LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

MASTER IN ACTUARIAL SCIENCE

MASTERS FINAL WORK

DISSERTATION

THE LIABILITIES OF A POST-RETIREMENT BRAZILIAN HEALTH PLAN ACCORDING TO IAS 19R

FLAVIO POLESE

OCTOBER – 2015

LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

MASTER IN ACTUARIAL SCIENCE

MASTERS FINAL WORK

DISSERTATION

THE LIABILITIES OF A POST-RETIREMENT BRAZILIAN HEALTH PLAN ACCORDING TO IAS 19R

FLAVIO POLESE

SUPERVISOR: ONOFRE ALVES SIMÕES

OCTOBER – 2015

ABSTRACT

The aim of this dissertation is to discuss the evaluation process of post-employment liabilities in private health plans sponsored by employers. Liabilities are obviously linked to expenses but in the case of health plans these expenses continue for long periods of time, raising a number of complex problems, namely problems of an accounting nature, essential from the point of view of the determination of the profit/loss of the sponsors, year after year, with consequences on tax payments, profit sharing, and the value of the firms.

The role of accounting is sometimes lessened, but this is in fact a matter of critical prominence for the survival of organizations, and to apply the appropriate accounting standard rules, national and international, to guarantee that the company's balance sheet complies with these rules, is of utmost importance.

KEYWORDS: Health Plans, Health Benefits, Post-employment, IFRS, IAS, Brazil.

RESUMO

O objetivo desta dissertação é discutir o processo de avaliação de passivos pós-emprego de planos privados de assistência médica patrocinados por empresas. Passivos são obviamente ligados à despesas, mas no caso de planos de assistência médica para aposentados essas despesas continuam por longos períodos de tempo trazendo uma série de problemas complexos, nomeadamente de natureza contábil, e essenciais do ponto de vista da mensuração dos ganhos/perdas dos patrocinadores, ano após ano, com consequências no pagamento de impostos, distribuição de lucros, e no valor propriamente dito das corporações.

O papel da contabilidade é às vezes subestimado, mas esta é de fato uma matéria de proeminência crítica para a sobrevivência das organizações, e aplicar as regras contábeis apropriadas, nacionais e internacionais, para garantir que o balanço contábil da empresa contempla essas regras, é de suma importância.

PALAVRAS-CHAVE: Planos de Saúde, Benefícios de Saúde, Aposentadoria, IFRS, IAS, Brasil.

LIST OF ACRONYMS AND ABBREVIATIONS

Aa – Average Age

AF – Aging Factor

Ai – Age of life i

ANS – Agência Nacional de Saúde Suplementar (National Agency for Supplementary Health Care)

BAC – Brazilian Agribusiness Corporation

BRL – Brazilian currency (Real)

B(r) – "Net" benefit at retirement

C – Average Cost at the Average Age Aa

CPC – Comitê de Pronunciamentos Contábeis (Brazilian entity equivalent to the IASB)

Ct – Total Annual Cost of the Policy

CVM – Comissão de Valores Mobiliários

C(r) – Individual Cost at Retirement

C% – Share of the premium paid by the employee through contributions

e – Number of employees

EPV – Expected Present Value

EPVFB – Expected Present Value of Future Benefits

HCCTR – Health Care Cost Trend Rate

HDI – Human Development Index

i – Interest rate

IASB – International Accounting Standards Board

IAS 19R – International Accounting Standard 19 – Employee benefits (amended 2011)

IFRS – International Financial Report Standards

n – Number of lives covered by the health plan policy (includes employee's dependents)

nc_z – Number of years of coverage of employee z

P – Policy premium per life

PBO – Projected Benefit Obligation

PBO_z – Projected Benefit Obligation of employee z

PS – Past Service

PS_z – Past Service of employee z

Pt – Total annual premium of the policy

PUC – Projected Unit Credit method

PUC Normal Cost$_z$ – PUC annual normal cost of employee z

PVFB – Present Value of Future Benefits

PVFB$_z$ – Present Value of Future Benefits of employee z

PVFEC – Present Value of Future Employee Contributions

P(r) – Individual premium to be paid by the retiree at retirement age

r – Retirement Age

SUS – Sistema Único de Saúde (Brazilian public health system)

TR – Take up Rate

TS – Total Service

UNDP – United Nations Development Programme

x – Age at valuation date

x_z – Age of employee z at valuation date

INDEX

1. INTRODUCTION **1**

1.1. THE BRAZILIAN AGRIBUSINESS CORPORATION HEALTH PLAN *1*

1.2. THE INTERNATIONAL ACCOUNTING AND FINANCIAL REPORTING STANDARDS *2*

1.2.1. THE INTERNATIONAL ACCOUNTING STANDARD 19R *4*

1.3. OUTLINE OF THE TEXT *5*

2. UNDERSTANDING THE BRAZILIAN HEALTH SYSTEM **7**

2.1. THE PUBLIC HEALTH SYSTEM – O SISTEMA ÚNICO DE SAÚDE *7*

2.2. THE PRIVATE MEDICAL CARE SYSTEM *11*

2.3. CORPORATE HEALTH PLANS *12*

3. BAC'S HEALTH PLAN: DESIGN AND POPULATION **14**

4. EVALUATION METHODOLOGY **17**

4.1. ACTUARIAL METHOD AND ASSUMPTIONS *17*

4.1.1. THE PROJECTED UNIT CREDIT FINANCING METHOD *18*

4.1.2. ASSUMPTIONS *21*

4.1.2.1. INTEREST RATE 22

4.1.2.2. MORTALITY TABLE 23

4.1.2.3. TURNOVER MODEL 23

4.1.2.4. HEALTH CARE COST TREND RATE 24

4.1.2.5. AGING FACTOR 25

4.1.2.6. TAKE UP RATE 26

4.2. EVALUATION METHODOLOGY *27*

4.3. RESULTS AND ACCOUNTING INSIGHTS *34*

5. CONCLUSIONS **41**

REFERENCES **44**

ANNEXES **48**

ANNEX I. IAS 19R: EMPLOYEE BENEFITS CLASSIFICATION *48*

ANNEX II. INTEREST RATE BOND INFORMATION: TESOURO IPCA *49*

ANNEX III. HEALTH PLAN DATA OF SELECTED COUNTRIES. *50*

ANNEX IV. ANNUITY 2000 BASIC TABLE *51*

1. INTRODUCTION

The aim of this dissertation is to discuss the evaluation process of post-employment liabilities in private health plans sponsored by employers. Liabilities are obviously linked to expenses but in the case of health plans these expenses continue for long periods of time, raising a number of complex problems, namely problems of an accounting nature, essential from the point of view of the determination of the profit/loss of the sponsors, year after year, with consequences on tax payments, profit sharing, and the value of the firms.

The role of accounting is sometimes lessened, but this is in fact a matter of critical prominence for the survival of organizations, and to apply the appropriate accounting standard rules, national and international, to guarantee that the company's balance sheet complies with these rules, is of utmost importance.

1.1. THE BRAZILIAN AGRIBUSINESS CORPORATION HEALTH PLAN

To help the discussion of the topic in question, the case of the Brazilian Agribusiness Corporation (BAC), a publicly traded company based in São Paulo and listed in the Brazilian stock market exchange, will now be introduced.

BAC is one of the largest and most competitive companies in Brazil, and in order to maintain its competitiveness one of the priorities is to attract and retain the best employees. According to the decision makers in the company, one way to accomplish

this goal is to offer an appealing benefits package which includes, among other benefits, an employment health plan to the employees (already existing) and a post-retirement health plan (to be implemented). The decision makers would like the post-retirement health plan to assure that when an employee retires he/she is granted the same health coverage as while being an active employee and without having to incur in any cost.

This is a very generous plan the company is considering, more even because BAC's main competitors offer similar benefit packages but instead of providing a post-retirement health plan with no cost to retirees, they define that upon retirement the employee (now retiree) can remain in the corporate health plan policy as long as he/she pays for the premiums.

As BAC and the competitors are publicly traded companies, investors and other interested parties want to analyse and compare their financial results and profitability and, in particular, it is necessary to assess the full extent of the costs resulting from the medical care post-retirement benefit in BAC's accounting and financial statements.

1.2. THE INTERNATIONAL ACCOUNTING AND FINANCIAL REPORTING STANDARDS

The International Accounting Standards Board (IASB[1]) is an independent, private-sector body that develops and approves International Financial Reporting Standards (IFRS). The IASB operates under the oversight of the IFRS Foundation.

[1] see http://www.ifrs.org/Pages/default.aspx

According to the IASB, accurate and correct accounting provides investors, regulators and others with a standardised way to describe the financial performance of a company. The International Financial Reporting Standards (2015) is a set of accounting standards developed and maintained by the IASB to be applied on a globally consistent basis providing investors and other users with the ability to compare the financial performance of publicly listed companies on a like-for-like basis with their international peers.

The IFRS are adopted in more than 90 countries, including European Union and Brazil, promoting transparency. Companies listed on a public stock exchange market wherein the Standards are implemented are legally required to publish financial statement in accordance with them. In the specific case of Brazil the Art. 3 of Law 11.638[2] makes IFRS more comprehensive since it determines that every company which registered in the previous exercise a total asset greater than BRL 240 million or a gross revenue above BRL 300 million also needs to comply with IFRS regardless the fact it is listed or not in the local stock exchange market.

After Brazil and the European Union have adopted IFRS, the accounting approach for all companies must be the same, including disclosure of how a post-retirement medical care plan can affect company results.

[2] (2007, see http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/lei/l11638.htm)

1.2.1. The International Accounting Standard 19R

Inside IFRS universe of standards, the IAS 19R *Employee Benefits* (see Annex I, and [3]) is of great relevance in the context of this work, it outlines the accounting requirements for employee benefits, including short-term benefits, like wages and salaries, leave, etc., and post-employment benefits such as retirement benefits and other long-term benefits, including the post-retirement medical care.

The objective of IAS 19R is to prescribe the accounting and disclosure procedures for employee benefits requiring an entity to recognise: a) a liability when an employee has provided service in exchange for employee benefits to be paid in the future; and b) an expense when the entity consumes the economic benefit arising from service provided by an employee in exchange for employee benefits. Therefore, assuming the Shareholder's Equity is the difference between assets and liabilities, a post-employment benefit liability diminishes the Equity and consequently affects the company results and/or its value.

The fact is that, depending on the size and on its development along time, a post-employment health plan liability can be very harmful to corporate results, emphasising the need to carefully analyse the implementation and maintenance of such benefits. On the other hand, the company is expected to find ways so that it can provide a sustainable

[3] (http://www.actuaries.org/CTTEES_IASSC/Documents/Zagreb_IAS19_4_FinalIAS19.pdf)

and effective post-retirement health plan benefit to its employees without causing serious damages to its own health.

IAS 19R warns about the complexity in measuring the obligation and the expense of a Defined Benefit Plan requiring the adoption of a series of actuarial assumptions and methods. Likewise to what happens with pension plans, and following paragraph 30 of IAS 19R, a Defined Benefit Plan is a plan where the entity is obliged to provide the agreed benefits to current and/or former employees. The existence of such granted benefits implies that actuarial risk and investment risk fall, in substance, on the entity.
Therefore, an obligation needs to be measured.

At this point it is clear that the post-retirement health plan BAC wishes to offer to its employees has Defined Benefit characteristics, but what about the post-employment health plans of its main competitors? Is it possible to affirm that since their retirees pay the health plan premium there is no liability involved? How to account for the assumed obligations in each case?

1.3. *OUTLINE OF THE TEXT*

To answer the previous questions it will be necessary to define how a post-retirement medical care liability is calculated, so that a better understanding of its progression and impacts can be achieved.

This text is organised in five chapters. Next, Chapter 2 gives an insight into the Brazilian health system, thus supplying a broad picture about the *status quo* of health care in the

country. Chapter 3 describes in a more detailed way BAC's health plan and the population covered. Chapter 4 displays the calculation of the liabilities, explaining the methods and assumptions and presenting the results. Chapter 5 contains the conclusions and final thoughts.

It is important to remark that, due to the lack of specific literature on the subject, the development of this work is grounded mostly on the experience observed in the market.

2. UNDERSTANDING THE BRAZILIAN HEALTH SYSTEM

2.1. THE PUBLIC HEALTH SYSTEM – O SISTEMA ÚNICO DE SAÚDE

The Brazilian Health System has two pillars, the Public one and the Private which is also known as the Supplementary Health System. According to Article 196 of the Brazilian Constitution[4] health is a right of the people and a duty of the State, and as a consequence Law 8.080[5] created the *Sistema Único de Saúde* (SUS) with the objective of providing such social services to the population. Therefore, considering the assurance given by the Constitution and the universal public health system offered, it would be expected that a strong Private Health Market would not flourish in Brazil.

To have a general overview and understanding of the subject and to try to make some conclusions, the data provided by the World Data Bank Health Nutrition and Population Statistics[6] was considered. The World Data Bank Health Nutrition and Population Statistics has data for almost all countries, but to avoid confusion and for the easy the HDI was used to choose two other countries to be compared to Brazil. The United Nations Development Programme[7] defines that "the Human Development Index (HDI) is a summary measure of the average achievement in key dimensions of human development" having education, income and health as its pillars. The HDI is divided in

[4] (1988, see http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm)
[5] (1990, see http://www.planalto.gov.br/ccivil_03/leis/L8080.htm)
[6] (see http://databank.worldbank.org/data/reports.aspx?source=health-nutrition-and-population-statistics)
[7] (UNDP, see http://hdr.undp.org/en/content/human-development-index-hdi)

five levels: very low (from 0 to 0,499), low (from 0.5 to 0.599), medium (from 0.6 to 0.699), high (from 0.7 to 0.799) and very high (from 0.8 to 1). According to the UNDP countries' data for 2014, Brazil has an HDI of 0.742, Portugal's HDI is 0.822 and Germany's one is 0.911. Portugal and Germany were chosen to be compared to Brazilian statistics once they present very high HDI, which might indicate that the health environment in these countries is better than in Brazil's case. Another reason is that both Portugal and Germany have public and extensive health systems as well as Brazil.

The table presented in Annex III is based on the Health Nutrition and Population Statistics of the World Data Bank. It focuses on health expenditure and gives the opportunity to compare some statistics between the selected countries (Brazil, Portugal and Germany). The key findings of Annex III are:

a) Per capita health expenditure in 2013: while Brazilian expenses were USD 1,083 per year, Portugal's expenditure was almost double of it (USD 2,037), and Germany expended more than 4,5 times compared to Brazil (USD 5,007);
b) Health expenditure, public (% of government expenditure) in 2013: 6.9% of the Brazilian Government expense is associated with public health; in Portugal this rate reached 12.9% and in Germany 19.4%;
c) Health expenditure, private (% of total health expenditure) in 2013: 52.5% of the total health expenditure in Brazil is financed by the private sector while in Germany this percentage does not reach 24.0%, and in Portugal it is 36.0%;

d) Hospital beds (per 1,000 people) in 2011: Germany provides more than 8.2 beds per 1,000 people, Brazil provides only 2.3 and Portugal 3.4 beds per 1,000 people.

Analysing the information given above, it can be said that the Brazilian per capita health expenditure is low compared to Portugal, and very low compared to Germany. Also comparing the public health expenditure of the Brazilian Government (% of the total expense) to Germany and Portugal, it is possible to see that such expense represents much less for the Brazilian Government budget than for the other two countries. On the other hand, the private health sector accounts for more than 52.0% of the total health expenditure in Brazil - where only 23.0% of the population has access to private health care, see (Affat 2013). Such statistics come to corroborate the fact that Brazil is probably investing less in public health than what would be ideal, all the indicators position Brazil in a worst situation when compared to the selected countries. It is not possible to affirm that Brazilian Government provides a good standard of public health when less than half of the total health expenditure is used to cover the 77% of the population who does not have access to private health while the other 23% of Brazilians who have access to private health account for 52% of all health expenditure. Naturally, other measures are necessary to confirm this point of view.

Going further into the Brazilian HDI analysis, the Programa das Nações Unidas para o Desenvolvimento (2013), which is the Brazilian subsidiary of UNDP, presented a HDI of 0.727 (high) for Brazil in 2010, but the interesting part of this report is the disclosure of the HDI by the five major regions in which the country is usually divided: *Sudeste*

(Southeast), *Sul* (South), *Centro-Oeste* (Central West), *Nordeste* (Northeast) and *Norte* (North).

From the total of 27 Brazilian States (including the Federal District) the first 11 better HDIs are observed in the States of the Central West, Southeast and South regions, where the lowest HDI is 0.725 and the highest is 0.824. On the other hand, the two other regions (North and Northeast) have HDIs that go from 0.631 to 0.708 giving the dimension of inequality between the Central-South and the Northern regions in Brazil.

Knowing that the Central-South region is wealthier and more developed than the Northern regions it is possible to understand the disparity between the levels of coverage of private health. The coverage level of private health is 38.9% in the Southeast, 25.8% in the South, 21.5% in the Central region, 12.7% in the Northeast and 11.9% in the North (Instituto de Saúde Suplementar 2015).

Following (Affat 2013), the Brazilian private health system is the sixth in the world ranking considering the volume of premiums in 2010, and after the data presented in the last two paragraphs it becomes more comprehensible. The Public Health System in Brazil does not meet the population demands in a satisfactory way driving those who have a better financial condition to look for the service provided by the supplementary health system.

2.2. THE PRIVATE MEDICAL CARE SYSTEM

Law 8.080[8] created the SUS, but it also defined that medical care services can be provided by private parties. Later, Law 9.656[9] was issued with the objective to regulate the Brazilian private health market, and the *Agência Nacional de Saúde Suplementar* (ANS) was created by Law 9.961[10] to take part as the regulatory agency.

Law 9.656 (1998) determines which companies can commercialize private health plans, and it also prescribes all the basic procedures that a private health plan operator (for now on called insurer) must offer, as well as giving other directives. Additionally, the Law determines the regimes in which a health plan can be contracted:

a) Individual or household: contract between a person and the insurer;
b) Collective - Corporate: contract between a company (or group of companies) and the insurer;
c) Collective - Other Entities: contract between an association (for example a class entity or a labour union) and the insurer.

Law 9.656 (1998) also grants some rights to employees covered by corporate policies and such rights may impact directly in the company strategic decision of offering a health plan to its employees. According to sections 30 and 31 of Law 9656 (1998), if the employees participate with the cost of the medical plan via fixed monthly contribution

[8] (1990, see http://www.planalto.gov.br/ccivil_03/leis/L8080.htm)
[9] (1998, see http://www.planalto.gov.br/ccivil_03/leis/l9656.htm)
[10] (2000, see http://www.planalto.gov.br/ccivil_03/Leis/L9961.htm)

such employees will have the right and the option to remain in the plan in case of dismissal or retirement. In the case of retirement the employee will have the right and option to remain in the plan for one year per each year of contribution to the plan while employed, and lifetime after 10 years of contribution. In the case of dismissal, the employee can remain in the policy for one third of the contributed period, considering the minimum of six months and the maximum of twenty four months. Retirees and dismissed employees have the option to remain in the corporate policy and such decision requires the full payment of the costs associated to the medical care plan; so, if the retiree or former employee does not agree in paying his/her own policy premium, this means that the decision is to leave the policy.

The legal requirement described above is indirectly linked with the goal of this dissertation given the act of requesting employee's contribution to cover medical care costs leads to an obligation of offering them the post-retirement health plan. Thereby, studying the proposed problem leads us by analogy to have some insights about the impacts of Law 9.656 (1998) from the company accounting perspective.

2.3. CORPORATE HEALTH PLANS

A Corporate Health Plan is a benefit offered by a company (e.g. BAC) and provided via an insurance company (or other health plan operators) or via self-management. The basic difference between these two vehicles, insurance company and self-management, is that in the second one the company also assumes the inherent administrative and operational responsibilities (and the full risk, obviously).

A Health Plan policy in a Collective Corporate regime is a contract between the Company and the Insurer where the first pays a premium to the second on behalf of health coverage of a predetermined population in predetermined conditions, both specified in the insurance policy. In Brazil such plans are normally settled upon on an annual basis when the policy is renegotiated and consequently premiums are readjusted. Still, it must be clear that it is not usual to see companies changing the health plan provider with frequency (motivated by lower premiums), since it can generate unwanted noise between the employees, mostly because the network and policy conditions are different from one insurer to another.

3. BAC'S HEALTH PLAN: DESIGN AND POPULATION

As described in the introduction, BAC is planning to offer a post-retirement benefit to its employees by allowing them to remain in the corporate health policy after retirement. However, the decision to offer or not to offer the post-retirement benefit will depend on how much it will cost to the company.

Considering that BAC already offers a health plan to its employees where the premium per life was priced and the risk accepted by an Insurer, it is reasonable to assume that the current premium is the best starting point: (i) to define how the premium will develop until and after the employees' retirement, and (ii) to establish the necessary assumptions concerning the long term.

Different from corporate health plan pricing where Insurers normally analyse the vector of the last claims to define the premium and offer (normally and only) one year of coverage, accounting valuations aim the long term departing from a "picture" of the current situation. That is to say: considering what is offered now, and current financial and demographic assumptions, how much will be the amount of the liability regarding the post-employment benefit? Moreover, the answer to this question must fully respect the accounting rules for post-employment liability recognition (namely the IAS 19R).

As said before, the basis of this study will be the current health plan already offered to BAC's employees. Therefore:

a) Population currently covered by the policy: all employees, their spouses and descendants with less than 25 years old;
b) Plan Premium: BRL 3,603 per life per year paid in advance;
c) Premium paid by employees: employees do not pay anything. The full premium is paid by the company;
d) Eligibility to the post-employment medical plan: all and only employees are eligible to the post-retirement medical plan when they reach 65 years of age. He/she can remain in the plan for the same length of time worked for the company while active; if this period exceeds ten years, the employee is entitled to a lifetime benefit;
e) The future retirees will remain in the same policy as the employees.

A few descriptive statistics are given next. As these are real individuals, the source cannot be revealed, for confidentiality reasons. This data refers to BAC health plan population in 30/06/2015.

Table 1: Health Plan Population Statistics in 30/06/2015

	Employees	Dependents	Policy
Number of Lives	607	1,023	1,630
Average Age (years)	42.7	26.7	32.7
Average Service (years)	14.1	n/a	14.1
Annual Premium (BRL)	2,187,021	3,685,869	5,872,890

The data in Table 1 shows a mature employee population where the average age is 42.7 years old and the average time of service is 14.1 years. It also indicates that the

employee dependents push the average age down to 32.7 years old. Additionally, the annual premium is BRL 5,872,890, and approximately 63% of the total premium is referred to employee dependents. At this moment BAC pays the entire described premium not requiring any kind of participation from employees.

4. EVALUATION METHODOLOGY

To evaluate a post-retirement Health Plan it is necessary to understand the plan structure and forecast if and in which conditions the employee will achieve the retirement benefit, and this is the aim of this chapter. Making use of some market practices that sometimes have no 'formal literature' behind, Chapter 4 settles the actuarial financing method, the financial and demographic assumptions, the methodology adopted to evaluate the health plan, and finally applies everything to obtain results for BAC.

4.1. ACTUARIAL METHOD AND ASSUMPTIONS

Actuarial liability calculation requires the definition of the actuarial financing method and a set of assumptions. There are several actuarial financing methods, see (Pugh 2006), (Giesecke 1994) and Pension Review Board (2013). Between them the more common are the Unit Credit method, the Projected Unit Credit method, the Aggregate method and the Entry Age method, among others.

According to Paragraph BC111 of IAS 19R: *"IAS 19 before its revision in 1998 did not specify which forms of accrued benefit valuation method should be permitted under the benchmark treatment. IAS 19 as revised in 1998 required a single accrued benefit method: the most widely used accrued benefit method, which is known as the projected unit credit method (sometimes known as the 'accrued benefit method pro-rated on*

service' or as the 'benefit/years of service method')". Therefore, IAS 19R require the use of the Projected Unit Credit (PUC) so there is no gap to adopt another one.

Regarding assumptions, it is necessary to have in mind that they are directly connected with the nature of the benefit that generates the liabilities and as many as technically justifiable must be made. A brief overview of it all will be given in the following topics.

4.1.1. The Projected Unit Credit Financing Method

When talking about the Projected Unit Credit (PUC) we are discussing a valuation method to define liabilities and the annual expenses according to the accounting rules and standards, and this method in itself is independent of any pricing method the insurance company may use to define the policy premium. Considering only unfunded plans (without assets to face liabilities) and following IAS 19R, the Projected Benefit Obligation (PBO) represents the liability to be accounted by the company in its statements, making clear for investors and other interested parties that it is an amount of money supporting a post-retirement benefit, diminishing the Equity and consequently being not susceptible to shareholders' distribution. Post-retirement benefits are normally revaluated on an annual basis, and a new PBO is determined every year; the deviation between what was expected/projected and what was realized comprehend the variations of the period.

The Present Value of Future Benefits (PVFB) represents the expected present value of a stream of benefit cash flows. Independent of all actuarial methods the PVFB is always

the same so the difference between the methods lies on how the PVFB is financed or accrued, i.e., the amount a company must pay (or save) periodically to cover the benefit expenses in the future. The service cost (or normal cost) is the present value of benefits earned by an active employee in exchange for an additional year of service, and it is one of the main components of the year expense together with the interest cost, the latest representing one less year of benefit cash flow discount once the benefit concession became closer.

IAS 19R defines that the Projected Unit Credit must be used when accounting for post-retirement benefit liabilities. As described by (Pugh 2006), the goal of this method is to maintain the fund asset (even if fictitious) at a level that with future investment income but without any future contributions the asset fund (or virtual asset fund) would be able to pay all accrued benefits until the last beneficiary dies.

The PVFB is the expected present value of the benefits the employee will receive at retirement and such value considers all projections until the retirement date what includes the future work service time, i.e. the portion of the benefit the employee will still acquire. On the other hand, the PBO is based on what was already acquired by the employee so at the valuation moment the future service is put apart since it will still be acquired. For valuation purposes, all calculations are run in an individual basis, and to segregate what was accrued to what will be acquired the PUC method brings the pro-rata concept which is given by the ration between the employee's past service and the employee's total service according to the expression below.

$$PBO_z = PVFB_z \times \frac{PS_z}{TS_z} \qquad (1)$$

Where:

PBO_z = Projected Benefit Obligation of employee z

$PVFB_z$ = Present Value of Future Benefits of employee z

PS_z = years of company service accrued by employee z at valuation date

TS_z = total years of company service expected to be accrued by employee z at retirement

In the Projected Unit Credit Method, and following the same pro-rata reasoning, the cost is split between the total number of years of service of the employee so we have a direct allocation to the accounting period. The PUC Normal Cost represents the amount offered to the employee as post-retirement benefit in exchange of one additional year of service, and is represented by:

$$PUC\ Normal\ Cost_z = PVFB_z \times \frac{1}{TS_z} \qquad (2)$$

For example, without using a probabilistic and financial approach, let's assume a lump sum payment at retirement where the employee will receive BRL 1,000 per year of service in the company. A specific male employee z has 10 years of service in the company and will need to work 10 additional years before retirement. We have:

$$PVFB_z = 1{,}000 \times 20 = BRL\ 20{,}000 \qquad (3)$$

$$PBO_z = PVFB_z \times \frac{10}{20} = BRL\ 10{,}000 \qquad (4)$$

$$PUC\ Normal\ Cost_z = PVFB_z \times \frac{1}{20} = BRL\ 1{,}000 \qquad (5)$$

For instance, the employee will cost BRL 1,000 (equation (5)) per worked year, and since he has worked 10 years he accrued a benefit of BRL 10,000 (equation (4)) up to this moment, and he will need to work 10 more years to be eligible to the BRL 20,000 full benefit (equation (3)). In summary, equation (4) represents the amount needed to cover the benefits accumulated up to valuation moment, so if at that moment the company decides to suspend the benefit, the amount determined in (4) would be enough to pay all accrued liabilities with no need of additional contributions. Otherwise, if the company decides to continue the benefit the cost of one more year of acquired benefit will be given by equation (5).

4.1.2. Assumptions

This section lists some general and specific assumptions about the health plan. As usual in this kind of studies, these assumptions are required mostly:

a) to determine the probability of each employee reaching the retirement age while working for BAC, having then access to the benefit;
b) to determine the expected future life time of each employee after retirement;
c) to determine the expected present value of the benefit for each employee and which part of it is a responsibility (a liability) of the company.

Apart from the general assumptions, like for example the interest rate and the mortality table and the turnover model, there are others which are intrinsic to the characteristics of the evaluated benefit. In particular, when talking about health plan liability calculations there are three very important ones that need to be considered: the Health Care Cost Trend Rate (HCCTR), the Aging Factor and the Take up Rate.

4.1.2.1. Interest rate

The interest rate is used to compute the present values of all future cash flows to the present. Following IAS 19R the rate used to compute the present values of post-employment benefit obligations (both funded and unfunded) shall be determined by reference to market yields at the end of the reporting period on high quality corporate bonds. In countries where there is no deep market in such bonds, the market yields (at the end of the reporting period) on government bonds shall be used.

In Brazil there are no high quality corporate bonds so the interest rate is determined considering the Tesouro IPCA market yield which is a government bond consistent with IAS 19R definitions. Annex II presents the reference rates of return, Tesouro IPCA market information as of 30/06/2015, as well as the maturity dates and the duration of each bond. According to such information the bond with the highest duration is the one with maturity in 15/05/2055, with duration around 15.44 years (McCaulay 2013).

Using (McCaulay 2013) convexity method it was determined the liability duration of BAC in approximately 23.4 years. Considering there is not an available bond being commercialized with such a long duration, for the sake of BAC calculation, the Tesouro

IPCA with maturity in 15/05/2055 will be considered as our reference, and this bond provides a rate of return of approximately 6.0% p.a. above inflation (Tesouro IPCA are bonds indexed by inflation). Saying that, the discount rate of 6.0% will be used as reference in BAC valuation to bring to present values all future benefit cash flows.

4.1.2.2. Mortality table

A mortality table is a function which provides the death probability of an individual according to his/her age. In health plan valuations it is used to find the probability of being alive at retirement and the probability of remaining alive after retirement.

In this study the Annuity 2000 Basic Table (Johansen 1996, see Annex IV) will be considered so BAC employees die (or remain alive) according to the probabilities given by such table. This specific table is widely used by the Brazilian actuaries for pension, life insurance and health plan valuations, and based on that we decided to adopt it for this study.

4.1.2.3. Turnover model

There is the possibility of employees leaving the company before retirement by ordinary reasons like a better job offer, dismissal, family affair, etc.; so it is necessary to set up a turnover assumption.

The turnover model is usually settle considering the company data, and there are several ways to design it: being a function of the service, salary, a constant rate along time, etc. For the easy of this study it will be considered that BAC assumes a flat turnover rate of

3.0% p.a. which means that in general, and per each year before retirement, an employee has a 3.0% probability of leaving the company. In the case of withdrawal before retirement the employee does not have access to the post-retirement medical plan since only employees who retire while working for BAC can require the post-retirement health plan. Those employees who leave the company before retirement will not be eligible to any benefit.

4.1.2.4. Health care cost trend rate

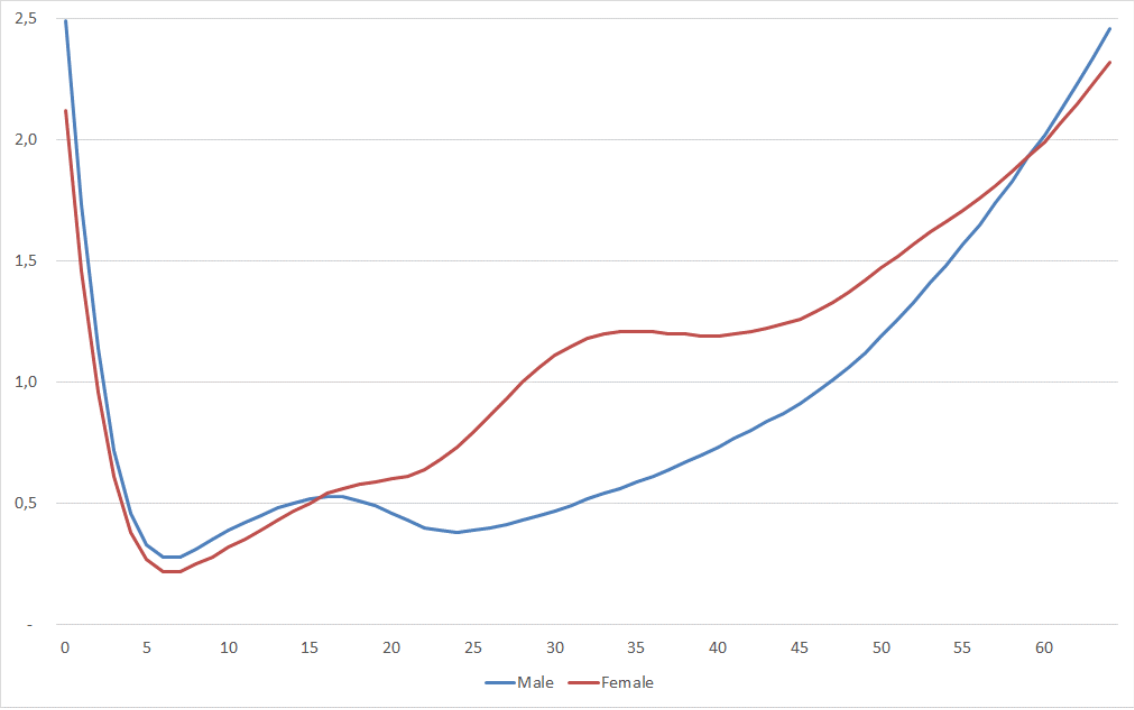
The HCCRT is a rate, a vector of rates or even a function, that aims to forecast how health plan costs are expected to grow with time. Getzen (2000, 2014) and (Getzen, Thomas E., iHEA and Temple University 2014) have been studying the subject. (Getzen et al. 2014) defend that the most common explanation for the expanding cost of medical care is the value of advances in medical technology called “Excess”, and such “Excess” growth is the difference between medical cost and income trends providing the most accurate and useful forecasts and mathematically equal to the percentage growth in the medical share of total spending. Additionally, (Getzen et al. 2014) come to the result that the “Excess” is now between +1.0% and +2.0%, allowing for an uncertainty of 1.0% per year (compounded), and appears to be headed downward.

In the BAC case study in presence, following (Getzen et al. 2014) results and considering the absence of similar studies for Brazil, it will be used a HCCTR assumption of 2.0% p.a. expressed as a real rate (liquid of inflation). In addition, it can be said that the Brazilian market practice for this assumption is the adoption of a rate between 2.0% and 4.0%.

4.1.2.5. Aging factor

It is a fact of life that health declines with aging, and from the insurance perspective the impact of the deterioration of health is the increase in health plan premiums with age. (Yamamoto 2013) studied the Medicare aging curve using health plan costs commercial data of the United States of America compiled for calendar years 2002 through 2010. This data was used to analyze health care cost differences by age and their contribution to overall health cost change. (Yamamoto 2013) defines a relative per capita cost according to age, and by comparing the per capita cost in a specific age with the cost attributed to the previous age we have a measure of the age effect. Fox example, if at age 30 the per capita relative cost is 1 and at age 31 it is 1.03 it means that one year of aging leads to a cost increase in the order of 3.0%.

Figure 1: (Yamamoto 2013) Aggregated Commercial Costs by Age for 2010



Source: (Yamamoto 2010), see http://www.healthcostinstitute.org/files/Age-Curve-Study_0.pdf

Figure 1 is the Aggregated Commercial Costs by age for 2010 according to (Yamamoto 2013). The relative aggregate cost of a man aged 20 is 0.46 and at age 64 is 2.46 what leads to an average Aging Factor of 3.4% p.a. (from 20 to 64 years old). On the other hand, the aggregate cost of a woman aged 20 is 0.60 and at age 64 is 2.32 leading to an average Aging Factor of 2.4% p.a. in the same age interval.

The Aging Factor represents the increasing rate in the premium (or cost) due to aging. The Brazilian market practice and accounting auditors consider that rates inside the interval of 2.00% and 4.00% p.a. are coherent and accepted from the health plan valuation point of view, however, there is not a specific study to determine the behavior of the Brazilian aging curve. Therefore, once it is expected that the employee population age of a company is inside the interval of 20-64 years old, based on (Yamamoto 2013) results and taking into account the Brazilian market practice, it will be assumed an average 3.0% real flat Aging Factor rate for both genders (male and female).

4.1.2.6. Take up rate

If a company offers a post-retirement medical plan, when retiring the employee has the option to accept or reject the benefit. However, the option of the employee can depend a lot on the plan design and in certain circumstances he/she may not choose to stay in the plan. For example, if the company provides a plan with no cost to an employee it is very likely that all employees will opt to remain in the plan after retirement. On the other hand, if the provided plan requires the retirees to pay their respective premiums the decision to stay or not to stay will depend on their personal motivation and analysis of their personal circumstances, taking into account their individual cost (premium) and

if it is worth paying the premium. In the later scenario it is not expected that all employees will take up the option to stay in the plan.

The take up rate varies according to the policy population and plan design so each health company policy has an intrinsic rate. For the sake of this study it will be considered that all employees will choose to remain in the post-retirement health plan so the take up rate will be 100%, i.e. all employees who fulfil the retirement requirements will opt to remain in plan.

4.2. EVALUATION METHODOLOGY

All previous information (plan design and structure, population data and assumptions) will be used now to help BAC on its decisions about the post-retirement medical plan to offer to its employees. It is important to remind that the company considers offering a post-retirement medical plan such that retired employees will remain in the same policy as the current employees and their dependents. The effects of such a decision need to be measured according to IAS 19R.

The goal of this section is to uncover and measure any liability that may arise according to the range of options given to BAC. To better help the decision process three different scenarios will be explored:

- Scenario 1: a “free” post-retirement health plan will be offered for those employees who comply with the eligibility requirements, i.e., the health plan is totally supported by the company;

- Employee contribution: none
- Retiree contribution: none

– Scenario 2: future retirees will pay their own policy premium with no direct subsidy by the company;
  - Employee contribution: none
  - Retiree contribution: BRL 3,603 (annual policy premium)

– Scenario 3: future retirees will pay their own policy premium with no direct subsidy by the company, and employees will also contribute.
  - Employee contribution: 10% (Scenario 3.1), 20% (Scenario 3.2) or 30% (Scenario 3.3) of the premium
  - Retiree contribution: BRL 3,603 (annual policy premium)

Denoting the 'net' benefit at retirement by B(r), it follows that

$$B(r) = C(r) - P(r) \qquad (6)$$

Where:
r = retirement age (65 years in BAC's case)
C(r) = individual cost at retirement age
P(r) = individual premium to be paid by the retiree at retirement age

When defining the premium per life covered in a certain health plan policy an insurance company uses its own pricing tools and techniques, and this is not what will be discussed hereon. Since the premium calculated and defined by the insurer is the amount paid in exchange for the coverage, we will assume that such premium reflects the cost of the

health plan policy. If Pt represents the total annual premium and Ct represents the total annual cost of the health plan, then

$$Pt = Number\ of\ Covered\ Lives\ (n) \times\ Premium\ per\ Life\ (P) = Ct \qquad (7)$$

From Chapter 3 the policy premium per life is BRL 3,603 and the total of lives covered is *n* = 1,630; so in the case of BAC

$$Pt\ =\ Ct\ =\ BRL\ 5{,}872{,}890 \qquad (8)$$

(7) and (8) give the total cost as a function of the number of covered lives *now*, because the premium calculated by the insurance company is based on global policy information (claims, average policy age, etc.) on a specific moment in time, and normally for only one year of coverage. Yet, it is necessary to consider in the liability calculations how much will be the premium and the cost when the retiree begins to receive the benefit, i.e., how this two variables alter with time.

As described in section 4.1.2.5, the older the individual the greater the claims amount, so at the end of the day letting retirees in the corporate policy implies increasing health plan costs in all circumstances. And since the premium/cost increase comes from a post-employment benefit this is the reason why the impacts have to comply with IAS 19R.

The variation in question will be modelled via the Aging Factor (AF), the key to determine the relationship between the insurance company total premium (Pt) and the premium/cost at each individual age. The next step will be to determine the average cost C at the average age Aa, which is the solution of equation (9) below

$$C \times \sum_{i=1}^{n} (1 + AF)^{Ai - Aa} = Pt \qquad (9)$$

Where: *Ai* = age of life *i*.

The average age of BAC's covered population is 32.67, and the Aging Factor (*AF*) was fixed at 3.0%, then from (9) it results that

$$C = \frac{Pt}{\sum_{i=1}^{n}(1+AF)^{Ai-Aa}} = \frac{5{,}872{,}890}{1{,}828.88} \cong BRL\ 3{,}211.19 \qquad (10)$$

The amount BRL 3,211.19 represents the health insurance cost at age 32.67 (average policy age). Departing from it and making use of the Aging Factor assumption it is possible to derive the health plan cost at each age respecting the fact that older people claim more than the young ones. For instance, some selected health costs per age and the actual paid premium are found in Table 2 where we can observe that the premium is constant for every age while the Average Cost (C) varies with it. This gap between the individual premium and the individual cost is not fundamental when we talk about corporate policies for employees, but it can turn to an issue when corporate policies allows for retirees coverage. The post-retirement health plan benefit offered in the same corporate health plan policy (mixing employees and retirees) will impact the premium in the short term given that the insurance policy population will became older and older along time, following the employee's retiring movement. This is the principal effect of maintaining retirees in the same corporate policy as employees once one of the causes of future policy premium increases is the increasing number of retirees caused by the post-retirement benefit. Therefore, the acceptance of a short term benefit impact (health plan policy premium rising) caused by a long term benefit human resources policy (post-retirement health plan) requires a liability to be measured and

accounted by the company. This happens because the benefit is being introduced at a point in time when workers have already periods of past service; therefore, the responsibilities from the past service periods must be acknowledged.

Table 2: Health Plan Costs and Premium for selected ages (in BRL)

Age	Average Cost (C)	Premium (P)	Age	Average Cost (C)	Premium (P)
32	3,147.93	3,603.00	34	3.339,64	3,603.00
32.67	3,211.19	3,603.00	35	3.439,83	3,603.00
33	3.242.37	3,603.00	36	3.543,02	3,603.00

Apart from the aging scale another important effect that must be included is the Health Care Cost Trend Rate (HCCTR). As described is section 4.1.2.4, the HCCTR is above inflation and it affects the policy premium. Adopting a HCCRT of 2.0% it is the same as assuming that the current premium *P* and consequently the Average Cost *C* will increase at a rate of 2.0% per year.

The relation between *C* and *P* together with *AF* and the *HCCTR* effects is what defines the level of benefit the employee will have on and after retirement. Considering the benefit expression introduced previously, it follows that

$$B(r) = C(r) - P(r) = C \times [(1 + HCCRT) \times (1 + AF)]^{r-x}$$

$$-P \times [(1 + HCCRT)]^{r-x} \qquad (11)$$

Where: *x* = age at valuation date (30/06/2015).

(11), the same way as (6), obviously implies that the lower the premium $P(r)$ paid by the retiree the higher is the 'net' benefit. Consequently, the lower the premium paid by

the retiree the higher is the liability assumed by the company. Considering (6), the Expected Present Value of Future Benefits (PVFB) for employee z is

$$PVFB_z = B(r)_z \times {}_{r-x_z}p_x + 0 \times \left(1 - {}_{r-x_z}p_x\right) = B(r)_z \times {}_{r-x_z}p_x$$

$$= [C(r)_z - P(r)_z] \times {}_{r-x_z}p_x \qquad (12)$$

where:

${}_{r-x_z}p_x$ = multi-decrement probability (mortality and turnover) of employee z reaching retirement

$PVFB_z$ =Expected Present Value of Future Benefits of employee z

$C(r)_z$ = individual cost of employee z (currently aged x_z) at retirement

$P(r)_z$ = individual premium to be paid by employee z at retirement

For all employees the PVFB (denote their number with *e*) is

$$PVFB = \sum_{z=1}^{e} PVFB_z$$

$$= \sum_{z=1}^{e} \left(C(r)_z \times \ddot{a}_{\boldsymbol{r}:\overline{nc_z}|i^*} - P(r)_z \times \ddot{a}_{\boldsymbol{r}:\overline{nc_z}|i^{**}}\right) \times {}_{r-x_z}p_{\boldsymbol{x_z}} \times v^{r-x_z}$$

$$\times TR \qquad (13)$$

where:

$\ddot{a}_{r:\overline{nc_z}|i^*} = \sum_{t=0}^{nc_z}(1+j)^t v^t \, {}_tp_r$, where nc_z = number of years of coverage of employee z at retirement (lifetime coverage, if $nc_z \geq 10$) and the EPV of one of the temporary life annuities is calculated at a rate $i^* = \frac{i-j}{1+j}$, i the interest rate and

$j = [(1 + HCCTR)(1 + AF) - 1]$, and the EPV of the other annuity is calculated at a rate $i^{**} = \frac{i-j^{**}}{1+j^{**}}$, $j^{**} = HCCTR$. The expressions for $i^*$and i^{**} result directly from the description above, in particular, from (11)

v^{r-x_z} is the usual discounting factor. *TR* = Take up rate

For BAC: $\begin{cases} i^{*} = \frac{i-[(1+HCCTR)\times(1+AF)-1]}{(1+HCCTR)\times(1+AF)} \\ i^{**} = \frac{i-j^{**}}{1+j^{**}} = \frac{i-HCCTR}{1+HCCTR} \end{cases}$ (14)

IAS 19R defines that the liability must be measured by the Projected Unit Credit (PUC) funding method. As already explained, PUC consists basically in applying to the PVFB the ratio between the number of years of work for the company accrued by the employee at the valuation date (past service) and the number of work years the employee is expected to accrue until the retirement date (total expected service). The Projected Benefit Obligation (PBO) represents the post-employment liability according to the PUC method, and is defined as:

$$PBO = \sum_{z=1}^{e} PVFB_z \times \frac{PS_z}{TS_z} \qquad (15)$$

Where:

PS_z = years of company service accrued by employee z at valuation date (30/06/2015)

TS_z = total years of company service expected to be accrued by employee z at retirement

In case BAC opts for requesting contributions from employees there is another interesting measure that can be taken into account that is the Expected Present Value of Future Employee Contributions (PVFEC). The PVFEC comprises the expected present value of the amount of money expected to be saved by the company through the adoption of employee contributions, and it can be expressed as:

$$PVFEC = \sum_{z=1}^{e} C\% \times P \times \ddot{a}_{x_z:\overline{r-x_z}|i^{**}} \qquad (16)$$

Where *C%* = share of the premium paid by the employee (10%, 20% or 30% in Scenarios 3.1, 3.2 and 3.3, respectively).

4.3. RESULTS AND ACCOUNTING INSIGHTS

Paragraph 1 of IAS 19R requests the company to account for a liability when the employee has provided a service in exchange for employee benefits to be paid in the future, and an expense when the entity consumes the economic benefit arising from the service provided by the employee. In addition, Paragraph 5 of IAS 19R defines and describes all classes of employee benefits (for more details see Annex I), and it makes an important distinction between the accounting treatment given to short-term and to long-term employee benefits.

Short-term benefits are benefits expected to be fully settled in twelve months while long-term benefits comprehend those expected to be settled after twelve months. For instance, a health plan benefit offered to employees is considered a short-term benefit, and it is accounted as an expense in the accounting exercise since it does not allow for future benefits. On the other hand, a post-retirement medical plan is characterized as a long-term employee benefit, once it will be provided in the future, requiring the measurement and recognition of the liability if material. Materiality is an accounting principle. There is not a definition on what is material or not, and it varies according to the accounting auditor as well as the company option which is beyond actuarial judgment. For the purpose of this study we will consider that any liability is material and needs to be accounted for.

Considering the accounting concepts described above, and the techniques and assumptions of previous sections of this chapter, a valuation exercise was performed with BAC individual data and the summary of results is presented in Table 3. It is possible to see that the Present Value of Future Benefits (PVFB – equation (13)) and the Projected Benefit Obligation (PBO – equation (15)) of Scenario 1 are higher when comparing with the other Scenarios and it relies in the fact that in the first Scenario the company supports alone the entire post-retirement plan. Remember (6) and that in Scenario 1 $P(r) = 0$, while in the other Scenarios $P(r) > 0$, as the retiree pays the entire premium.

Table 3: Valuation results in 30/06/2015 (in BRL)

Scenario	*PVFB* (13)	*PBO* (15)	Expense of Next Exercise
1	22,063,433	11,632,033	1,401,101
2, 3.1, 3.2 and 3.3	15,019,229	7,923,004	926,051

Following IAS 19R, if BAC offers the post-retirement medical benefit according to Scenario 1, it should recognize a liability of BRL 11,632,033; if offering according to the other Scenarios, the liability would be BRL 7,923,004. One could think that it should not exist a liability to be accounted in Scenarios 2 and 3 since the retiree pays its own premium, however, given the structure of the corporate policy (average premium per life and retirees staying in the same policy as employees) it is not possible to charge/transfer to retirees what they really cost so the company will have to somehow absorb the policy cost increase generated by the post-retirement medical benefit plan which is the cause of such liability.

Another component that comes up with the post-employment benefit is the yearly expense arising from and additional year of service of the employee. It has two main components, the Service Cost that is the future benefit portion given by an additional year of service in the company, and the Interest Cost meaning that the liability has one less year to be discounted, i.e. the benefit is one year closer to be granted. As well as the liability, the Expense of the Next Exercise in Scenario 1 is much bigger motivated by the higher level of ´net´ benefit provided.

The Benefit at Retirement (B(r) – equation (6)) does not keep relation with the contribution made by the employee while working for the company, and since the liability is computed considering equation (6) the employee contribution to the health plan does not bring any change in benefit liabilities. However, although employee participation with costs of the health plan has no effect in liability calculation, the existence of contributions, like in Scenarios 3.1 to 3.3, makes way to an interesting analysis. Table 4 presents the Expected Present Value of Future Employee Contributions (PVFEC) that must be made before retirement in each scenario (equation (16)).

Table 4: Valuation results in 30/06/2015 (in BRL)

Scenario	Description	PVFEC (16)	Expected Employee Contribution for next exercise
3.1	Employee pays 10% of the Insurance Premium	2,379,216	218,702
3.2	Employee pays 20% of the Insurance Premium	4,758,433	437,404
3.3	Employee pays 30% of the Insurance Premium	7,137,649	656,106

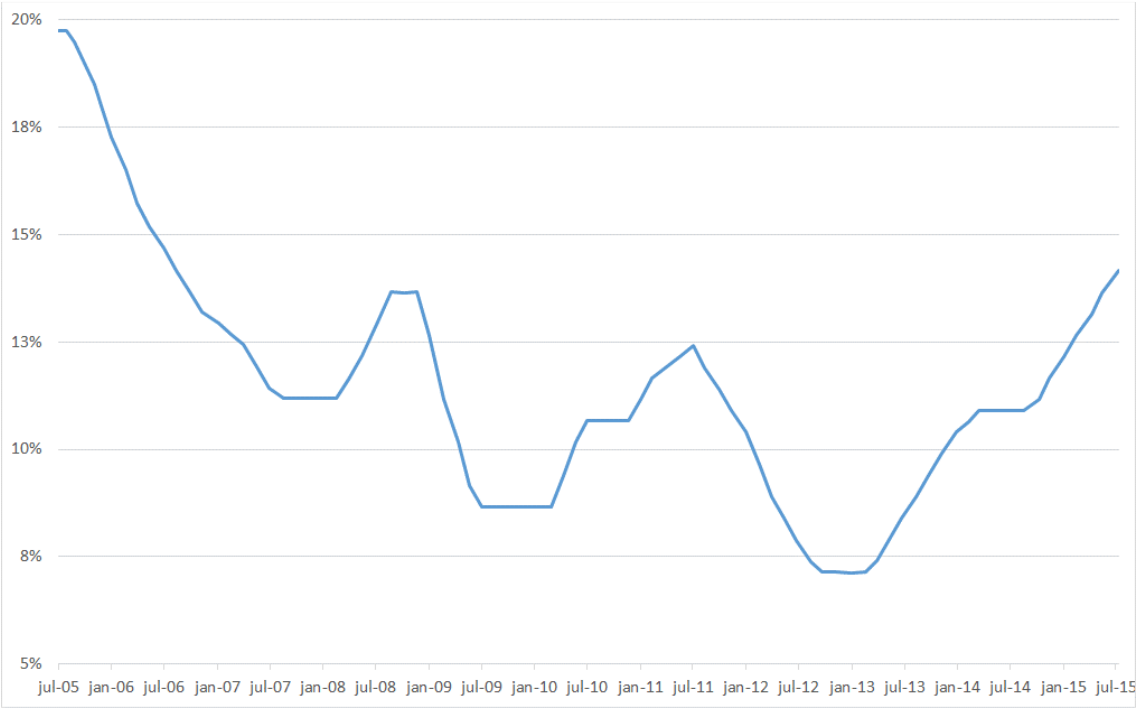
Observing Table 4 is immediate that the inclusion of employee contributions has some impact on short term expenses. The PVFEC can be understood as the amount to be saved by the company in the long run due to employee contributions. For example, if BAC opts for Scenario 3 the PVFEC is BRL 7,137,649, and the expected saving for the next exercise will be BRL 656,106. This amount is obtained since, according to Table 1, the premium related to employees is BRL 2,187,021, and for simplicity it is considered that the expected contribution for the next exercise is $656{,}106 = 30\% \times 2{,}187{,}021$.

Thus, at the valuation date (30/06/2015) the PVFEC of Scenario 3 is close to the respective PBO (BRL 7,923,004) and the saving for the next exercise is also close to the respective post-retirement medical plan expense of the next exercise (BRL 926,051). If it was possible to combine the results there would be few liability to be recognized in the exercise, but since the accounting principles do not allow it to be done the company will have to account the long term liability and experience the benefit expenses in the short term.

An important aspect of post-retirement liabilities is that they are obviously highly connected and sensitive to the assumptions adopted in the calculations. For instance, the Mortality Table, the Turnover Model, and the Take up Rate are assumptions that can be calibrated once the evaluated population and the scientific production already give the basis for the definition. Otherwise, the Interest Rate, the Aging Factor and the HCCTR are a bit trickier to be defined, and represent a significant share of the volatility involved. (See section 4.1 of this Chapter)

The settling of the interest rate itself is not very complex and since is pre-defined in IAS 19R the volatility is not due to this step (see section 4.1.2.1), but to the market behaviour. When talking about interest rates in Brazil we also talk about enormous volatility like showed in Figure 2 where the gross rate of Taxa Selic (basic interest rate of the Central Bank of Brazil) peaked almost 20% in July/2015 and felt to less than 8% in Jan/2013, with a series of ups a downs.

Figure 2: Taxa Selic – historic from July/2005 to July/2015 (gross rates)



Source: Banco Central do Brasil, see http://www.bcb.gov.br/?COPOMJUROS

Considering BAC valuation, Table 5 presents a sensitivity of the variation of +/- 0.5% in the interest rate used in is calculations, all the other assumptions unchanged. When the interest rate decreases in 0.5% (from 6.0% to 5.5%) the liability increases approximately 11.9% in Scenario 1 and 12.4% for the other scenarios. On the other hand, when the

interest rate increases in 0.5% the liability decreases around 10.4% in Scenario 1 and 10.7% for the other scenarios.

Table 5: Interest Rate (IR) sensitivity (+/- 0.5%)

Assumption	Scenario 1	Other Scenarios
IR - 0.5% (5.5%)	13,020,830	8,904,537
IR (6.0%)	11,632,033	7,923,004
IR + 0.5% (6.5%)	10,425,920	7,073,804

Differently from the interest rate the main problem related to Aging Factor (AF) and to the HCCTR is still at the level of settling a proper assumption. Since there is not enough scientific production regarding the behaviour of this two very important health plan valuation assumptions in Brazil and/or for Brazil, we have less risk mitigation, allowing for an eventual and significant mismatch between what is adopted in the valuation and what will effectively happen when the employee retires in several years ahead, not being a 'good factor' from the company perspective.

To illustrate how sensitive to this assumptions results can be Tables 6 (Scenario 1) and 7 (other scenarios) present a series of simulations of AF and HCCTR where the rates vary +/- 0.5% from the ones adopted in the valuation (AF 3.0%; HCCRT 2.0%). Considering the two extreme scenarios when both AF and HCCTR decrease by 0.5% or increase by 0.5% we observe: (i) the decrease of 0.5% makes the liability in Scenario 1 decrease by 25.1% (to BRL 8,706,672), and in the other scenarios it decreases by 32.2% (to BRL 5,369,232); (ii) the increase of 0.5% makes the liability in Scenario 1 decreases by 33.7% (to BRL 15,554,358), and in the other scenarios it decreases by 44.2% (to BRL 11,423,300); (iii) if

we compare the "extreme" results of the simulations we have gaps of BRL 6,847,686 (Scenario 1: 15,554,358 – 8,706,672) and BRL 6,054,068 (other scenarios: 11,423,300 – 5,369,232), i.e., in BAC's case a variation of +/- 0.5% in the HCCTR and in the AF can double its liability depending on the scenario.

Table 6: Scenario 1– Aging Factor (AF) and HCCTR sensitivity (+/- 0.5%)

Assumption	HCCTR – 0.5% (1.5%)	HCCTR (2.0%)	HCCTR + 0.5% (2.5%)
AF – 0.5% (2.5%)	8,706,672	9,745,395	10,934,376
AF (3.0%)	10,376,224	11,632,033	13,071,856
AF + 0.5% (3.5%)	12,307,377	13,818,701	15,554,358

Table 7: Other scenarios – Aging Factor (AF) and HCCTR sensitivity (+/- 0.5%)

Assumption	HCCTR – 0.5% (1.5%)	HCCTR (2.0%)	HCCTR + 0.5% (2.5%)
AF – 0.5% (2.5%)	5,369,232	6,036,259	6,803,075
AF (3.0%)	7,038,884	7,923,004	8,940,670
AF + 0.5% (3.5%)	8,970,149	10,109,793	11,423,300

5. CONCLUSIONS

Offering a post-retirement medical plan can result in a company having to recognize a liability according to IAS 19R. However, if the company decides to see beyond this rules and take the post-retirement health plan and the employee contributions as an integrated benefit policy, the methodology applied in this work may give the decision makers the sense that maintaining a certain level of employee contribution leads to an economically viable policy by bringing controlled additional expense from the company side. Naturally, it all depends mostly on the calibration for employee contributions and for re-evaluation assumptions.

Companies accounting for post-employment benefits normally re-evaluate the respective liability every reporting year, and re-evaluations can mean significant variation from previous valuations since the assumptions will be redefined according to the current circumstances and the health plan structure and premium, which may have changed considerably. Therefore, if a company is risk averse it may not want to carry on post-employment liabilities and prefer not to provide this kind of employee benefit that can represent some sort of risk/volatility.

On one hand, we can have a company that even seeing expenses increase not being very significant in the long run it still chooses not to offer this kind of plan because of its risk aversion or because its investors are risk averse and would not like to see the company

enrolled in liabilities that may lead to volatile results. On the other hand, we can have a company that may want to offer a post-retirement health plan motivated by an employee retention policy, or maybe aiming the employee welfare in the future or even having a social appeal since the Brazilian Health System is deficient and does not provide adequate assistance to people. In summary, it is a company's duty to do a self-judgment in a way that its decisions will not damage the company results and performance, but still promote the company's principles as well as empowering intangible benefits when worrying about the welfare of its employees.

Considering BAC study case in Scenario 1 a liability of BRL 11,632,033 would need to be reflected in its statements. We do not know how big is BAC asset as well as what is the level of materiality of Scenario 1 liability, but we do know that offering the proposed post-retirement health plan will diminish the equity or impact in the company value (in the share value). If BAC decides that Scenario 1 is too expensive it can offer Scenarios 2, 3.1, 3.2 or 3.3, where a liability of BRL 7,923,004 will need to be accounted, but allowing for inflows (employee and/or retiree contributions) that can be very interesting for the overall cash flow and current/year expenses of the company. Alternatively, if BAC is worried about volatility/risk, it can choose to purchase assets to face the liabilities so that, independent of any scenario, part of the risk can be mitigated.

All the issues involving this master's dissertation are being discussed due to the obligation brought by the IFRS accounting rules, namely IAS 19R, and at this point it is possible to understand how important such accounting rules are: (i) to the analysis of the financial health of a company; (ii) to the definition of its investment strategies; (iii)

to plan the company's expansion; (iv) to guarantee that the company is going to carry on. The calculation involved in this sort of valuation is complex, but essential to have a deep understanding on post-retirement benefit liabilities (health plan liabilities in our case).

If BAC provides Scenario 1 post-retirement health plan benefit and the IAS 19R is ignored, meaning that the liability is not known nor recognized in its statements, one party who is considering to invest in the company may be guided to a bad judgement or choice due to the lack of information, and may incur in the participation of a liability of BRL 11,632,033 instead of a profit. This example is an extreme situation, and its goal is not to send the distorted view that companies with post-retirement liabilities are bad investments, but instead it alerts for the importance of the transparency needed and provided by IFRS to investors and other parties in a way they can take conscious/proper decisions.

This study was based on current practices and due to the lack of specific literature it was not possible to go deeper in some key aspects. For instance, it was not possible to find research about the *HCCTR* and the *AF* in the Brazilian set, so further studies on these two essential parameters will be quite interesting. As a result, mitigating risks can drive companies to be more interested in implementing post-retirement health plan policies, calming investors and benefiting employees when playing an important role that the local government cannot stand alone.

REFERENCES

Affat, Ronald P. (2013), ―Brazilian Private Health Care Market - Ready for Liftoff,‖ *International News*, Society of Actuaries, 55 (January), 12-18. Available from: https://www.soa.org/library/newsletters/international-section-news/2012/january/isn-2012-iss55-affat.pdf

Getzen, Thomas E. (2000), ―Forecasting Health Expenditures: Short, Medium and Long (Long) Term,‖ in *Journal of Health Care Finance*, Vol. 26, 3 (Spring), 56-72. Available from: http://www.researchgate.net/publication/12586568_Forecasting_health_expenditures_short_medium_and_long_%28long%29_term

_____ (2014), ―Modeling the Cost of Medical Care for the Elderly,‖ *Health Watch*, Society of Actuaries, 74 (January), 21-25. Available from: https://www.soa.org/news-and-publications/newsletters/health/pub-health-section-newsletters-details.aspx

Getzen, Thomas E., iHEA - International Health and Economic Association and Temple University (2014), ―Modeling Long Term Healthcare Cost Trends, Society of Actuaries. Available from: https://www.soa.org/research/research-projects/health/research-hlthcare-trends.aspx

Giesecke, Gerald L. (1994), ―The Projected Unit Credit Method with Benefits Apportioned by Interest-Adjusted Salary,‖ in *Transactions of Society of Actuaries*, Vol. 46, 193-226. Available from: https://www.soa.org/library/research/transactions-of-society-of-actuaries/1990-95/1994/january/tsa94v468.pdf

Johansen, Robert J. (1996), ―Annuity 2000 Mortality Tables,‖ *Transactions of Society of Actuaries*, 1995-96 Reports. Available from: https://www.soa.org/library/research/transactions-reports-of-mortality-moribidity-and-experience/1990-99/1995/january/TSR9510.pdf.

McCaulay, M. (2013), - Duration and Convexity for Pension Liabilities,‖ *Pension Section News*, Society of Actuaries, 81 (September), 18-21. Available from: https://www.soa.org/library/newsletters/pension-section-news/2013/september/psn-2013-iss81-mccaulay.aspx

Pugh, C. (2006), - Funding Rules and Actuarial Methods,‖ *OECD Working Papers on Insurance and Private Pensions*, OECD Publishing, 1 (October), 25-31. Available from: http://www.oecd.org/pensions/insurance/37566192.pdf

Yamamoto, Dale H. (2013), ―Health Care Costs - From Birth to Death,‖ *Health Care Cost Institute's Independent Report Series* –, Health Care Cost Institute, 1 (June). Available from: http://www.healthcostinstitute.org/files/Age-Curve-Study_0.pdf

Instituto de Saúde Suplementar (2015), *Saúde Suplementar em Números*, 7 (March), table 7. Available from: http://www.iess.org.br/?p=publicacoes&id_tipo=14

International Financial Reporting Standards (2011), *IAS 19 Employee Benefits*, IFRS Foundation. Available from: http://www.actuaries.org/CTTEES_IASSC/Documents/Zagreb_IAS19_4_FinalIAS19.pdf

International Financial Reporting Standards (2015), *A Guide through IFRS*, IFRS Foundation.

Pension Review Board (2013), *Understanding the Basics of Actuarial Methods*, Research Paper, 13-001 (April). Available from: http://www.texastransparency.org/Special_Features/Reports/Pension_Obligations/pdf/finalbasicsofactmethod.pdf

Programa das Nações Unidas para o Desenvolvimento (2013), *Atlas do Desenvolvimento Humano no Brasil*. Available from: http://www.pnud.org.br/arquivos/idhm-do-brasil.pdf

Brazilian Constitution (1988), Social Order, Section II: Health, Articles 196-200. Available from: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm

Law 8,080 (1990), Presidency of the Federative Republic of Brazil. Brasília, DF: Civil House. Available from: http://www.planalto.gov.br/ccivil_03/leis/L8080.htm

Law 9,656 (1998), Presidency of the Federative Republic of Brazil. Brasília, DF: Civil House. Available from: http://www.planalto.gov.br/ccivil_03/leis/l9656.htm

Law 9,961 (2000), Presidency of the Federative Republic of Brazil. Brasília, DF: Civil House. Available from: http://www.planalto.gov.br/ccivil_03/Leis/L9961.htm

Law 11,638 (2007), Presidency of the Federative Republic of Brazil. Brasília, DF: Civil House. Available from: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/lei/l11638.htm

Associação Brasileira de Entidades de Mercados Financeiro e de Capitais - Anbima. Available from: http://www.anbima.com.br/ima/ima.asp

Banco Central do Brasil. Available from: http://www.bcb.gov.br/?COPOMJUROS

United Nations Development Programme (2014), *Human Development Index.* Available from: http://hdr.undp.org/en/content/human-development-index-hdi

World DataBank Health Nutrition and Population Statistics. Available from: http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=health-nutrition-and-population-statistics

ANNEXES

ANNEX I. IAS 19R: EMPLOYEE BENEFITS CLASSIFICATION

5 Employee benefits include:

(a) short-term employee benefits, such as the following, if expected to be settled wholly before twelve months after the end of the annual reporting period in which the employees render the related services:

(i) wages, salaries and social security contributions;

(ii) paid annual leave and paid sick leave;

(iii) profit-sharing and bonuses; and

(iv) non-monetary benefits (such as medical care, housing, cars and free or subsidised goods or services) for current employees;

(b) post-employment benefits, such as the following:

(i) retirement benefits (eg pensions and lump sum payments on retirement); and

(ii) other post-employment benefits, such as post-employment life insurance and post-employment medical care;

(c) other long-term employee benefits, such as the following:

(i) long-term paid absences such as long-service leave or sabbatical leave;

(ii) jubilee or other long-service benefits; and

(iii) long-term disability benefits; and

(d) termination benefits

Source: IAS 19R, Paragraph 5, see http://www.actuaries.org/CTTEES_IASSC/Documents/Zagreb_IAS19_4_FinalIAS19.pdf.

ANNEX II. *INTEREST RATE BOND INFORMATION: TESOURO IPCA*

Reference Date	Bond	Maturity	Indicative Rate of Return (% p.a.)	Duration (years)
30/06/2015	Tesouro IPCA	15/08/2016	7,212	1,08
30/06/2015	Tesouro IPCA	15/05/2017	6,675	1,78
30/06/2015	Tesouro IPCA	15/08/2018	6,700	2,83
30/06/2015	Tesouro IPCA	15/05/2019	6,730	3,47
30/06/2015	Tesouro IPCA	15/08/2020	6,611	4,38
30/06/2015	Tesouro IPCA	15/08/2022	6,440	5,75
30/06/2015	Tesouro IPCA	15/05/2023	6,491	6,31
30/06/2015	Tesouro IPCA	15/08/2024	6,361	6,98
30/06/2015	Tesouro IPCA	15/08/2030	6,152	9,91
30/06/2015	Tesouro IPCA	15/05/2035	6,169	11,75
30/06/2015	Tesouro IPCA	15/08/2040	6,130	12,98
30/06/2015	Tesouro IPCA	15/05/2045	6,120	14,11
30/06/2015	Tesouro IPCA	15/08/2050	6,063	14,74
30/06/2015	Tesouro IPCA	15/05/2055	6,090	15,44

Source: Anbima, see http://www.anbima.com.br/ima/ima.asp

ANNEX III. *HEALTH PLAN DATA OF SELECTED COUNTRIES.*

Country Name	Series Name	2010	2011	2012	2013
Brazil	Health expenditure per capita (current US$)	989	1.154	1.078	1.083
Portugal	Health expenditure per capita (current US$)	2.352	2.332	2.000	2.037
Germany	Health expenditure per capita (current US$)	4.668	4.992	4.717	5.007
Brazil	Health expenditure, public (% of government expenditure)	10,7	9,3	7,9	6,9
Portugal	Health expenditure, public (% of government expenditure)	14,5	14,0	13,4	12,9
Germany	Health expenditure, public (% of government expenditure)	18,5	19,1	19,3	19,4
Brazil	Health expenditure, public (% of total health expenditure)	47,0	47,4	47,5	48,2
Portugal	Health expenditure, public (% of total health expenditure)	68,7	66,5	64,0	64,7
Germany	Health expenditure, public (% of total health expenditure)	76,7	76,5	76,7	76,8
Brazil	Health expenditure, private (% of total health expenditure)	53,0	52,6	52,5	51,8
Portugal	Health expenditure, private (% of total health expenditure)	31,3	33,5	36,0	35,3
Germany	Health expenditure, private (% of total health expenditure)	23,3	23,5	23,3	23,2
Brazil	Hospital beds (per 1,000 people)	2,4	2,3	2,3	..
Portugal	Hospital beds (per 1,000 people)	3,4	3,4	..	..
Germany	Hospital beds (per 1,000 people)	8,3	8,2	..	..

Source: World Data Bank - Health Nutrition and Population Statistics

(http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=health-nutrition-and-population-statistics)

ANNEX IV. *ANNUITY 2000 BASIC TABLE.*

Age	Male	Female	Age	Male	Female	Age	Male	Female
15	0,000470	0,000197	40	0,001043	0,000677	65	0,010993	0,007017
16	0,000481	0,000212	41	0,001168	0,000732	66	0,012188	0,007734
17	0,000495	0,000228	42	0,001322	0,000796	67	0,013572	0,008491
18	0,000510	0,000244	43	0,001505	0,000868	68	0,015160	0,009288
19	0,000528	0,000260	44	0,001715	0,000950	69	0,016946	0,010163
20	0,000549	0,000277	45	0,001948	0,001043	70	0,018920	0,011165
21	0,000573	0,000294	46	0,002198	0,001148	71	0,021071	0,012339
22	0,000599	0,000312	47	0,002463	0,001267	72	0,023388	0,013734
23	0,000627	0,000330	48	0,002740	0,001400	73	0,025871	0,015391
24	0,000657	0,000349	49	0,003028	0,001548	74	0,028552	0,017326
25	0,000686	0,000367	50	0,003330	0,001710	75	0,031477	0,019551
26	0,000714	0,000385	51	0,003647	0,001888	76	0,034686	0,022075
27	0,000738	0,000403	52	0,003980	0,002079	77	0,038225	0,024910
28	0,000758	0,000419	53	0,004331	0,002286	78	0,042132	0,028074
29	0,000774	0,000435	54	0,004698	0,002507	79	0,046427	0,031612
30	0,000784	0,000450	55	0,005077	0,002746	80	0,051128	0,035580
31	0,000789	0,000463	56	0,005465	0,003003	81	0,056250	0,040030
32	0,000789	0,000476	57	0,005861	0,003280	82	0,061809	0,045017
33	0,000790	0,000488	58	0,006265	0,003578	83	0,067826	0,050600
34	0,000791	0,000500	59	0,006694	0,003907	84	0,074322	0,056865
35	0,000792	0,000515	60	0,007170	0,004277	85	0,081326	0,063907
36	0,000794	0,000534	61	0,007714	0,004699	86	0,088863	0,071815
37	0,000823	0,000558	62	0,008348	0,005181	...	...	...
38	0,000872	0,000590	63	0,009093	0,005732	114	0,904945	0,896693
39	0,000945	0,000630	64	0,009968	0,006347	115	1,000000	1,000000

Source: Johansen, Robert J. (1996), see SOA Tables 884-885 in http://mort.soa.org/