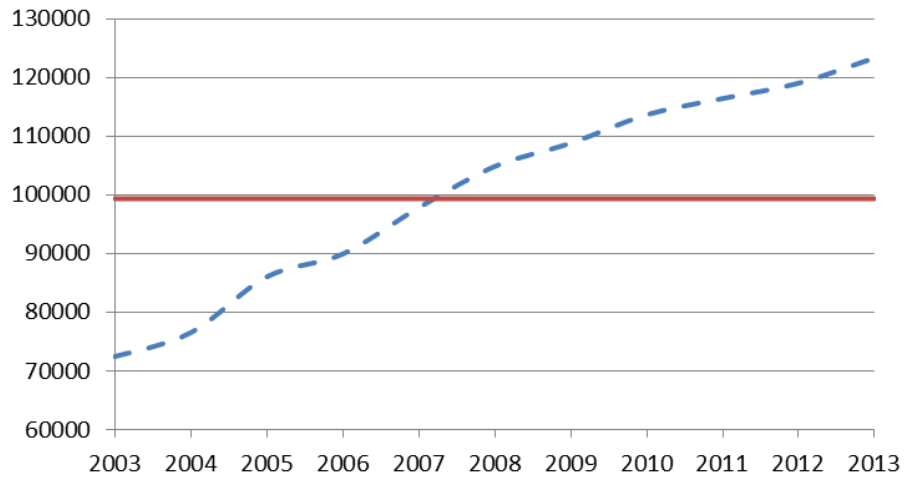
-The expenses corresponding to the National Institute for Healthcare Management (INGESA) and the Institute for the Elderly and Social Services (IMSERSO).

-Cessation benefits (of employees of self-employed workers), as well as non-contributory benefits, except for supplements to minimum pensions.

In functional terms, contributory expenditure is the sum of contributory pensions, temporary disability, maternity, paternity and the risk of pregnancy, other contributory benefits and expenses of implementing these policies.

Like the revenue series, the series of total expenses is also obtained directly from the information supplied by the SSS, including the figures corresponding to the years prior to the one for which the PRI is calculated – from 2003 to 2006 – and the subsequent year –2007 to 2013 (the fourth column in Table 1). Graph 2 shows the total expenditure level over the period 2003-2013 (the dotted line), as well as its average amount[2] (used in the formula) known as G^*_{2008}:

Graph 2: Total expenditure and its 2008 geometric average G^*_{2008}. (million of Euros)



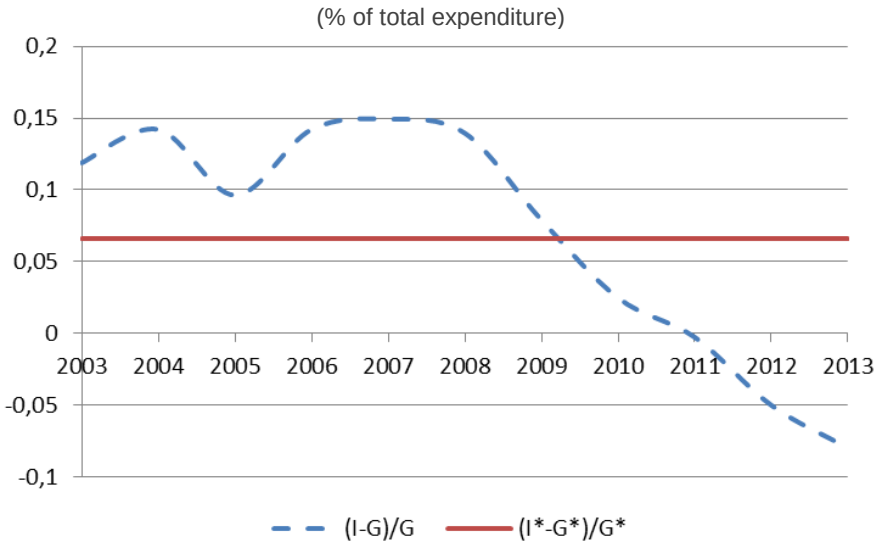
Note: The 2008 geometric average is shown as continuous line.

This graph shows continuous and sustained growth of expenditure over the whole period. It averages slightly less than one hundred thousand million Euros over the period in question (99,327.48 million Euros).

[2] This average was obtained by calculating the geometric average over the 11 years considered: 2004-2013.

According to this formula, the imbalance in the contributory segment of the Social Security during the period from 2003-2013 is expressed by $\left[\frac{I^*_{2008}-G^*_{2008}}{G^*_{2008}}\right]$, which is shown in graph 3 by the continuous line. This graph also shows, as additional data, the difference between the revenue and expenditure in each year, expressed as a percentage of expenditure (the dotted line) without any transformation, i.e., without averages being calculated.

Graph 3: Normalised SSS balance $\left[\frac{I_t-G_t}{G_t}\right]$ and its geometrical average $\left[\frac{I^*_{2008}-G^*_{2008}}{G^*_{2008}}\right]$



The graph above shows two clearly differentiated periods. From 2003 to 2010 the system ran surpluses (see also data table 1). However, after 2010 deficits suddenly increased mainly due to two reasons: a) a continuous increase in pension expenditure and b) a sudden drop in the revenue from social quotas as a consequence of the crisis that started in 2008.

As it was pointed out above, 11-year moving averages are used to ensure smooth changes in the PRI by offsetting the effect of economic cycles.

The value $\left[\frac{I^*_{2008}-G^*_{2008}}{G^*_{2008}}\right]$ obtained from geometric averages reduce the fluctuations observed in annual data and counterbalance relatively high revenues associated with expansionary periods, such as occurred prior to 2008, with situations in which revenues are relatively low, as it is currently

the case. The average surplus for these years is 7%, as a share of total expenditure.

The effect of the pace of adjustment parameter α on the SSS balance:

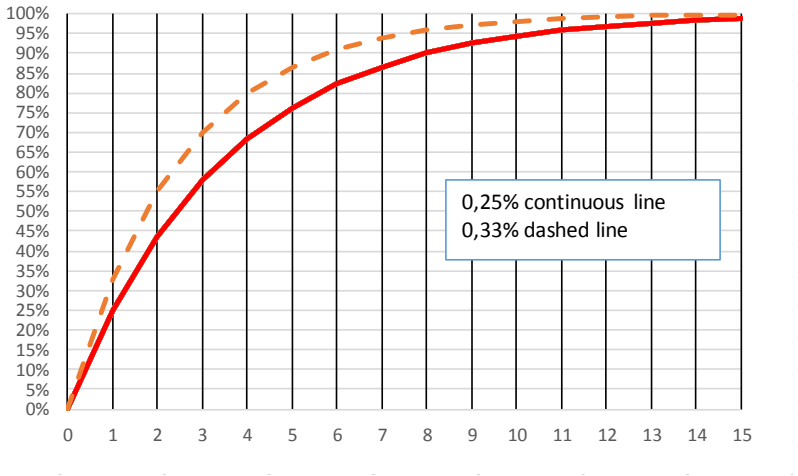
$$\alpha\left[\frac{I^*_{2008}-G^*_{2008}}{G^*_{2008}}\right]$$

As it was mentioned above, the formula uses a parameter known as α, which expresses the number of years it takes to balance revenue and expenditure. Other things equal, a value of α=0.25 indicates that approximately 10 years are required to correct an existing imbalance. However, 68% of the imbalance is already corrected during the first 4 years. Likewise, if the value of this parameter stands at 0.33, fewer years will be needed to reach this situation (see the graph below). Only when α = 1, the change in pensions due to the PRI would completely correct any existing imbalance in one year.

Year	Percentage of correction	
	0.25	0.33
0	0.0%	0.0%
1	25.0%	33.0%
2	43.8%	55.1%
3	57.8%	69.9%
4	68.4%	79.8%
5	76.3%	86.5%
6	82.2%	91.0%
7	86.7%	93.9%
8	90.0%	95.9%
9	92.5%	97.3%
10	94.4%	98.2%
11	95.8%	98.8%
12	96.8%	99.2%
13	97.6%	99.5%
14	98.2%	99.6%
15	98.7%	99.8%

Correction of imbalances due to the coefficient α

(constant growth rate of total revenue and total expenditure)



The application of the parameter α=0.25 to the estimated values gives the following result:

$$\left[\frac{I^*_{t+1}-G^*_{t+1}}{G^*_{t+1}}\right]=0{,}07 \qquad \alpha\left[\frac{I^*_{t+1}-G^*_{t+1}}{G^*_{t+1}}\right]=0{,}25\times 0{,}07=0{,}016$$

Hence, if the PRI only takes into account the balance between revenue and expenditure during the period (i.e. α =1), pensions would have to increase by 7%. Nevertheless, if α equalled 0.25, pensions would have to rise by 1.6%, and more years would be necessary to achieve an accumulated increase of 7% required to correct the imbalance.

II. 2.- ANNUAL GROWTH RATES IN REVENUE AND EXPENDITURE

$\bar{g}_{I,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1}$

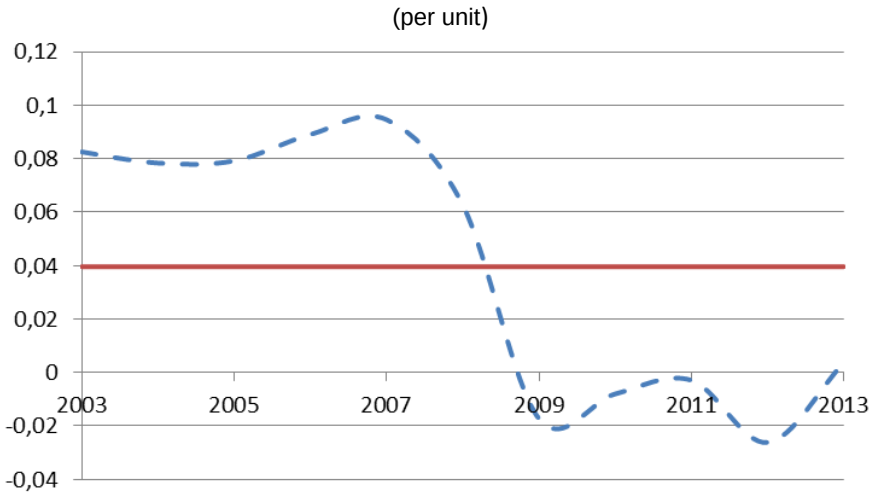
SSS Total revenue : $\bar{g}_{I,2008}$

The data in the third column of Table 1 allows to obtain the annual growth rate, per unit, of total revenue:

$$g_{I,t+1} = tasacreI_t = \Delta I_t = \frac{\text{Re}venue_t - \text{Re}venue_{t-1}}{\text{Re}venue_{t-1}}$$

The dotted line in graph 4 shows the development of revenue growth throughout the period 2003-2013 (in each year, g_I). The average growth rate for 2008, $\bar{g}_{I,2008}$, is also shown[3].

Graph 4: Annual growth rate of SSS contributions revenue g_I and its 2008 arithmetic mean $\bar{g}_{I,2008}$



Note: The 2008 arithmetic mean is shown as continuous line.

This graph shows that until 2008 revenue grew at a rate of approximately 8%, although it quickly started to fall at the beginning of the crisis. The average annual growth rate of revenue (the continuous line) amounted to 4% (0.04 per unit) during the period under consideration. Once again, this result shows the effect of using 11-year moving averages in the PRI formula, as this limits the effect of economic cycles.

[3] The average value is obtained by calculating the arithmetic average of the series and not the geometric average as in the previous cases.

Annual growth rate in the number of pensions: $\bar{g}_{p,2008}$

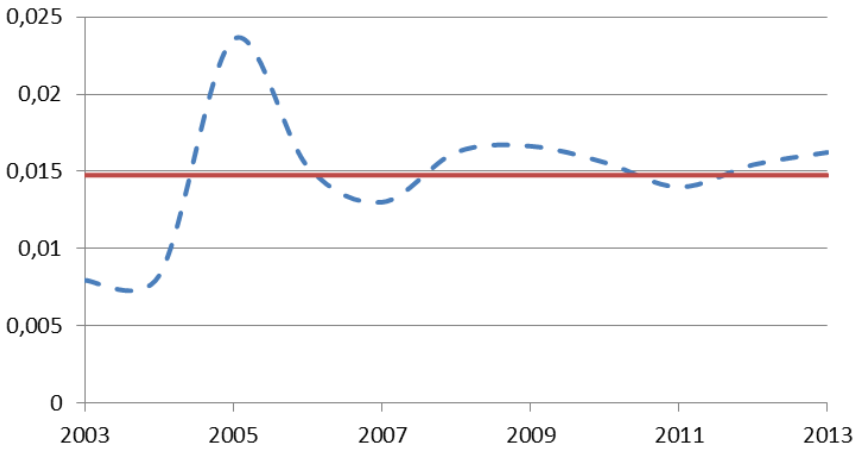
The next series shows the growth in the number of pensions. Hence, it is necessary to know the variation in the total number of contributory pensions, as this allows to know their annual change (the fifth column in Table 1). Similarly to the previous series about revenue, the annual growth rate in the number of pensions, expressed per unit, is obtained with the following formula:

$$g_{p,t+1} = tasacrePen_t = \Delta Pen_t = \frac{n^o\ pen_t - n^o\ pen_{t-1}}{n^o\ pen_{t-1}}$$

Graph 5 shows the series for the years analysed (the dotted line), as well as its average value, which for the year of interest is denominated $\bar{g}_{p,2008}$.

Graph 5: Growth rate in the number of pensions g_p and its 2008 arithmetical mean $\bar{g}_{p,2008}$

(per unit)



Note: The 2008 arithmetic mean is shown as continuous line.

This series, after displaying a certain volatility at the start of the period analysed, show a very stable behaviour after 2007, at around the average for the period (1.47%).

Size of pensions, according to the difference between pensions newly registered in the system and those which ceased (the replacement effect) $\bar{g}_{s,2008}$

The final series required is the one showing the "replacement effect", which expresses the increase in the average pension arising due to the difference between the amounts corresponding to newly registered pensions in the system and those which terminate, i.e., the growth in the level of the average

pension without taking annual indexation into account (either the CPI or the PRI).

Any increase in the size of the average pension observed from one year to the next is due to two reasons:

- The "nominal" increase of pensions. This is due to indexation (the CPI up to 2014, with some exceptions, and the PRI after 2015).
- The replacement effect, which takes into account the fact that the average pension of new pensioners is higher than the average pension corresponding to those who die.

The increase in the average pension may therefore be expressed as:

$$\Delta pension\ \text{media} = \underbrace{(PRI)}_{incremento\ "nominal"} + \underbrace{(efecto.sustitucion)}_{incremento\ real}$$

To obtain the series of the annual rate of the replacement effect it is necessary to have the data corresponding to at least two variables: the current average pension and the index for Revaluation used each year (the last two columns in Table 1). The growth rate of the average pension is obtained as:

$$\Delta Penmed_t = \frac{pension_t - pension_{t-1}}{pension_{t-1}}$$

The replacement rate is obtained by calculating this new variable together with the pension update data shown in the final column of Table 1 using the following formula:

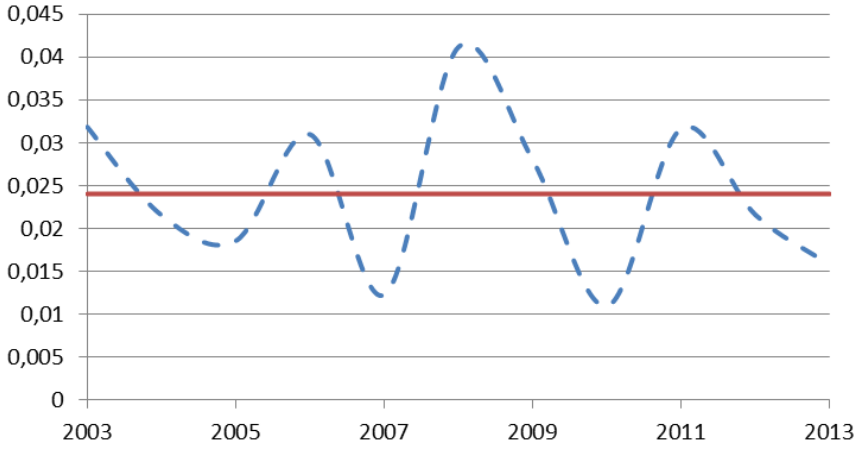
$$\Delta Penmed_t = PRI_t + efectosustitucion_t$$

The temporal series of the "replacement rate" (which to date has always increased) is therefore obtained from:

$$efectosustitucion_t = \Delta Penmed_t - PRI_t$$

Graph 6: Replacement rate g_s and its 2008 arithmetical mean $\bar{g}_{s,2008}$

(per unit)



Note: The 2008 arithmetic mean is shown as continuous line.

Graph 6 shows the variations in the replacement effect during the period 2003-2013 (the dotted line), as well as its average value, which for the year in question is denominated $\bar{g}_{s,2008}$.

Throughout the period analysed the average annual rate of the replacement effect stood at 2.4%.

Growth rates affecting the PRI: $\bar{g}_{I,2008} - \bar{g}_{s,2008} - \bar{g}_{s,2008}$

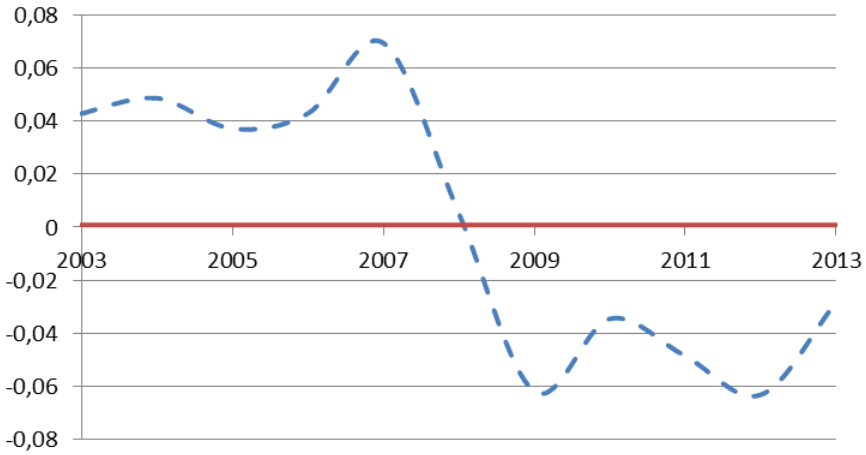
The effect of the rates of variation in the PRI formula is obtained by adding all three average values of the three previous variables.

Replacing the values obtained:

$$Comp.tasas.IRP = \bar{g}_{I,2008} - \bar{g}_{s,2008} - \bar{g}_{s,2008} = 3.96 - 1.47 - 2.4 = 0.09\%$$

The result obtained after subtracting the expenditure growth rate from the revenue growth rate is close to zero. This shows that the new revenue obtained by the contributory segment of the Social Security system has hardly been able to cover the increase in payments caused by the increase in the number of pensions and the increase in average pension size caused by the replacement effect.

Graph 7: The effect of $\bar{g}_{I,2008} - \bar{g}_{s,2008} - \bar{g}_{s,2008}$
(per unit)



Note: The 2008 arithmetic average is shown as continuous line.

The average value here shows the combination of two periods which are clearly differentiated in terms of revenue, given that expenditure was more stable.

II.3.- CALCULATION OF THE PRI FOR THE YEAR 2008

Using the average values calculated for all of the variables included in the formula, it is possible to calculate the PRI for the year 2008 and the effect of the different factors on this.

Replacing all of the values calculated in the above sections in (1) results:

$$IR_{t+1} = \underbrace{\bar{g}_{I,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1}}_{0.0009} + \underbrace{\alpha\left[\frac{I^*_{t+1} - G^*_{t+1}}{G^*_{t+1}}\right]}_{0.0165} = 0{,}0174$$

Therefore, the PRI calculated for 2007 would have led to an increase in pensions of 1.74% for the year 2008 if the data used had been those which we currently have. This increase in the benefit is basically due to the level factor, i.e., the one that reflects the surplus during this period of revenue over expenditure. This makes up about 95% of the final value of the PRI. The factor which expresses tendencies in the annual variation has an effect that is irrelevant on the annual increase of current pensions.

Lastly, it is necessary to check that the value obtained falls between the minimum (0.25%) and maximum limits (RPI+0.5%) set by law. For the year 2008, the maximum limit amounts to $CPI_{2008} + 0.5 = 2{,}4 + 0.5 = 2{,}9$. The final value of the PRI for 2008 would therefore have been 1.74%.