

*Original Paper*

## Comparison of the Projection Methods of both Benefits Guarantee vs. Retroactivity

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### Abstract

In the case of the termination of the social benefit liability in Venezuela, in accordance with the provisions of the organic labor law (year 1997); It is established that the employee must be paid the difference between retroactivity and the accumulation of the guarantee at the time of leaving the company by the employee. Generally, all valuations are made under the Projected Benefit method in the context of IAS-19.

There are 3 potential equally valid approaches, but one with less uncertainty than the other. (In our opinion is the best method that minimizes uncertainty and it is explained in detail below<sup>1</sup>).

**Keywords:** Expected unitary value of obligations, projected benefit method, IAS-19, actuarial obligations, Lump Sum type social benefit plans.

### SOCIAL BENEFITS IN VENEZUELA

In Venezuela, there are two types of social benefits:

**I. Guarantee**

**II. Retroactivity**

The guarantee accumulates every year and follows the following dynamic equation:

$$G_t = G_{t-1} + S_t * \tilde{\delta} \quad (1)$$

Being;

$G_t$ : Guarantee in t

$G_{t-1}$ : Guarantee in t-1

$S_t$ : Current salary in t

$\tilde{\delta}$ : Applicable rate in t

On the other hand, retroactivity is determined as:

$$R_t = S_t(t)^1 = S_t(t - k) \quad (2)$$

$k$ : Adjustment that reflects the validity of the years of service, since effective

$R_t$ : Retroactivity in t.

(1) Effective date June/1997

$S_t$ : Current salary in t years of service.

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<sup>1</sup> Throughout our professional career, we have seen the 3 approaches applied interchangeably, with also different liability orders, all under the **Projected Benefit actuarial method**.

**FIRST APPROACH (Benefit Differentials)**

1. The benefit subject to the valuation is the following<sup>2</sup>:

$$B_t = \text{Max}(R_t, G_t) - G_t \tag{3}$$

As you can see  $B_t$ , the differential benefit is not a linear structure, however, retroactivity is explained by a **multiplicative model**, while the guarantee is given by an **additive model**.

That is, the guarantee can always be calculated as:

$$G_t = \sum S_t \tilde{\delta}_t \text{ for all } t \{1,2,3,4, \dots\} \tag{4}$$

**SECOND APPROACH**

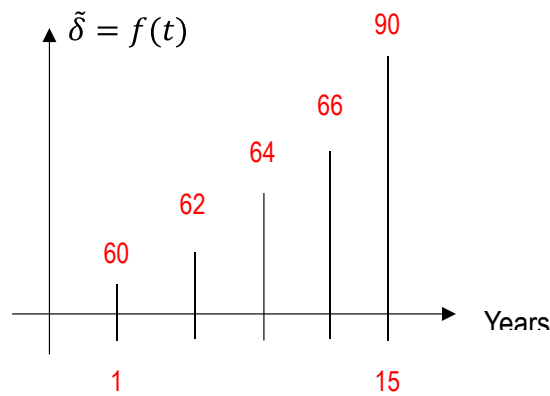
2. Another equally valid approach would consist of projecting both contingencies, guarantee and retroactivity and subtracting the liabilities associated with them  $PBOG_t$  and  $PBOR_t$  thus determining the differential liability of the PBO, that is;

$$PBOD_t = PBOR_t - PBOG_t. \tag{5}$$

The rate  $\tilde{\delta}$  depending on  $t$  according to the following sequence<sup>3</sup>:

t	DR	$\tilde{\delta}$
1	60	2
2	62	.
3	64	.
4	66	.
.	.	.
.	.	.
.	.	.
.	.	.
15	90	3
15	90	3

Table 1



Graphic 1

$$\tilde{\delta} = \frac{\text{Recognized days}}{30} \tag{6}$$

DR: Recognized days

**THIRD APPROACH (Retroactivity PBO less Guarantee)**

The third approach is based on determining the retroactivity liability,  $PBOR_t$  and subtracting the certain guarantee accumulated by the employee at the valuation date.

As is customary, in the field of actuarial sciences, the unitary expected values of the future projections of the Guarantee and Future Retroactivity are determined, probably up to a final age  $w = 70$  years, to then determine the expected differential PBO.

Below are illustrated several cases of the guarantee projection  $\{G_t\}$  with 1 year of service, with 5 years and with 10 years of service.

<sup>2</sup> It is very important to visualize that this mathematical structure somewhat complicates the actuarial calculation based on commutative actuarial under the Projected Benefit method.

<sup>3</sup> In accordance with the provisions of the Venezuelan Organic Labor Law.

**ACTUARIAL VALUATION MODELS (UNIT EXPECTED PRESENT VALUES)**

**Model Notation:**

- (1) **Accrual factor:** Refers to the attribution of the benefit under IAS-19
- (2) **V<sup>t</sup>:** Discount factor, in this case the interest rate is (108%), in the case of Venezuela.
- (3) **Age:** The age of the employee.
- (4) **Service:** The years of seniority of the employee.
- (5) **Salary:** Current unitary salary of the employee.
- (6) **Salary Rate:** Salary increase rate (100%)
- (7) **Benefit adjustment rate (δ̃):** # of days earned per year in terms of monthly wages.
- (8) **Guarantee:** Guarantee provision level.
- (9) **Retroactivity:** Retroactivity provision level
- (10) **Max (Gx ; Rx):** Maximum of both benefits.
- (11) **Benefit = Max (Gx):** Valuation profit. Differential between maximum benefit and guarantee.
- (12) **PBO:** Actuarial Liability under IAS-19, using the Projected Benefit Obligation
- (13) **Adjustment rate (θ):** Adjustment rate to the 1st term of the guarantee accredited by the employee, at that age x with the accumulated service to that date.
- (14) **Expected Unitary present value E(VPE).**

**GARANTEE MODELS<sup>4</sup>(Approach 1 and 2)**

**Example 1 year of Service**

V= 2,0800			Edad		Edad		Ajuste 100,00%		Tasa SAL		100,00%	
V/t	Edad X	Servicio	Prob.	Salario X	Garantía fracción	Garantía X	Retroactividad X	Max (Gx; Rx)	Beneficio= Max - Gx	PBO		
0.480769231	19	1	0.209997	1,00	2,00	2,00	1,00	2,00	-	-	-	-
0.231139053	20	2	0.1573925	2,00	4,07	6,13	4,00	6,13	-	-	-	-
0.111124545	21	3	0.1195805	4,00	6,20	14,67	12,00	14,67	-	-	-	-
0.053425262	22	4	0.0920105	8,00	8,40	32,27	32,00	32,27	-	-	-	-
0.025685222	23	5	0.0716435	16,00	10,67	68,53	80,00	80,00	11,47	0,0042	-	-
0.012348664	24	6	0.0564096	32,00	13,00	143,20	192,00	192,00	48,80	0,0057	-	-
0.005936858	25	7	0.0448822	64,00	15,40	296,80	448,00	448,00	151,20	0,0058	-	-
1.89438E-13	58	40	0.00065	549.755.813.888,00	112,00	3.298.534.878.957,07	21.990.232.555.520,00	21.990.232.555.520,00	18.691.697.676.562,90	0,0001	-	-
9.10759E-14	59	41	0.0006095	1.099.511.627.776,00	115,00	6.597.069.762.285,07	45.079.976.738.816,00	45.079.976.738.816,00	38.482.906.976.530,90	0,0001	-	-
4.37865E-14	60	42	0.0005737	2.199.023.255.552,00	118,00	13.194.139.528.941,10	92.358.976.733.184,00	92.358.976.733.184,00	79.164.837.204.242,90	0,0000	-	-
2.10512E-14	61	43	9,217E-05	4.398.046.511.104,00	121,00	26.388.279.062.253,10	189.115.999.977.472,00	189.115.999.977.472,00	162.727.720.915.219,00	0,0000	-	-
1.01208E-14	62	44	0.0001016	8.796.093.022.208,00	124,00	52.776.558.128.877,10	387.028.092.977.152,00	387.028.092.977.152,00	334.251.534.848.275,00	0,0000	-	-
4.86575E-15	63	45	0.000112	17.592.186.044.416,00	127,00	105.553.116.262.125,00	791.648.371.998.720,00	791.648.371.998.720,00	686.095.255.736.595,00	0,0000	-	-
2.3393E-15	64	46	0.0001232	35.184.372.088.832,00	130,00	211.106.232.528.621,00	1.618.481.116.086.270,00	1.618.481.116.086.270,00	1.407.374.883.557.650,00	0,0000	-	-
1.12467E-15	65	47	0.0001354	70.368.744.177.664,00	133,00	422.212.465.061.613,00	3.307.330.976.350.210,00	3.307.330.976.350.210,00	2.885.118.511.288.590,00	0,0000	-	-
5.40704E-16	66	48	0.0001488	140.737.488.355.328,00	136,00	844.424.930.127.597,00	6.755.399.441.055.740,00	6.755.399.441.055.740,00	5.910.974.510.928.150,00	0,0000	-	-
2.58954E-16	67	49	0.000164	281.474.976.710.656,00	139,00	1.688.849.860.259.560,00	13.792.273.858.822.100,00	13.792.273.858.822.100,00	12.103.423.398.562.600,00	0,0000	-	-
1.24978E-16	68	50	0.0001817	562.949.953.421.312,00	142,00	3.377.699.720.523.500,00	28.147.497.671.065.600,00	28.147.497.671.065.600,00	24.769.797.950.542.100,00	0,0000	-	-
6.00855E-17	69	51	0.0002025	1.125.899.906.842.620,00	145,00	6.755.399.441.051.370,00	57.420.895.248.973.800,00	57.420.895.248.973.800,00	50.665.495.807.922.400,00	0,0000	-	-
2.88873E-17	70	52	0.0002271	2.251.799.813.685.250,00	148,00	13.510.798.882.107.100,00	117.093.590.311.633.000,00	117.093.590.311.633.000,00	103.582.791.429.526.000,00	0,0000	-	-
						27.021.597.764.048.100,00	229.683.580.995.895.000,00	229.683.580.995.895.000,00	202.661.983.231.847.000,00	5,20%		

Table 2

The expected unit present value is 5.20%, that is,  $E(VPU) = 0,052$  **1st approach**

<sup>4</sup> All the details of the calculation can be seen in each of the annexes. The tables show two sections of the complete table in the annexes, for pedagogical reasons. The first 7 years of evolution and the last from 58 to 70 years of age.

**Example 5 years of service**

2,0800			Edad		Ajuste 90,00%		Tasa SAL		100,00%	
Edad X	Servicio	Prob	Salario X	Garantía fracción	Garantía X	Retroactividad X	Max (Gx; Rx)	Beneficio= Max - Gx	PBO	
24	5	0,161458	1,00	10,67	9,60	5,00	9,60	-	-	
25	6	0,1284638	2,00	13,00	14,27	12,00	14,27	-	-	
26	7	0,1032202	4,00	15,40	23,87	28,00	28,00	4,13	0,0339	
27	8	0,0837057	8,00	17,87	43,60	64,00	64,00	20,40	0,0570	
28	9	0,0684736	16,00	20,40	84,13	144,00	144,00	59,87	0,0585	
29	10	0,0564728	32,00	23,00	167,33	320,00	320,00	152,67	0,0532	
60	41	0,001642	68.719.476.736,00	115,00	412.316.860.148,13	2.817.498.546.176,00	2.817.498.546.176,00	2.405.181.686.027,87	0,0008	
61	42	0,0002638	137.438.953.472,00	118,00	824.633.720.564,13	5.772.436.045.824,00	5.772.436.045.824,00	4.947.802.325.259,87	0,0001	
62	43	0,0002909	274.877.906.944,00	121,00	1.649.267.441.396,13	11.819.749.998.592,00	11.819.749.998.592,00	10.170.482.557.195,90	0,0001	
63	44	0,0003205	549.755.813.888,00	124,00	3.298.534.883.060,13	24.189.255.811.072,00	24.189.255.811.072,00	20.890.720.928.011,90	0,0001	
64	45	0,0003526	1.099.511.627.776,00	127,00	6.597.069.766.388,13	49.478.023.249.920,00	49.478.023.249.920,00	42.880.953.483.531,90	0,0002	
65	46	0,0003877	2.199.023.255.552,00	130,00	13.194.139.533.044,10	101.155.069.755.392,00	101.155.069.755.392,00	87.960.930.222.347,90	0,0002	
66	47	0,0004259	4.398.046.511.104,00	133,00	26.388.279.066.356,10	206.708.186.021.888,00	206.708.186.021.888,00	180.319.906.955.532,00	0,0002	
67	48	0,0004693	8.796.093.022.208,00	136,00	52.776.558.132.980,10	422.212.465.065.984,00	422.212.465.065.984,00	369.435.906.933.004,00	0,0002	
68	49	0,00052	17.592.186.044.416,00	139,00	105.553.116.266.228,00	862.017.116.176.384,00	862.017.116.176.384,00	756.463.999.910.156,00	0,0002	
69	50	0,0005796	35.184.372.088.832,00	142,00	211.106.232.532.724,00	1.759.218.604.441.600,00	1.759.218.604.441.600,00	1.548.112.371.908.880,00	0,0002	
70	51	0,0006501	70.368.744.177.664,00	145,00	422.212.465.065.984,00	3.588.805.953.060.860,00	3.588.805.953.060.860,00	3.166.593.487.995.150,00	0,0002	
					844.424.930.121.559,00	7.036.874.417.766.400,00	7.036.874.417.766.400,00	6.192.449.487.644.850,00	52,38%	

Table 3

The unit expected present value is 52.38%, that is,  $E(VPU) = 0,5238$  **1st approach**

**Example 10 years of service**

2,0800			Edad		Ajuste 90,00%		Tasa SAL		100,00%	
Edad X	Servicio	Prob	Salario X	Garantía fracción	Garantía X	Retroactividad X	Max (Gx; Rx)	Beneficio= Max - Gx	PBO	
29	10	0,1242038	1,00	23,00	20,70	10,00	20,70	-	-	
30	11	0,1032282	2,00	25,67	26,03	22,00	26,03	-	-	
31	12	0,0864181	4,00	28,40	36,97	48,00	48,00	11,03	0,0883	
32	13	0,0728418	8,00	31,20	59,37	104,00	104,00	44,63	0,1336	
60	41	0,0036114	2.147.483.648,00	115,00	12.884.901.895,10	88.046.829.568,00	88.046.829.568,00	75.161.927.672,90	0,0044	
61	42	0,0005802	4.294.967.296,00	118,00	25.769.803.783,10	180.388.626.432,00	180.388.626.432,00	154.618.822.648,90	0,0007	
62	43	0,0006399	8.589.934.592,00	121,00	51.539.607.559,10	369.367.187.456,00	369.367.187.456,00	317.827.579.896,90	0,0007	
63	44	0,0007048	17.179.869.184,00	124,00	103.079.215.111,10	755.914.244.096,00	755.914.244.096,00	652.835.028.984,90	0,0008	
64	45	0,0007756	34.359.738.368,00	127,00	206.158.430.215,10	1.546.188.226.560,00	1.546.188.226.560,00	1.340.029.796.344,90	0,0008	
65	46	0,0008526	68.719.476.736,00	130,00	412.316.860.423,10	3.161.095.929.856,00	3.161.095.929.856,00	2.748.779.069.432,90	0,0009	
66	47	0,0009368	137.438.953.472,00	133,00	824.633.720.839,10	6.459.630.813.184,00	6.459.630.813.184,00	5.634.997.092.344,90	0,0009	
67	48	0,0010322	274.877.906.944,00	136,00	1.649.267.441.671,10	13.194.139.533.312,00	13.194.139.533.312,00	11.544.872.091.640,90	0,0010	
68	49	0,0011436	549.755.813.888,00	139,00	3.298.534.883.335,10	26.938.034.880.512,00	26.938.034.880.512,00	23.639.499.997.176,90	0,0010	
69	50	0,0012748	1.099.511.627.776,00	142,00	6.597.069.766.663,10	54.975.581.388.800,00	54.975.581.388.800,00	48.378.511.622.136,90	0,0011	
70	51	0,0014299	2.199.023.255.552,00	145,00	13.194.139.533.319,10	112.150.186.033.152,00	112.150.186.033.152,00	98.956.046.499.832,90	0,0012	
					26.388.279.066.943,00	219.902.325.555.192,00	219.902.325.555.207,00	193.514.046.488.264,00	1,27	

Table 4

The unit expected present value is 127%, that is,  $E(VPU) = 1,27$  **1st approach**

As we can see from the table of the model of the present expected value of the guarantee, the benefit is based on an initial guarantee in year 1 of projection, which in the case of 1 year of service of the worker  $\{G_1\}$  is fully known and its amount in terms of A unit salary would be the following:

$$G_1 = S_1 * \tilde{\delta}_1 = 2S_1 \tag{7}$$

Since  $\tilde{\delta} = 2$  and  $S_1 = 1$

When we do the same for the case of  $t = 10$ , years of service for the 1st year of projection, we observe that the rate is  $\tilde{\delta}$  and if we value  $G_{10}$ , without any adjustment, we would be overestimating the guarantee and consequently underestimating the obligation.

The above occurs because in the projection model the guarantee  $G_{10}$  has history and previous years were not necessarily calculated with the same salary increase rate.

In fact, in Venezuela this statement is totally true, **given the volatility of inflation and its reflection in wage increase rates**. That is, we decompose  $G_{10}$  we would have:

$$G_{10} = G_9 + \tilde{\delta}_{10}S_{10}$$

$$G_{10} = \sum_{t=1}^{10} S_t \tilde{\delta}_t \tag{8}$$

That is, the history of  $\{G_t\}$   $\{G_1, G_2, G_3 \dots G_{10}\}$  corresponds to a salary filter  $\{S_1, S_2, S_3 \dots S_{10}\}$  and a rate filter  $\{\delta_1, \delta_2, \delta_3 \dots \delta_{10}\}$ , when one determines the current salary rates as:

$$\Delta S_t = (S_t - S_{t-1}) \quad (9)$$

$$\left(\frac{\Delta S_t}{S_{t-1}}\right) = \frac{S_t}{S_{t-1}} - 1 = s\% \quad (10)$$

It's easy to see that the filter  $s = \{s_1, s_2, s_3, \dots, s_{10}\}$  are generally different for any pair:

$$(s_i, s_j) \quad i \neq j, s_i \neq s_j \quad (11)$$

**For worker tenures greater than 1 year, the underestimation of collateral in the projection model could be substantial in both approaches, depending on the company's demographics.**

- i. **Projection of the Benefit differential (Approach 1).**
- ii. **PBO differential of retroactive and guarantees (Approach 2).**

Companies generally do not have real historic guarantees immediately available. Obviously, if we add an adjustment parameter to the model to the 5-year guarantee ( $\theta$ ), for example, **it would be quite reasonable to think that this adjustment would try to minimize a bit of uncertainty.**

However, **each company has its own compensation and salary increase structure** and a certain amount  $\theta$  would not definitely be applicable for all companies.

On the other hand,  $\theta_i = f(T_i)$ , is a function of the employee's years of service, that is, in the case of 3 employees of 5 years, 10 years and 20 years of service, the  $\theta$  corresponding ones would obviously be different. There still remains a certain degree of model uncertainty, even though we will correct the overestimation.

### **RETROACTIVITY MODEL. Approach 3**

In the case of the calculation of Retroactivity  $R_t$ , this problem does not exist, since being a multiplicative model,  $R_t = S_t t$  for any  $t$  future, the order of magnitude of the benefit is known exactly; and in the event that the employee at the time of the actuarial valuation  $\{t\}$  exceeds the limit of the 1997 restriction, the only thing that would have to be done is simply a small change to  $(t)$  and instead of using  $t$  would be used  $t^*$ , generally  $t^* < t$  to the valuation date **in order to meet compliance with the validity of the accumulation of creditable service as of the valuation date.**

The actuarial valuation would then be carried out under the assumption that all prospective future employees leave retroactively and the total accumulated guarantee is subtracted from the total Actuarial Liability without any projection.

In summary, the 3 approaches previously indicated and described seem to be reasonable, if the objective is to measure the differential as a function, between retroactivity and the guarantee, however; It would be more convenient to project the retroactivity and **calculate its expected present value and subtract the certain, perfectly known accumulated guarantee**, without making any assumptions, that is, the  $PBO_t = PBOR_t - G_t$ , instead of calculating both projections  $PBO_t = PBOR_t - PBOG_t$  and the  $PBO$  based on the projection of  $\Delta\beta$ .

ii. *PBO based on  $\Delta B$ .*

In our opinion, we would consider that the **3rd model is superior**, in the sense that it minimizes the uncertainty of the 1st and 2nd models, by generally not having the complete history or **at least the penultimate certain guarantee.**

Adding an additional assumption to a projection model always implies a higher level of uncertainty in the result of this model. Even more, in very volatile economies like the Venezuelan one.

### COMPARATIVE ANALYSIS OF THE 3 APPROACHES

In order to compare the three approaches in terms of the order of magnitude of the respective liabilities, a large company characterized by the following demographic data was taken as a sample:

	CURRENT	FEM	MAS	TOTAL
Statistics	Population	833	844	1.677
	Average Current age	41,82	42,31	42,07
	Average Current Service	11,86	11,33	11,59
	Average Current Salary	50.319,12	53.575,58	51.958,03
	Payroll/Month	41.915.823,29	45.217.785,98	87.133.609,27

Table 5

Likewise, real hard data is available on the levels of nominal (non-actuarial) liabilities of each type of social benefits, guarantees vs. retroactivity.

Social Benefits	Guarantee PS in x (Bs.)	91.797.413,45	96.406.460,35	188.203.873,80	29.079.758,50	547,20%
	PS Retroactivity in x (Bs.)	593.259.866,09	613.089.774,04	1.206.349.640,13	381.748.766,35	216,01%
	PS a Pay in x (Bs.)	593.658.185,00	613.982.314,32	1.207.640.499,32	381.833.311,20	216,27%
	Dif a pay vs Guarantee in x (Bs.)	501.860.771,55	517.575.853,98	1.019.436.625,52	352.753.552,70	188,99%

Table 6

### Actuarial results of the 3rd approach

Dif PS	PBO Differential (Bs.)	49.453.887,81	63.996.559,49	113.450.447,30	127.062.277,03
	Cost per Service (Bs.)	12.486.607,11	18.049.575,64	30.536.182,75	17.502.848,39
	Interest cost (Bs.)	67.522.206,94	87.378.144,07	154.900.351,01	104.337.362,26
	PBO Differential (Bs.)	10.341.148,80	22.832.226,03	33.173.374,83	15.015.681,97

Table 7

Likewise, it is observed that the current differential at the date of the valuation in nominal terms between the accumulated guarantee and the retroactivity in millions of Bs., is in the order of 1,019.43 MMBs, the total retroactivity in the order of 1,206.34 MMBs., and the accumulated guarantee is in the order of 188.20MMBs. The results of approach 1 and 2 are summarized in the table below.

**When the actuarial valuation is carried out for each of the aforementioned approaches, all done with the Projected Benefit method, we obtain:**

ACTUARIAL LIABILITY APPROACHES (MMBs) - (1)					
1G	%	2G	%	3R	%
101,68	9,98	113,45	11,13%	279,11	27,34

Table 8

In the cases of the guarantee (1G and 2G) the respective ones were assumed  $\{\theta_i\}$  to adjust the projection of the guarantee in the 1st year. The liabilities caused by these 2 methods are very similar.

1. The (1G) consisted of the separate projection of the adjusted guarantee and, on the other hand, the retroactivity and the difference of both liabilities was obtained, that is:

$$PBOR_t - PBOGA_t = PBO_t$$

2. In the second case, something similar, slightly different, was obtained

$$PBOR_t - PBOGA_t = PBOU_t$$

**PBOR:** Retroactive Liability

**PBPGA:** Adjusted guarantee Liability

**PBOU<sub>t</sub>:** Sum of unit projected liabilities (year by year)

3. In the third case, no adjustment of any kind was made to the guarantee, the amount accumulated to date was assumed in full and only retroactivity was projected.  $PBOR_t - G_t = PBO_t$

**As we can see, the highest liability corresponds to approach 3, however, the one with the least uncertainty by not making any adjustments to the guarantee.**

This amount seems more appropriate to us, to finance all of the future differentials, where at the date of the valuation in nominal terms, the difference in the amount of retroactivity vs. guarantee is in the order of 1,019.43 and the corresponding actuarial liability. It is around almost 30% more exactly in this case than 27.38%.

## CONCLUSIONS

In general, we can affirm that the 3 approaches are acceptable and equally valid, some with a little more uncertainty than others, and the third with less uncertainty. By working with fewer assumptions  $\{\theta_i\}$ <sup>6</sup>, the results of the application of any approach will be obviously different, but **equally valid in our opinion, and the order of magnitude of the liability will be logically different. Under the retroactive model, it is implicitly assumed that the vast majority of future employees leave retroactively, which empirical and statistical evidence confirms 100%.**

**The retroactive approach results in a larger liability, but with much less uncertainty, which goes some way to guaranteeing that the outcome is likely to be more unbiased than the other two approaches.**

In those cases that  $PBOR_t < G_t$  obviously, it implies that for that year the  $PBO_t$  differential is zero.

One of the advantages of the retroactivity model is its transparency and ease of mathematically representing it with **actuarial commutative**, since being a multiplicative model, the attribution of the

<sup>5</sup> Actuarial liability in terms of the projected benefits for the guarantee and retroactivity.

<sup>6</sup> It reflects a  $\theta$  for each year of accumulated service  $\{1,2,3, \dots, 20\}$  given the history of accumulation of the Guarantee.

projected benefit is in line with the direct calculation offered by commutative transformations, not so in the case of the guarantee that obeys an additive model that in some way makes the calculation a little more complex and introduces a higher level of uncertainty by having to generate them  $\{\theta_i\}$  for each level of service for the same company and probably another  $\{\theta_i^*\}$  for other different companies.

We are likely to leave out other equally valid and reasonably good alternative approaches; however, **we are of the opinion of endorsing the 3rd approach, as it is the most unbiased, the one with the least uncertainty in the modeling of the liability under the actuarial method of the projected benefit and eventually the most conservative in terms of the effects that could have on the liability. Macroeconomic distortions, especially inflation rates, wage increase rates and the interest rate to discount obligations<sup>7</sup>.** Due to Venezuela's macroeconomic distortions, particularly inflation and its effect on wage growth and interest rates, **it would seem that the most reasonable method would definitely be the one described in the third approach.**

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<sup>7</sup> In many actuarial reports that we have reviewed internationally, and the large actuarial practice consulting companies, warn that the future is certainly unpredictable and that there may be other scenarios with different actuarial premises and hypotheses that are equally valid, as well as varied approaches to the solution. of the same problem with also different results



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Evaristo Diz Cruz, J. Tim Query. Approximate method for calculating the actuarial liability under IAS-19 with the unit credit method of the projected benefit.

**ANNEXES**

**Example 1 year of service**

V= 2,0800		Age 19		Adjustment 100,00%		Tasa SAL		100,00%	
V't	Age X	Service	Prob	Salary X	Fractional Guarantee	Guarantee X	Retroactivity X	Max (Gx; Rx)	Benefit= Max - Gx
0,480769231	19	1	0,209997	1,00	2,00	2,00	1,00	2,00	-
0,231139053	20	2	0,1573925	2,00	4,07	6,13	4,00	6,13	-
0,111124545	21	3	0,1195805	4,00	6,20	14,67	12,00	14,67	-
0,053425262	22	4	0,0920105	8,00	8,40	32,27	32,00	32,27	-
0,025685222	23	5	0,0716435	16,00	10,67	68,53	80,00	80,00	11,47
0,012348664	24	6	0,0564096	32,00	13,00	143,20	192,00	192,00	48,80
0,005936858	25	7	0,0448822	64,00	15,40	296,80	448,00	448,00	151,20
0,002854259	26	8	0,0360627	128,00	17,87	612,53	1.024,00	1.024,00	411,47
0,00137224	27	9	0,0292448	256,00	20,40	1.261,07	2.304,00	2.304,00	1.042,93
0,000659731	28	10	0,023923	512,00	23,00	2.592,27	5.120,00	5.120,00	2.527,73
0,000317178	29	11	0,0197303	1.024,00	25,67	5.322,93	11.264,00	11.264,00	5.941,07
0,00015249	30	12	0,0163982	2.048,00	28,40	10.920,80	24.576,00	24.576,00	13.655,20
7,33123E-05	31	13	0,0137278	4.096,00	31,20	22.389,60	53.248,00	53.248,00	30.858,40
3,52463E-05	32	14	0,0115712	8.192,00	34,07	45.873,33	114.688,00	114.688,00	68.814,67
1,69453E-05	33	15	0,0098165	16.384,00	37,00	93.933,07	245.760,00	245.760,00	151.826,93
8,14679E-06	34	16	0,0083787	32.768,00	40,00	192.237,07	524.288,00	524.288,00	332.050,93
3,91673E-06	35	17	0,007193	65.536,00	43,00	388.845,07	1.114.112,00	1.114.112,00	725.266,93
1,88304E-06	36	18	0,0062079	131.072,00	46,00	782.061,07	2.359.296,00	2.359.296,00	1.577.234,93
9,05309E-07	37	19	0,0053857	262.144,00	49,00	1.568.493,07	4.980.736,00	4.980.736,00	3.412.242,93
4,35245E-07	38	20	0,0046952	524.288,00	52,00	3.141.357,07	10.485.760,00	10.485.760,00	7.344.402,93
2,09252E-07	39	21	0,0041124	1.048.576,00	55,00	6.287.085,07	22.020.096,00	22.020.096,00	15.733.010,93
1,00602E-07	40	22	0,0036176	2.097.152,00	58,00	12.578.541,07	46.137.344,00	46.137.344,00	33.558.802,93
4,83663E-08	41	23	0,0031956	4.194.304,00	61,00	25.161.453,07	96.468.992,00	96.468.992,00	71.307.538,93
2,32531E-08	42	24	0,0028342	8.388.608,00	64,00	50.327.277,07	201.326.592,00	201.326.592,00	150.999.314,93
1,11794E-08	43	25	0,0025231	16.777.216,00	67,00	100.658.925,07	419.430.400,00	419.430.400,00	318.771.474,93
5,37469E-09	44	26	0,0022546	33.554.432,00	70,00	201.322.221,07	872.415.232,00	872.415.232,00	671.093.010,93
2,58398E-09	45	27	0,0020218	67.108.864,00	73,00	402.648.813,07	1.811.939.328,00	1.811.939.328,00	1.409.290.514,93
1,2423E-09	46	28	0,0018195	134.217.728,00	76,00	805.301.997,07	3.758.096.384,00	3.758.096.384,00	2.952.794.386,93
5,9726E-10	47	29	0,0016427	268.435.456,00	79,00	1.610.608.365,07	7.784.628.224,00	7.784.628.224,00	6.174.019.858,93
2,87144E-10	48	30	0,0014878	536.870.912,00	82,00	3.221.221.101,07	16.106.127.360,00	16.106.127.360,00	12.884.906.258,93
1,3805E-10	49	31	0,0013516	1.073.741.824,00	85,00	6.442.446.573,07	33.285.996.544,00	33.285.996.544,00	26.843.549.970,93
6,63702E-11	50	32	0,0012313	2.147.483.648,00	88,00	12.884.897.517,07	68.719.476.736,00	68.719.476.736,00	55.834.579.218,93
3,19088E-11	51	33	0,0011247	4.294.967.296,00	91,00	25.769.799.405,07	141.733.920.768,00	141.733.920.768,00	115.964.121.362,93
1,53408E-11	52	34	0,0010301	8.589.934.592,00	94,00	51.539.603.181,07	292.057.776.128,00	292.057.776.128,00	240.518.172.946,93
7,37536E-12	53	35	0,0009462	17.179.869.184,00	97,00	103.079.210.733,07	601.295.421.440,00	601.295.421.440,00	498.216.210.706,93
3,54585E-12	54	36	0,0008718	34.359.738.368,00	100,00	206.158.425.837,07	1.236.950.581.248,00	1.236.950.581.248,00	1.030.792.155.410,93
1,70473E-12	55	37	0,0008059	68.719.476.736,00	103,00	412.316.856.045,07	2.542.620.639.232,00	2.542.620.639.232,00	2.130.303.783.186,93
8,19584E-13	56	38	0,0007475	137.438.953.472,00	106,00	824.633.716.461,07	5.222.680.231.936,00	5.222.680.231.936,00	4.398.046.515.474,93
3,94031E-13	57	39	0,0006958	274.877.906.944,00	109,00	1.649.267.437.293,07	10.720.238.370.816,00	10.720.238.370.816,00	9.070.970.933.522,93
1,89438E-13	58	40	0,00065	549.755.813.888,00	112,00	3.298.534.878.957,07	21.990.232.555.520,00	21.990.232.555.520,00	18.691.697.676.562,90
9,10759E-14	59	41	0,0006095	1.099.511.627.776,00	115,00	6.597.069.762.285,07	45.079.976.738.816,00	45.079.976.738.816,00	38.482.906.976.530,90
4,37865E-14	60	42	0,0005737	2.199.023.255.552,00	118,00	13.194.139.528.941,10	92.358.976.733.184,00	92.358.976.733.184,00	79.164.837.204.242,90
2,10512E-14	61	43	9,217E-05	4.398.046.511.104,00	121,00	26.388.279.062.253,10	189.115.999.977.472,00	189.115.999.977.472,00	162.727.720.915.219,00
1,01208E-14	62	44	0,0001016	8.796.093.022.208,00	124,00	52.776.558.128.877,10	387.028.092.977.152,00	387.028.092.977.152,00	334.251.534.848.275,00
4,86575E-15	63	45	0,000112	17.592.186.044.416,00	127,00	105.553.116.262.125,00	791.648.371.998.720,00	791.648.371.998.720,00	686.095.255.736.595,00
2,3393E-15	64	46	0,0001232	35.184.372.088.832,00	130,00	211.106.232.528.621,00	1.618.481.116.086.270,00	1.618.481.116.086.270,00	1.407.374.883.557.650,00
1,12467E-15	65	47	0,0001354	70.368.744.177.664,00	133,00	422.212.465.061.613,00	3.307.330.976.350.210,00	3.307.330.976.350.210,00	2.885.118.511.288.590,00
5,40704E-16	66	48	0,0001488	140.737.488.355.328,00	136,00	844.424.930.127.597,00	6.755.399.441.055.740,00	6.755.399.441.055.740,00	5.910.974.510.928.150,00
2,59954E-16	67	49	0,000164	281.474.976.710.656,00	139,00	1.688.849.860.259.560,00	13.792.273.858.822.100,00	13.792.273.858.822.100,00	12.103.423.998.562.600,00
1,24978E-16	68	50	0,0001817	562.949.953.421.312,00	142,00	3.377.699.720.523.500,00	28.147.497.671.065.600,00	28.147.497.671.065.600,00	24.769.797.950.542.100,00
6,00855E-17	69	51	0,0002025	1.125.899.906.842.620,00	145,00	6.755.399.441.051.370,00	57.420.895.248.973.800,00	57.420.895.248.973.800,00	50.665.495.807.922.400,00
2,88873E-17	70	52	0,0002271	2.251.799.813.685.250,00	148,00	13.510.798.882.107.100,00	117.093.590.311.633.000,00	117.093.590.311.633.000,00	103.582.791.429.526.000,00
						<b>27.021.597.764.048.100,00</b>	<b>229.683.580.995.895.000,00</b>	<b>229.683.580.995.895.000,00</b>	<b>202.661.983.231.847.000,00</b>

**Example 5 years of service**

2,0800	Age		24			Adjustment 90,00%		Rate Salary		100,00%	
Age X	Service	Prob	Salary X	Fractional guarantee	Guarantee X	Retroactivity X	Max (Gx; Rx)	Benefit= Max - Gx	PBO		
24	5	0,161458	1,00	10,67	9,60	5,00	9,60	-	-		
25	6	0,1284638	2,00	13,00	14,27	12,00	14,27	-	-		
26	7	0,1032202	4,00	15,40	23,87	28,00	28,00	4,13	0,0339		
27	8	0,0837057	8,00	17,87	43,60	64,00	64,00	20,40	0,0570		
28	9	0,0684736	16,00	20,40	84,13	144,00	144,00	59,87	0,0585		
29	10	0,0564728	32,00	23,00	167,33	320,00	320,00	152,67	0,0532		
30	11	0,0469356	64,00	25,67	338,00	704,00	704,00	366,00	0,0464		
31	12	0,0392924	128,00	28,40	687,87	1.536,00	1.536,00	848,13	0,0396		
32	13	0,0331196	256,00	31,20	1.404,67	3.328,00	3.328,00	1.923,33	0,0336		
33	14	0,0280971	512,00	34,07	2.872,40	7.168,00	7.168,00	4.295,60	0,0284		
34	15	0,023982	1.024,00	37,00	5.876,13	15.360,00	15.360,00	9.483,87	0,0240		
35	16	0,020588	2.048,00	40,00	12.020,13	32.768,00	32.768,00	20.747,87	0,0204		
36	17	0,0177687	4.096,00	43,00	24.308,13	69.632,00	69.632,00	45.323,87	0,0174		
37	18	0,0154152	8.192,00	46,00	48.884,13	147.456,00	147.456,00	98.571,87	0,0149		
38	19	0,013439	16.384,00	49,00	98.036,13	311.296,00	311.296,00	213.259,87	0,0128		
39	20	0,0117706	32.768,00	52,00	196.340,13	655.360,00	655.360,00	459.019,87	0,0110		
40	21	0,0103546	65.536,00	55,00	392.948,13	1.376.256,00	1.376.256,00	983.307,87	0,0095		
41	22	0,0091467	131.072,00	58,00	786.164,13	2.883.584,00	2.883.584,00	2.097.419,87	0,0082		
42	23	0,0081121	262.144,00	61,00	1.572.596,13	6.029.312,00	6.029.312,00	4.456.715,87	0,0071		
43	24	0,0072219	524.288,00	64,00	3.145.460,13	12.582.912,00	12.582.912,00	9.437.451,87	0,0062		
44	25	0,0064532	1.048.576,00	67,00	6.291.188,13	26.214.400,00	26.214.400,00	19.923.211,87	0,0054		
45	26	0,005787	2.097.152,00	70,00	12.582.644,13	54.525.952,00	54.525.952,00	41.943.307,87	0,0047		
46	27	0,0052077	4.194.304,00	73,00	25.165.556,13	113.246.208,00	113.246.208,00	88.080.651,87	0,0041		
47	28	0,0047019	8.388.608,00	76,00	50.331.380,13	234.881.024,00	234.881.024,00	184.549.643,87	0,0036		
48	29	0,0042585	16.777.216,00	79,00	100.663.028,13	486.539.264,00	486.539.264,00	385.876.235,87	0,0032		
49	30	0,0038686	33.554.432,00	82,00	201.326.324,13	1.006.632.960,00	1.006.632.960,00	805.306.635,87	0,0028		
50	31	0,0035242	67.108.864,00	85,00	402.652.916,13	2.080.374.784,00	2.080.374.784,00	1.677.721.867,87	0,0025		
51	32	0,0032191	134.217.728,00	88,00	805.306.100,13	4.294.967.296,00	4.294.967.296,00	3.489.661.195,87	0,0022		
52	33	0,0029484	268.435.456,00	91,00	1.610.612.468,13	8.858.370.048,00	8.858.370.048,00	7.247.757.579,87	0,0019		
53	34	0,0027083	536.870.912,00	94,00	3.221.225.204,13	18.253.611.008,00	18.253.611.008,00	15.032.385.803,87	0,0017		
54	35	0,0024954	1.073.741.824,00	97,00	6.442.450.676,13	37.580.963.840,00	37.580.963.840,00	31.138.513.163,87	0,0015		
55	36	0,0023066	2.147.483.648,00	100,00	12.884.901.620,13	77.309.411.328,00	77.309.411.328,00	64.424.509.707,87	0,0014		
56	37	0,0021395	4.294.967.296,00	103,00	25.769.803.508,13	158.913.789.952,00	158.913.789.952,00	133.143.986.443,87	0,0012		
57	38	0,0019915	8.589.934.592,00	106,00	51.539.607.284,13	326.417.514.496,00	326.417.514.496,00	274.877.907.211,87	0,0011		
58	39	0,0018605	17.179.869.184,00	109,00	103.079.214.836,13	670.014.898.176,00	670.014.898.176,00	566.935.683.339,87	0,0010		
59	40	0,0017445	34.359.738.368,00	112,00	206.158.429.940,13	1.374.389.534.720,00	1.374.389.534.720,00	1.168.231.104.779,87	0,0009		
60	41	0,001642	68.719.476.736,00	115,00	412.316.860.148,13	2.817.498.546.176,00	2.817.498.546.176,00	2.405.181.686.027,87	0,0008		
61	42	0,0002638	137.438.953.472,00	118,00	824.633.720.564,13	5.772.436.045.824,00	5.772.436.045.824,00	4.947.802.325.259,87	0,0001		
62	43	0,0002909	274.877.906.944,00	121,00	1.649.267.441.396,13	11.819.749.998.592,00	11.819.749.998.592,00	10.170.482.557.195,90	0,0001		
63	44	0,0003205	549.755.813.888,00	124,00	3.298.534.883.060,13	24.189.255.811.072,00	24.189.255.811.072,00	20.890.720.928.011,90	0,0001		
64	45	0,0003526	1.099.511.627.776,00	127,00	6.597.069.766.388,13	49.478.023.249.920,00	49.478.023.249.920,00	42.880.953.483.531,90	0,0002		
65	46	0,0003877	2.199.023.255.552,00	130,00	13.194.139.533.044,10	101.155.069.755.392,00	101.155.069.755.392,00	87.960.930.222.347,90	0,0002		
66	47	0,0004259	4.398.046.511.104,00	133,00	26.388.279.066.356,10	206.708.186.021.888,00	206.708.186.021.888,00	180.319.906.955.532,00	0,0002		
67	48	0,0004693	8.796.093.022.208,00	136,00	52.776.558.132.980,10	422.212.465.065.984,00	422.212.465.065.984,00	369.435.906.933.004,00	0,0002		
68	49	0,00052	17.592.186.044.416,00	139,00	105.553.116.266.228,00	862.017.116.176.384,00	862.017.116.176.384,00	756.463.999.910.156,00	0,0002		
69	50	0,0005796	35.184.372.088.832,00	142,00	211.106.232.532.724,00	1.759.218.604.441.600,00	1.759.218.604.441.600,00	1.548.112.371.908.880,00	0,0002		
70	51	0,0006501	70.368.744.177.664,00	145,00	422.212.465.065.716,00	3.588.805.953.060.860,00	3.588.805.953.060.860,00	3.166.593.487.995.150,00	0,0002		
					<b>844.424.930.121.559,00</b>	<b>7.036.874.417.766.400,00</b>	<b>7.036.874.417.766.400,00</b>	<b>6.192.449.487.644.850,00</b>	<b>52,38%</b>		

Example 10 years of service

T	V= 2,0800			Age 29			Adjustment 40,00%		Salary Rate	100,00%	(12)PBO	
	(1)Accrual factor	(2)V <sup>n</sup>	(3)Age X	(4) Service	(5)Prob	(6)Salary X	(7)Fractional guarantee	(8)Guarantee X	(9)Retroactivity X	(10)Max (Gx; Rx)		(11)Benefit= Max - Gx
1	1	0,480769231	29	10	0,1242038	1,00	23,00	9,20	10,00	10,00	0,80	0,0478
2	0,909090909	0,231139053	30	11	0,1032282	2,00	25,67	14,53	22,00	22,00	7,47	0,1620
3	0,833333333	0,111124545	31	12	0,0864181	4,00	28,40	25,47	48,00	48,00	22,53	0,1803
4	0,769230769	0,053425262	32	13	0,0728418	8,00	31,20	47,87	104,00	104,00	56,13	0,1680
5	0,714285714	0,025685222	33	14	0,0617956	16,00	34,07	93,73	224,00	224,00	130,27	0,1477
6	0,666666667	0,012348664	34	15	0,052745	32,00	37,00	187,60	480,00	480,00	292,40	0,1270
7	0,625	0,005936858	35	16	0,0452803	64,00	40,00	379,60	1.024,00	1.024,00	644,40	0,1083
8	0,588235294	0,002854259	36	17	0,0390796	128,00	43,00	763,60	2.176,00	2.176,00	1.412,40	0,0927
9	0,555555556	0,00137224	37	18	0,0339034	256,00	46,00	1.531,60	4.608,00	4.608,00	3.076,40	0,0795
10	0,526315789	0,000659731	38	19	0,029557	512,00	49,00	3.067,60	9.728,00	9.728,00	6.660,40	0,0684
11	0,5	0,000317178	39	20	0,0258878	1.024,00	52,00	6.139,60	20.480,00	20.480,00	14.340,40	0,0589
12	0,476190476	0,00015249	40	21	0,0227734	2.048,00	55,00	12.283,60	43.008,00	43.008,00	30.724,40	0,0508
13	0,454545455	7,33123E-05	41	22	0,0201168	4.096,00	58,00	24.571,60	90.112,00	90.112,00	65.540,40	0,0439
14	0,434782609	3,52463E-05	42	23	0,0178413	8.192,00	61,00	49.147,60	188.416,00	188.416,00	139.268,40	0,0381
15	0,416666667	1,69453E-05	43	24	0,0158835	16.384,00	64,00	98.299,60	393.216,00	393.216,00	294.916,40	0,0331
16	0,4	8,14679E-06	44	25	0,0141929	32.768,00	67,00	196.603,60	819.200,00	819.200,00	622.596,40	0,0288
17	0,384615385	3,91673E-06	45	26	0,0127277	65.536,00	70,00	393.211,60	1.703.936,00	1.703.936,00	1.310.724,40	0,0251
18	0,37037037	1,88304E-06	46	27	0,0114536	131.072,00	73,00	786.427,60	3.538.944,00	3.538.944,00	2.752.516,40	0,0220
19	0,357142857	9,05309E-07	47	28	0,0103412	262.144,00	76,00	1.572.859,60	7.340.032,00	7.340.032,00	5.767.172,40	0,0193
20	0,344827586	4,35245E-07	48	29	0,009366	524.288,00	79,00	3.145.723,60	15.204.352,00	15.204.352,00	12.058.628,40	0,0170
21	0,333333333	2,09252E-07	49	30	0,0085085	1.048.576,00	82,00	6.291.451,60	31.457.280,00	31.457.280,00	25.165.828,40	0,0149
22	0,322580645	1,00602E-07	50	31	0,0077509	2.097.152,00	85,00	12.582.907,60	65.011.712,00	65.011.712,00	52.428.804,40	0,0132
23	0,3125	4,83663E-08	51	32	0,0070798	4.194.304,00	88,00	25.165.819,60	134.217.728,00	134.217.728,00	109.051.908,40	0,0117
24	0,303030303	2,32531E-08	52	33	0,0064847	8.388.608,00	91,00	50.331.643,60	276.824.064,00	276.824.064,00	226.492.420,40	0,0103
25	0,294117647	1,11794E-08	53	34	0,0059565	16.777.216,00	94,00	100.663.291,60	570.425.344,00	570.425.344,00	469.762.052,40	0,0092
26	0,285714286	5,37469E-09	54	35	0,0054883	33.554.432,00	97,00	201.326.587,60	1.174.405.120,00	1.174.405.120,00	973.078.532,40	0,0082
27	0,277777778	2,58398E-09	55	36	0,0050731	67.108.864,00	100,00	402.653.179,60	2.415.919.104,00	2.415.919.104,00	2.013.265.924,40	0,0073
28	0,27027027	1,2423E-09	56	37	0,0047055	134.217.728,00	103,00	805.306.363,60	4.966.055.936,00	4.966.055.936,00	4.160.749.572,40	0,0066
29	0,263157895	5,9726E-10	57	38	0,00438	268.435.456,00	106,00	1.610.612.731,60	10.200.547.328,00	10.200.547.328,00	8.589.934.596,40	0,0059
30	0,256410256	2,87144E-10	58	39	0,0040918	536.870.912,00	109,00	3.221.225.467,60	20.937.965.568,00	20.937.965.568,00	17.716.740.100,40	0,0053
31	0,25	1,3805E-10	59	40	0,0038368	1.073.741.824,00	112,00	6.442.450.939,60	42.949.672.960,00	42.949.672.960,00	36.507.222.020,40	0,0048
32	0,243902439	6,63702E-11	60	41	0,0036114	2.147.483.648,00	115,00	12.884.901.883,60	88.046.829.568,00	88.046.829.568,00	75.161.927.684,40	0,0044
33	0,238095238	3,19088E-11	61	42	0,0005802	4.294.967.296,00	118,00	25.769.803.771,60	180.388.626.432,00	180.388.626.432,00	154.618.822.660,40	0,0007
34	0,23255814	1,53408E-11	62	43	0,0006399	8.589.934.592,00	121,00	51.539.607.547,60	369.367.187.456,00	369.367.187.456,00	317.827.579.908,40	0,0007
35	0,227272727	7,37536E-12	63	44	0,0007048	17.179.869.184,00	124,00	103.079.215.099,60	755.914.244.096,00	755.914.244.096,00	652.835.028.996,40	0,0008
36	0,222222222	3,54585E-12	64	45	0,0007756	34.359.738.368,00	127,00	206.158.430.203,60	1.546.188.226.560,00	1.546.188.226.560,00	1.340.029.796.356,40	0,0008
37	0,217391304	1,70473E-12	65	46	0,0008526	68.719.476.736,00	130,00	412.316.860.411,60	3.161.095.929.856,00	3.161.095.929.856,00	2.748.779.069.444,40	0,0009
38	0,212765957	8,19584E-13	66	47	0,0009368	137.438.953.472,00	133,00	824.633.720.827,60	6.459.630.813.184,00	6.459.630.813.184,00	5.634.997.092.356,40	0,0009
39	0,208333333	3,94031E-13	67	48	0,0010322	274.877.906.944,00	136,00	1.649.267.441.659,60	13.194.139.533.312,00	13.194.139.533.312,00	11.544.872.091.652,40	0,0010
40	0,204081633	1,89438E-13	68	49	0,0011436	549.755.813.888,00	139,00	3.298.534.883.323,60	26.938.034.880.512,00	26.938.034.880.512,00	23.639.499.997.188,40	0,0010
41	0,2	9,10759E-14	69	50	0,0012748	1.099.511.627.776,00	142,00	6.597.069.766.651,60	54.975.581.388.800,00	54.975.581.388.800,00	48.378.511.622.148,40	0,0011
42	0,196078431	4,37865E-14	70	51	0,0014299	2.199.023.255.552,00	145,00	13.194.139.533.307,60	112.150.186.033.152,00	112.150.186.033.152,00	98.956.046.499.844,40	0,0012
								<b>26.388.279.066.460,00</b>	<b>219.902.325.555.192,00</b>	<b>219.902.325.555.192,00</b>	<b>193.514.046.488.732,00</b>	<b>1,63</b>

**Example 20 years of service**

2,0800	Age			Adjustment 90,00%			Tasa SAL	100,00%	
Age X	Service	Prob	Salary X	Fractional guarantee	Guarantee X	Retroactivity X	Max (Gx; Rx)	Benefit= Max - Gx	PBO
39	20	0,0737654	1,00	52,00	46,80	20,00	46,80	-	-
40	21	0,0648913	2,00	55,00	52,80	42,00	52,80	-	-
41	22	0,0573214	4,00	58,00	64,80	88,00	88,00	23,20	0,1343
42	23	0,0508377	8,00	61,00	88,80	184,00	184,00	95,20	0,2248
43	24	0,0452588	16,00	64,00	136,80	384,00	384,00	247,20	0,2395
44	25	0,0404418	32,00	67,00	232,80	800,00	800,00	567,20	0,2266
45	26	0,0362668	64,00	70,00	424,80	1.664,00	1.664,00	1.239,20	0,2052
46	27	0,0326363	128,00	73,00	808,80	3.456,00	3.456,00	2.647,20	0,1827
47	28	0,0294667	256,00	76,00	1.576,80	7.168,00	7.168,00	5.591,20	0,1615
48	29	0,0266879	512,00	79,00	3.112,80	14.848,00	14.848,00	11.735,20	0,1425
49	30	0,0242444	1.024,00	82,00	6.184,80	30.720,00	30.720,00	24.535,20	0,1258
50	31	0,0220857	2.048,00	85,00	12.328,80	63.488,00	63.488,00	51.159,20	0,1112
51	32	0,0201735	4.096,00	88,00	24.616,80	131.072,00	131.072,00	106.455,20	0,0984
52	33	0,0184776	8.192,00	91,00	49.192,80	270.336,00	270.336,00	221.143,20	0,0873
53	34	0,0169727	16.384,00	94,00	98.344,80	557.056,00	557.056,00	458.711,20	0,0776
54	35	0,0156384	32.768,00	97,00	196.648,80	1.146.880,00	1.146.880,00	950.231,20	0,0692
55	36	0,0144556	65.536,00	100,00	393.256,80	2.359.296,00	2.359.296,00	1.966.039,20	0,0618
56	37	0,0134081	131.072,00	103,00	786.472,80	4.849.664,00	4.849.664,00	4.063.191,20	0,0555
57	38	0,0124806	262.144,00	106,00	1.572.904,80	9.961.472,00	9.961.472,00	8.388.567,20	0,0499
58	39	0,0116594	524.288,00	109,00	3.145.768,80	20.447.232,00	20.447.232,00	17.301.463,20	0,0450
59	40	0,0109327	1.048.576,00	112,00	6.291.496,80	41.943.040,00	41.943.040,00	35.651.543,20	0,0408
60	41	0,0102905	2.097.152,00	115,00	12.582.952,80	85.983.232,00	85.983.232,00	73.400.279,20	0,0371
61	42	0,0016533	4.194.304,00	118,00	25.165.864,80	176.160.768,00	176.160.768,00	150.994.903,20	0,0057
62	43	0,0018233	8.388.608,00	121,00	50.331.688,80	360.710.144,00	360.710.144,00	310.378.455,20	0,0061
63	44	0,0020084	16.777.216,00	124,00	100.663.336,80	738.197.504,00	738.197.504,00	637.534.167,20	0,0065
64	45	0,00221	33.554.432,00	127,00	201.326.632,80	1.509.949.440,00	1.509.949.440,00	1.308.622.807,20	0,0069
65	46	0,0024294	67.108.864,00	130,00	402.653.224,80	3.087.007.744,00	3.087.007.744,00	2.684.354.519,20	0,0073
66	47	0,0026694	134.217.728,00	133,00	805.306.408,80	6.308.233.216,00	6.308.233.216,00	5.502.926.807,20	0,0078
67	48	0,0029412	268.435.456,00	136,00	1.610.612.776,80	12.884.901.888,00	12.884.901.888,00	11.274.289.111,20	0,0083
68	49	0,0032586	536.870.912,00	139,00	3.221.225.512,80	26.306.674.688,00	26.306.674.688,00	23.085.449.175,20	0,0088
69	50	0,0036325	1.073.741.824,00	142,00	6.442.450.984,80	53.687.091.200,00	53.687.091.200,00	47.244.640.215,20	0,0095
70	51	0,0040744	2.147.483.648,00	145,00	12.884.901.928,80	109.521.666.048,00	109.521.666.048,00	96.636.764.119,20	0,0102
					<b>25.769.805.075,60</b>	<b>214.748.364.782,00</b>	<b>214.748.364.819,60</b>	<b>188.978.559.744,00</b>	<b>2,45</b>