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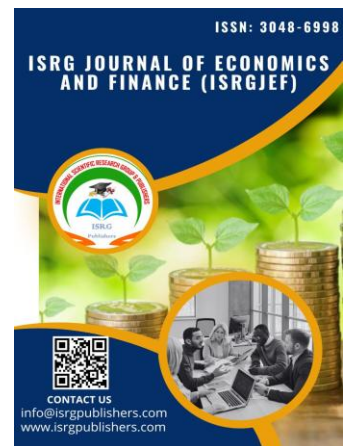
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A Multi-Measure PBO Framework for Venezuelan Social Benefits under IAS 19

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Abstract

The actuarial valuation of Venezuelan social benefits should not be reduced to one severance liability. The legal rule requires a comparison between a guarantee benefit and a retroactive benefit. Under IAS 19, this legal rule must be converted into a projected, probability-weighted, and discounted defined benefit obligation. This article presents a multi-measure Projected Benefit Obligation (PBO) framework for Venezuelan social benefits. It defines the PBO of the guarantee, the PBO of the retroactive benefit, the PBO of the maximum benefit, the positive differential PBO, and the informational difference between retroactivity and guarantee. Each measure has a different meaning and a different use. The article defines the variables, gives the main equations, presents comparative tables and figures, and proposes validation controls for actuarial reporting and model governance.

Keywords: Venezuelan social benefits; IAS 19; Projected Benefit Obligation; Projected Unit Credit; guarantee; retroactivity; maximum benefit; actuarial valuation; severance benefits.

JEL codes: J32; M41; C63; G22.

1. Introduction

Venezuelan social benefits have a special actuarial structure. The liability is not only a simple final salary severance benefit. It is also not only an accumulated guarantee. The benefit paid at the end of employment is based on a comparison between two measures. One measure is the guarantee benefit. The other measure is the retroactive benefit. The employee receives the greater amount.

For this reason, a complete actuarial valuation should not report only one PBO number. It should report several PBO measures. Each one explains a different part of the obligation.

The objective of this article is to give a clear framework for these measures. The article uses direct English. It avoids unnecessary idiomatic expressions. The purpose is to support communication with management, auditors, actuaries, finance teams, and academic readers.

2. Accounting and Legal Context

IAS 19 requires an entity to estimate the cost of defined benefits using an actuarial method. The projected unit credit method is the

central measurement method for defined benefit obligations under IAS 19 [1, 2]. The method projects the benefit, attributes it to service, weights it by probability, and discounts it to the valuation date.

The Venezuelan labor benefit structure contains a guarantee mechanism and a retroactive calculation. Article 142 of the Venezuelan labor law states the comparison principle: the employee receives the greater amount between the guarantee and the retroactive calculation [3, 4]. This legal comparison is the reason why the actuarial model must calculate more than one PBO.

3. Notation and Main Variables

Let employee i be observed at valuation date 0. Let t be the projection year. The projection runs from the current age until the terminal age, usually 70.

Table 1. Main variables used in the model

Symbol	Definition
i	Employee index.
t	Projection year from the valuation date.
x_i	Current age of employee i .
$x_{i,t} = x_i + t$	Projected age of employee i at year t .
T_i	Last projection year for employee i , normally until age 70.
$S_{i,0}$	Current monthly salary of employee i .
$S_{i,t}$	Projected monthly salary at year t .
g	Global salary growth rate. The reference model uses one global rate for all employees.
r	Discount rate.
v_t	Discount factor at year t .
$s_{i,0}$	Current service of employee i , measured in years.
$s_{i,t} = s_{i,0} + t$	Projected service at year t .
$G_{i,t}$	Projected guarantee benefit before attribution.
$R_{i,t}$	Projected retroactive benefit before attribution.
$G_{i,t}^*$	Attributed or accrued guarantee benefit under the projected unit credit method.
$R_{i,t}^*$	Attributed or accrued retroactive benefit under the projected unit credit method.
$M_{i,t}$	Maximum attributed benefit between guarantee and retroactivity.
$q_{i,t}^{\text{mort}}$	Mortality probability at year t .
$q_{i,t}^{\text{rot}}$	Turnover probability at year t .
$q_{i,t}^{\text{ant}}$	Early exit or anticipated exit probability at year t .
$q_{i,t}^{\text{term}}$	Terminal exit probability, equal to 1 at

Symbol	Definition
	terminal age.
$q_{i,t}^{\text{total}}$	Total exit probability at year t .
$\ell_{i,t}$	Probability of survival to the beginning of year t .
$p_{i,t}^{\text{exit}}$	Probability of exit during year t .
$PBO_{G,i}$	PBO of the guarantee for employee i .
$PBO_{R,i}$	PBO of the retroactive benefit for employee i .
$PBO_{\text{MAX},i}$	PBO of the maximum benefit for employee i .
Δ_i^+	Positive differential PBO for employee i .

4. Salary Projection

The projected salary is calculated with the global salary growth rate:

$$S_{i,t} = S_{i,0}(1 + g)^t. \quad (1)$$

The reference implementation uses one global value of g . This is important for model control. A separate personal salary growth rate can create confusion if it overrides the global assumption. For a clean valuation process, the global salary growth rate should be the only salary growth assumption unless the report clearly states another rule.

5. Benefit Formulas

5.1. Guarantee benefit

The projected guarantee benefit is based on the guarantee days accumulated under the labor rule. Let $D_{i,t}^G$ be the guarantee days expressed in salary-day units. A general form is:

$$G_{i,t} = \frac{S_{i,t}}{30} D_{i,t}^G. \quad (2)$$

The exact construction of $D_{i,t}^G$ depends on the statutory guarantee rule, the initial days, additional days, and applicable limits. The model stores this construction in the annual projection detail.

5.2. Retroactive benefit

The projected retroactive benefit is linked to final salary and service. A simple representation is:

$$R_{i,t} = \frac{S_{i,t}}{12} \min(s_{i,t}, L_R). \quad (3)$$

where L_R is the retroactivity service limit used by the model. The limit must be tested with employees whose projected service is high enough to make the limit active. Otherwise, a validation test can fail because the selected employee is not sensitive to the limit.

6. Projected Unit Credit Attribution

Under the projected unit credit idea, the projected benefit is attributed to service. The attribution factor must be between 0 and 1.

$$A_{i,t}^G = \min\left(1, \frac{S_{i,0}}{\max(s_{i,t}, \varepsilon)}\right). \quad (4)$$

$$A_{i,t}^R = \min\left(1, \frac{\min(s_{i,0}, L_R)}{\max(\min(s_{i,t}, L_R), \varepsilon)}\right). \quad (5)$$

where ε is a small positive denominator control. In implementation, if the denominator is zero, the factor is set to zero. This avoids division by zero and avoids a silent NaN result.

The attributed benefits are:

$$G_{i,t}^* = G_{i,t} A_{i,t}^G. \quad (6)$$

$$R_{i,t}^* = R_{i,t} A_{i,t}^R. \quad (7)$$

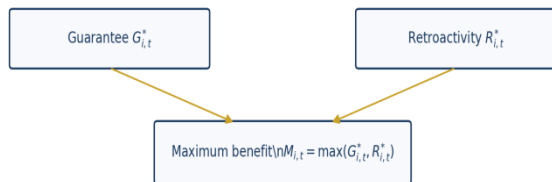
7. The Maximum Benefit Rule

The payable benefit in each projection year is the maximum of the attributed guarantee and retroactive benefits:

$$M_{i,t} = \max(G_{i,t}^*, R_{i,t}^*). \quad (8)$$

This formula is the central point of the framework. The maximum benefit is not equal to the guarantee and it is not equal to the retroactive benefit. It is the greater of both, measured at each projected exit point.

Figure 1. The benefit paid is based on the greater of guarantee and retroactivity.



8. Exit Probabilities and Survival

The model uses several exit sources. The total exit probability is:

$$q_{i,t}^{\text{total}} = \min(1, q_{i,t}^{\text{mort}} + q_{i,t}^{\text{rot}} + q_{i,t}^{\text{ant}} + q_{i,t}^{\text{term}}). \quad (9)$$

At terminal age, the model must force exit:

$$q_{i,t}^{\text{term}} = 1 \quad \text{if } x_{i,t} = 70. \quad (10)$$

Survival to the beginning of year t is:

$$\ell_{i,0} = 1. \quad (11)$$

$$\ell_{i,t} = \prod_{j=0}^{t-1} (1 - q_{i,j}^{\text{total}}), \quad t \geq 1. \quad (12)$$

The probability of exit during year t is:

$$p_{i,t}^{\text{exit}} = \ell_{i,t} q_{i,t}^{\text{total}}. \quad (13)$$

A complete projection should not leave residual survival after terminal age. This is a key validation control.

9. Discounting

The discount factor is:

$$v_t = \frac{1}{(1+r)^t}. \quad (14)$$

If all other assumptions remain unchanged, a higher discount rate should not increase the PBO. This is a basic monotonicity control.

10. Main PBO Measures

10.1. PBO of the guarantee

$$PBO_{G,i} = \sum_{t=0}^{T_i} G_{i,t}^* p_{i,t}^{\text{exit}} v_t. \quad (15)$$

This measure answers the question: what is the present value of the

guarantee component?

10.2. PBO of the retroactive benefit

$$PBO_{R,i} = \sum_{t=0}^{T_i} R_{i,t}^* p_{i,t}^{\text{exit}} v_t. \quad (16)$$

This measure answers the question: what is the present value of the retroactive component?

10.3. PBO of the maximum benefit

$$PBO_{MAX,i} = \sum_{t=0}^{T_i} M_{i,t} p_{i,t}^{\text{exit}} v_t. \quad (17)$$

This is the central liability measure because it values the benefit that is expected to be paid under the maximum rule.

10.4. Positive differential PBO

$$\Delta_i^+ = PBO_{MAX,i} - PBO_{G,i}. \quad (18)$$

This measure is zero or positive. It answers the question: what is the additional value created by the maximum rule compared with the guarantee alone?

10.5. Informational difference

The annual informational difference is:

$$D_{i,t} = R_{i,t}^* - G_{i,t}^*. \quad (19)$$

This value can be negative. It is not a PBO. It is a diagnostic indicator.

11. Interpretation of the PBO Measures

Table 2. Interpretation of the main PBO measures

Measure	Meaning	Use
PBO_G	Present value of the guarantee benefit.	Baseline statutory component.
PBO_R	Present value of the retroactive benefit.	Final salary and service exposure.
PBO_{MAX}	Present value of the greater of guarantee and retroactivity.	Main expected payable obligation.
$PBO_{MAX} - PBO_G$	Incremental value over the guarantee.	Measures the extra liability created by the maximum rule.
$R^* - G^*$	Annual informational difference.	Diagnostic only. It may be negative.

12. PBO Non-Negativity

A PBO is a liability measure. It should not be negative. Therefore:

$$PBO_{G,i} \geq 0, \quad PBO_{R,i} \geq 0, \quad PBO_{MAX,i} \geq 0. \quad (20)$$

If the informational difference $R^* - G^*$ is negative, it should not be used as a negative liability. The correct approach is to keep the negative value as information, but not as a negative PBO.

13. Employee, Company, and Total Consolidation

The employee-level results are consolidated by company and then by total portfolio.

$$PBO_{MAX,c} = \sum_{i \in c} PBO_{MAX,i}. \quad (21)$$

$$PBO_{MAX}^{Total} = \sum_c PBO_{MAX,c} = \sum_i PBO_{MAX,i}. \quad (22)$$

The same aggregation logic applies to PBO_G , PBO_R , and Δ^+ . The total must be the sum of the detail. It should not be recalculated by a shortcut.

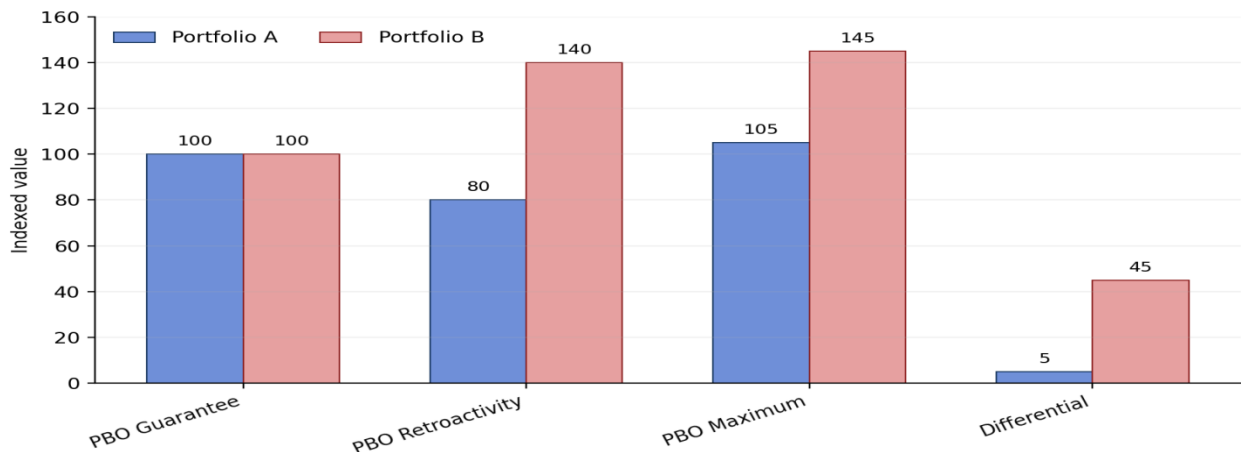
14. Comparative Pedagogical Example

Table 3 gives an indexed example. The numbers are not a company valuation. They are used only to explain the meaning of the measures.

Table 3. Indexed example of the multi-measure PBO structure

Measure	Portfolio A	Portfolio B	Interpretation
PBO_G	100	100	Same guarantee base.
PBO_R	80	140	Retroactivity differs.
PBO_{MAX}	105	145	Maximum benefit differs.
$PBO_{MAX} - PBO_G$	5	45	Incremental exposure differs.

Figure 2. The same guarantee PBO can hide very different maximum-benefit exposure.



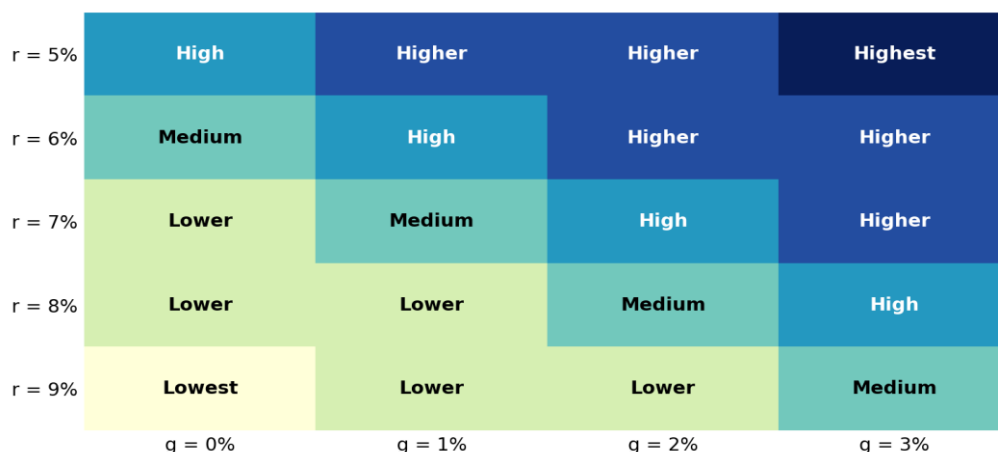
15. Sensitivity Analysis

The model should test the main assumptions. A change in an assumption should be reflected in the results when the selected employee or portfolio is sensitive to that assumption.

Table 4. Expected direction of key sensitivities

Assumption change	Expected direction	Reason
Higher discount rate r	Lower PBO, all else equal.	Future benefits are discounted more strongly.
Higher salary growth g	Higher salary-linked PBO.	Future salaries and benefits increase.
Higher early exit probability	Ambiguous.	Earlier payment increases present value, but may reduce future service and salary growth.
Higher terminal age	Usually higher PBO.	More service and salary projection may occur.
Lower retroactivity limit	Lower retroactivity exposure.	The retroactive benefit is capped earlier.

Figure 3. Conceptual heat map: salary growth raises the PBO; discounting reduces it.



16. Early Exit Switches

The reference model allows an early exit assumption over different age ranges. Two common ranges are:

- 60 to 69 years; and
- 50 to 69 years.

The early exit rate can be defined by an initial rate and an annual increase. A simple representation is:

$$q_{i,t}^{\text{ant}} = q_0^{\text{ant}} + k_{i,t} d^{\text{ant}}. \quad (23)$$

where q_0^{ant} is the initial early exit rate, d^{ant} is the annual increase, and $k_{i,t}$ is the number of years since the employee entered the selected early-exit age band.

This assumption can have an ambiguous effect on the PBO. It can bring payments closer to the valuation date, but it can also reduce future salary growth and service accumulation. This is why early-exit sensitivity must be shown in separate matrices.

17. Validation Controls

A professional implementation should include at least the controls listed in Table 5.

Table 5. Minimum controls for the HTML implementation

Control	Expected result
PBO non-negativity	No PBO measure should be negative.
No NaN	Undefined numerical results should not appear.
No Infinity	No uncontrolled division by zero should occur.
Terminal survival	Survival should close at terminal age.
Terminal exit	The terminal exit probability should be 1 at age 70.
Detail-to-total reconciliation	Company and total results should equal the sum of employee detail.
Discount monotonicity	If only the discount rate increases, the PBO should not increase.
Salary growth reactivity	If salary growth increases, salary-linked benefits should react.
Assumption zero control	A zero assumption should be accepted as zero, not replaced by a default.
Dashboard reactivity	Changes in dashboard assumptions should update results.
Excel reproducibility	Same data and same assumptions should generate the same results.

18. Recommended Reporting Format

A report should present the PBO family in a clear order. A good sequence is:

1. Total PBO of the maximum benefit.
2. PBO of the guarantee.
3. PBO of the retroactive benefit.
4. Difference between the maximum PBO and the guarantee PBO.
5. Company-level results.
6. Employee-level detail.
7. Sensitivity matrices.
8. Validation controls.

This sequence helps management understand both the liability and its drivers.

19. Scientific Contribution

The main contribution of this framework is the separation of the Venezuelan social benefit obligation into actuarial layers. The layers are:

1. the guarantee layer;
2. the retroactivity layer;
3. the maximum-benefit layer;
4. the positive differential layer;
5. the diagnostic difference layer.

This separation prevents three common errors:

1. treating the guarantee PBO as the full obligation;
2. treating the retroactive PBO as the full obligation;
3. treating a negative informational difference as a negative liability.

The framework also improves audit communication because each measure has a defined formula and a defined purpose.

20. Conclusion

The actuarial valuation of Venezuelan social benefits requires more than one PBO measure. The guarantee, the retroactive benefit, and the maximum benefit are different objects. They should be calculated separately and reconciled clearly.

The most important liability measure is the PBO of the maximum benefit. The most useful management comparison is often the difference between the PBO of the maximum benefit and the PBO of the guarantee. This difference measures the extra exposure created by the maximum rule.

A strong model should also show the annual projection detail, the exit probabilities, the survival probabilities, the discount factors, the expected benefit payments, and the company-level consolidation. It should include sensitivity tests and validation controls. In this way, the valuation becomes clear, reproducible, and suitable for professional review.

A. Formula Checklist

Item	Formula
Salary projection	$S_{i,t} = S_{i,0}(1 + g)^t$
Guarantee benefit	$G_{i,t} = \frac{S_{i,t}}{30} D_{i,t}^G$
Retroactive benefit	$R_{i,t} = \frac{S_{i,t}}{12} \min(s_{i,t}, L_R)$
Attributed guarantee	$G_{i,t}^* = G_{i,t} A_{i,t}^G$
Attributed retroactivity	$R_{i,t}^* = R_{i,t} A_{i,t}^R$
Maximum benefit	$M_{i,t} = \max(G_{i,t}^*, R_{i,t}^*)$
Total exit probability	$q_{i,t}^{\text{total}} = \min(1, q_{i,t}^{\text{mort}} + q_{i,t}^{\text{rot}} + q_{i,t}^{\text{ant}} + q_{i,t}^{\text{term}})$
Survival	$\ell_{i,t} = \prod_{j=0}^{t-1} (1 - q_{i,j}^{\text{total}})$
Exit probability	$p_{i,t}^{\text{exit}} = \ell_{i,t} q_{i,t}^{\text{total}}$
Discount factor	$v_t = (1 + r)^{-t}$
PBO guarantee	$PBO_{G,i} = \sum_t G_{i,t}^* p_{i,t}^{\text{exit}} v_t$
PBO retroactivity	$PBO_{R,i} = \sum_t R_{i,t}^* p_{i,t}^{\text{exit}} v_t$
PBO maximum	$PBO_{MAX,i} = \sum_t M_{i,t} p_{i,t}^{\text{exit}} v_t$
Positive differential	$\Delta_i^+ = PBO_{MAX,i} - PBO_{G,i}$

B. Practical Reading of the Dashboard

The dashboard should be read as follows:

- If PBO_{MAX} is close to PBO_G , the guarantee explains most of the liability.
- If $PBO_{MAX} - PBO_G$ is high, retroactivity or the maximum rule creates a material additional exposure.
- If PBO_R is lower than PBO_G , this does not create a negative liability. It only means that the guarantee dominates for that part of the projection.
- If a higher discount rate increases the PBO while all other assumptions are fixed, the model should be reviewed.
- If a zero salary growth assumption is entered, the model must keep it as zero.

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