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## Financial Actuarial Assumptions: Empirical Study of How Brazilian Companies Manage Their Defined Benefit Plans

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### ABSTRACT

This study investigates the factors that Brazilian companies use to manage their defined benefit plans, specifically the determinants of the three financial actuarial assumptions: discount rate, expected return on assets and compensation growth rate. The focus of this research is the companies listed on the B3 – Brazilian Stock Exchange - that recognized and disclosed, from 2010 to 2017, post-employment benefit characterized as Defined Benefit (DB). The sample containing 296 firm/year was divided into two subgroups considering the firm's political connections. The results suggest that politically connected companies are less effective in managing the solvency of funds or, according to Kido, Petacchi and Weber (2012) act intentionally to justify the company's financial stress. The year before the elections proved to be the most relevant period of discretion, while the specific year of the electoral election only influences the determination of the actuarial financial premises in politically connected companies and, just like in Naughton, Petacchi and Weber (2015) the manager acts to improve the solvency (reduce the deficit) of the pension fund in these periods. The hypothesis that politically connected companies have an incremental adjustment in actuarial assumptions in electoral years has shown results consistent with the theory suggesting that this group of companies manages the reduction of the actuarial deficit in election times more incisively.

*Keywords:* Pension Funds, Defined Benefit, Political Connection

### Introduction

The focus of this research is the companies listed on the Brazilian Stock Exchange (B3) that recognized and disclosed, in the period from 2010 to 2017, post-employment benefit characterized as Defined Benefit (DB). In particular, considering the current scenario of uncertainties regarding the capacity of the Brazilian public authorities to manage pension funds for their employees, it is salutary to question whether companies, controlled by this same

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government, can offer beneficiaries of DB plans a peaceful retirement, without the risk of lack of resources or the need for additional unforeseen contributions. At the Federal level, in addition to the budgetary problem (the so-called social security gap) which directly affects public investment and, consequently, Brazilian companies, also appear in the news headlines the blunt and scandals of reckless management of Closed Private Supplementary Retirement Entities, for example, POSTALIS (of the Brazilian Post) and FUNCEF (of *Caixa Econômica Federal*).

In this environment, the review of the CPC 033 (R1) – Employee benefits (equivalent to the amendments to IAS 19 - Employee Benefits, issued by the IASB - International Accounting Standards Board) was effective in Brazil in 2013 and brought, as a novelty, the obligation of full recognition of all actuarial gains and losses that until then could be amortized smoothly.

Moreover, by definition, it is characteristic of DB plans that a substantial part of the actuarial and investment risk falls on the sponsoring companies, including the obligation to make additional contributions to cover eventual deficits. Thus, academic research shows that managers use the complexity of market understandings, standardization loopholes and the difficulty of predicting all actuarial assumptions with a reasonable level of accuracy, to assume actuarial assumptions that best suit their interests (Bergstresser, Rauh, & Desai, 2006; Comprix & Muller, 2011).

In this way, the current scenario contemplates a) a new regulatory framework that began to demand more transparency from companies in recognizing actuarial obligations; b) fiscal crisis in Brazil, with an imminent need to cut spending by the government and c) a fertile field of possibilities for discretion, especially concerning the adoption of actuarial assumptions. Thus, this research aims to investigate which factors that companies listed on the stock exchange, connected politically, are used to manage their defined benefit plans, specifically in the determinants of the three financial actuarial assumptions: discount rate, expected return on assets and compensation rate.

Empirical analyzes were carried out from 2010 to 2017, totalling 296 firm/year. The results suggest that politically connected companies are less effective in managing the solvency of funds or, according to Kido, Petacchi and Weber (2012) act intentionally to justify the company's financial stress. The year before the elections proved to be the most relevant period of discretion, while the specific year of the electoral election only influences the determination of the actuarial financial premises in politically connected companies and, just like in Naughton, Petacchi and Weber (2015) the manager acts to improve the solvency (reduce the deficit) of the pension fund in these periods. The hypothesis that politically connected companies have an incremental adjustment in actuarial assumptions in electoral years has shown results consistent with the theory suggesting that this group of companies manages the reduction of the actuarial deficit in election times more incisively.

## **Theoretical framework**

### *Defined benefit plans*

Closed Private Pension Entities (CPPE), commonly called Pension Funds, operate in the form of private law or civil society foundations and are non-profit making. Its main function is to manage and operate pension benefit plans created by companies (sponsors) for its employees (participants). The points that deserve attention are:

- There are three sources of funds in pension plans: the contribution of the employee, that

of the sponsor and the profitability achieved by investing the fund's assets;

- The outflow of resources is made through the payment of administrative expenses to fund the very operation of the CPPE and the payment of benefits due;

- According to the statute approved at the meeting, CPPE may invest the plan assets in 5 types of investments: federal bonds, equities, real estate and loans to employees and others.

CPPEs can manage three types of employee benefit plans: defined contribution (CD), variable contribution (VC) and defined benefit (DB). In the defined benefit (DB) plan there is an understanding that the entity should provide the agreed benefits to current and former employees so that actuarial risk and investment risk (that the benefits will cost more than expected) fall substantially on the entity. Novy-Marx and Rauh (2009) define that the purpose of the DB pension fund, in the public sector, is to deliver the contractually pre-specified value to employees, with all taxpayers acting as guarantors for any shortcomings.

According to Picconi (2006), the main management measures for DB pension plans are: funded status (FS), project benefit obligation (PBO) which is the total of obligations, present and future, brought to present value), fair value pension asset (FVPA), the discount rate (DR), the expected rate of return of the asset (ERR) and compensation rate (CR). We highlight the concept of the financial situation of the plan (funded status) which is the difference between the fair value of the assets and the defined benefit obligations brought to present value ( $FS = FVPA - PBO$ ). The biggest challenge in the DB plans accounting is to define actuarial assumptions, such as inflation, DR, ERR and CR, that represent the sponsor's dynamics concerning the future demographics of its current and former employees.

*Regulatory evolution and relevance of post-employment benefit accounting information*

Napier (2009) made a historical retrospective, starting from the 70s of the principles that guide the accounting of post-employment benefits.

Just as it was done by Coronado, Mitchell, Sharpe and Blake Nesbitt (2008), Napier (2009) criticized the practice of smoothing the corridor method and defends disclosure as a tool to avoid unwanted surprises. His final words sum up the story of the evolution of post-employment benefit accounting: “Say what this actually means” (in free translation). In this context, the timeline of Figure 1 shows that the normative bodies moved in the direction indicated by Napier (2009).

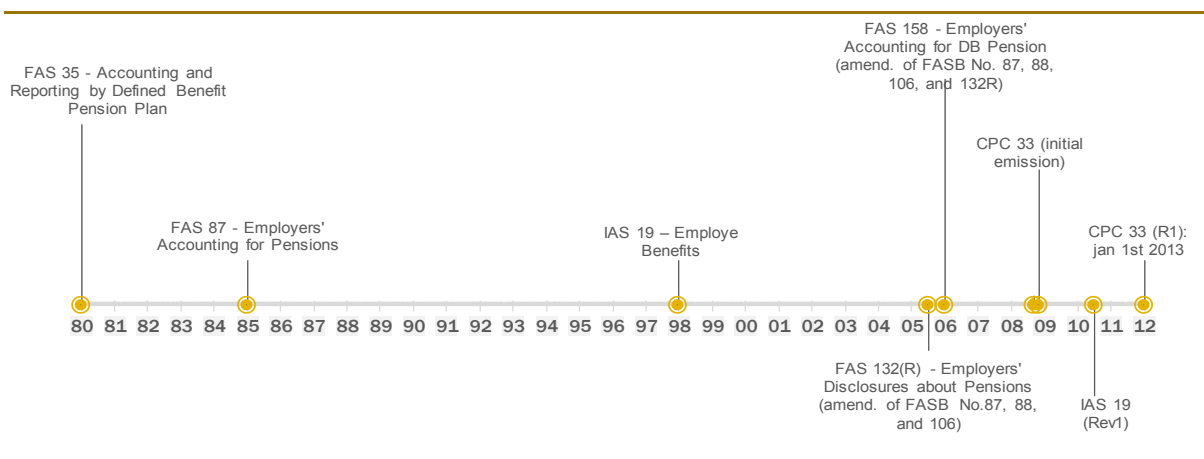


Figure 1. Timeline with the main regulatory frameworks for post-employment benefit accounting

Note: Author's own elaboration

It was with the adoption of SFAS 158<sup>1</sup>, from the year of 2006, that the scenario began to change, triggering a series of studies after its mandatory. Shin and Yu (2016) showed a gain in analyst pricing using information from DB plans when comparing the period before and after SFAS 158. Mitra and Hossain (2009) showed that there is a negative relationship between the value of the shares and the magnitude of the adjustments resulting from the adoption of this standard. In short, the new changes chose actuarial assumptions by managers, that until then was neglected by the market, now it has to be done with more caution because the possibilities of discretion have decreased (Li & Klumpes, 2013).

#### *Discretion in accounting for DB plans*

Bergstresser, Rauh and Desai (2006), Picconi (2006), Coronado, Mitchell, Sharpe and Blake Nesbitt (2008), Shin and Yu (2014) point out as the main reason for analysts not to incorporate in their forecasts all changes in DB pension plans the complexity of understanding actuarial calculations. Managers use this complexity, the standardization loopholes and the difficulty of predicting all actuarial assumptions with a reasonable level of accuracy, to assume assumptions that best suit their interests. These choices are not always the best to plan beneficiaries. If the manager wants to maximize the revenue recognized in the Income Statement or reduce the actuarial deficit recognized in the balance sheet, it would be enough to increase the ERR. Until 2012, if there were significant differences between the predicted and realized (that is, actuarial gains or losses), recognition could be smoothed using the corridor method, making the device advantageous to managers with other interests in addition to ensuring the financial health of the funds (Bergstresser, Rauh, & Desai, 2006; Chaudhry, Au Yong, & Veld, 2017; Comprix & Muller, 2011; Stefanescu, Wang, Xie, & Yang, 2018).

A similar analysis can be made from the perspective of the present value of actuarial obligations (Projected Benefit Obligation-PBO). However, unlike the Fair Value Pension Asset (FVPA), which had only one relevant financial, actuarial assumption, PBO is affected by the discount rate, compensation rate, and all biometric and demographic assumptions.

Bergstresser, Rauh and Desai (2006) brought up the reasons for manipulating the expected rate of return (ERR) on assets ranging from merger and acquisition possibilities to bonus options. However, they did not identify a direct relationship between the asset allocation in equity (higher return) that would justify the increase in ERR. The results by Rauh (2009) show that the choice of the best investment portfolio for the assets of the DB fund depends on the sponsor's default risk. As for Comprix and Muller (2011), they suggest an opportunistic behaviour of managers, when choosing both ERR and DR, whenever they wanted to close DB pension plans, sell their shares or compensate for poor investment results. According to the authors, one of the reasons for closing the DB plan is the need to reduce expenses or the sponsor's risk. For this, in an attempt to get support from employees, they left the plan excessively burdensome to the beneficiaries.

Li and Kumples (2013) pointed out the use of ERR and the compensation rate as a way to manage leverage in UK companies. Managers also have a greater incentive to increase DR, the greater the deficit in the plan (underfunded status) (Fried & Davis-Friday, 2013). Moral Hazard

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<sup>1</sup> Statement of Financial Accounting Standard (SFAS) 158 – Employers' Accounting for Defined Benefit Pension and Other Postretirement Plans.

and risk-shifting hypotheses are also present in the DB pension fund literature in the studies developed by Choy, Lin and Officer (2014) and by Klumpes, Whittington and Li (2009) when analyzing the reasons for closing (freeze) and reduction of plans (curtailment).

Rauh (2009) and An, Huang and Zhang (2013) investigated the risk determinants in the investment strategy of BD pension plan assets. Both works found results consistent with the risk management hypothesis, in which the sponsor takes less risk, the higher the company's credit risk (bankruptcy risk) and lower level of funding ratio. However, An, Huang and Zhang (2013), when analyzing a sub-sample formed by companies with financial stress (bankruptcy), with companies that closed or converted DB funds to DC, identified that the sponsor changed its behaviour and started to assume greater risks in its pension funds, following, in this case, the risk-shifting hypothesis (Moral Hazard). For Choy, Lin and Officer (2014), BD pension funds act as “inside debt” protecting beneficiaries while the fund is open. However, by closing it (freeze), the sponsor substantially increases the investment in risky assets.

In the thesis defended by Kühl (2017), the Theory of Political Cycles is used to justify fluctuations in the economy that occur through cyclical movements in pre-election and post-election periods. Such fluctuations, which tend to be greater when there are uncertainties about the outcome of the election, suggest the government's lack of commitment to economic activity and aims to maximize voter votes. According to the same author, government officials act politically in order to change the economic variables that are within their reach, in order to increase the probability of remaining in power.

Concerning the public sector DB plan, the management of funding status is related to elections (Kido, Petacchi & Weber, 2012), need to raise taxes, cut expenses or forecast rising personnel costs (Naughton, Petacchi & Weber, 2015) or even the obligation to comply with the public budget (Chaney, Copley, & Stone, 2002). Depending on the financial stress of the public entity, it increases revenues and decreases recognized expenses only by acting in an opportunistic manner, managing discount rates or expected rates of return on assets. Another incentive for government officials is to improve the solvency of the fund close to the elections in order to garner good public repercussions. Novy-Marx and Rauh (2009) showed that American State Governments use much higher discount rates than they should, underestimating the real actuarial liabilities.

These results suggest that the sponsor adopts the most appropriate investment strategy for the company's financial situation and is not concerned with achieving higher rates of return with a focus on maximizing the beneficiary's income or decreasing the possibility of additional future contributions.

### *Hypothesis development*

In efficient management of pension funds, it is expected that the factors that explain the choice of financial, actuarial assumptions are those that characterize the plan's management of the plans and not exogenous events such as election, change of norms, results and characteristics of the sponsor. Kido, Petacchi and Weber (2012) managed to show that the government recognizes a smaller actuarial deficit in election years, especially if they are suffering from fiscal and budget problems. The intuition that justifies this discretion, according to the authors, is that cutting spending or raising taxes in an election year affects voters' choice. Novy-Marx and Rauh (2011) also show that the government uses a higher discount rate to bring its

obligations to present value, causing a downward bias for the deficit of DB plans. It is observed, therefore, that the government is an active agent in the definition of the premises and, therefore, in the management of the solvency of public pension funds. It should be noted, however, that these surveys were carried out considering the informational and regulatory environment in the United States, more efficient than the Brazilian, where companies have greater autonomy without government interference.

A peculiar Brazilian characteristic is that the regulatory agency responsible for supervising closed private pension funds, PREVIC – National Superintendence of Complementary Pensions, is kept under the scrutiny of the Federal Government since the agency is directly linked to the Ministry of Finance. Thus, pension funds controlled by the government are therefore inspected by the government itself, weakening the regulatory system.

Therefore, it is assumed that companies by sponsoring defined benefit pension funds controlled by the government, directly or indirectly, allow managers a greater discretion on its pension plans. Indeed, these companies manage their defined benefit plan according to the government's interests. Besides, due to the recent cases of corruption and reckless management of public funds, it is reasonable to hypothesize that the Brazilian government manages funds with an upward bias of the actuarial deficit, that is, it manages the actuarial assumptions in order to allow a critical situation of insolvency to obtain popular appeal for extra money concessions (Naughton, Petacchi & Weber, 2015).

Subject to the level of corruption and economic development, Faccio (2010) also showed that politically connected companies underperformed unconnected companies. Thus, when identifying companies listed on B3, sponsors of defined benefit plans, and politically connected, it is possible to propose the following hypothesis:

*H1: Sponsoring companies, politically connected, manage actuarial assumptions to increase the actuarial deficit of DB pension plans.*

The moment of the election in Brazil is always a moment for the government to “show results”, improve results and complete works. Also, as employees are sensitive to social security and post-employment benefits issues, pension fund results influence voting decisions or affect job satisfaction (Kido, Petacchi & Weber, 2012).

In addition, Brazilian elections are always times of uncertainty and risk for all companies. Kühl (2017) addresses the Theory of Political Cycles to explain the use of public or economic policies by government officials in order to achieve permanence in power, demonstrating an “opportunistic” behaviour of the government in these periods. From this Theory, it can be inferred that the government manipulates, in the period before the elections, economic variables, such as unemployment rate, interest rate and inflation.

Thus, considering that the actuarial assumptions are sensitive to economic variables, it is hypothesized that, in electoral years, companies with DB plans protect themselves from political risk and take advantage of fluctuations in the rate of inflation and interest to manage actuarial assumptions in order to reduce their actuarial deficit. Thus, it follows that:

*H2a: Sponsoring companies manage actuarial assumptions to reduce the actuarial deficit of DB pension plans in electoral years.*

Politically connected companies are subject to greater public scrutiny with press follow-up, especially in electoral periods. The fact that the company is connected to the public sector can

be a driver to boost results at this time so that the manager has an extra incentive to improve the results of the company and pension funds (Chaney, Faccio, & Parsley, 2011; Bradley, Pantzalis, & Yuan, 2016). Thus;

*H2b: Sponsoring companies, politically connected, manage actuarial assumptions in order to have a marginally larger reduction in the actuarial deficit of DB pension plans in electoral years.*

## Research methodology

### *Model assumptions: definition of dependent variables*

In order to capture the existing management bias in the definition of the actuarial premise chosen by the company, Fried and Davis-Friday (2013) proposed in their work the use of the dependent variable as being the difference of the actuarial premise (discount rate) and its benchmark (high-quality US government bonds “Moody's index of Aaa Corporate bond yields”), under the argument that, in this way, changes in the discount rate would be controlled by market conditions.

Thus, the three main dependent variables of this work are defined as follows:

- a)  $Ddesc_{it} = DR_{it} - ke\_adjusted_{it}$
- b)  $Derr_{it} = ERR_{it} - DI_t$
- c)  $Dcr_{it} = CR_{it} - NCPI_t$

Where  $DR_{it}$  is the discount rate that company  $i$  disclosed in the notes to the financial statements for the year  $t$ ;  $ERR_{it}$  is the expected rate of return on pension plan assets that company  $i$  disclosed in the financial statements for the year  $t$ ;  $DI_t$  is risk-free rate proxy and represents the weighted average of the rates on daily loans made between banks through interbank deposit certificates<sup>2</sup> accumulated for the year  $t$ ;  $CR_{it}$  is the expected compensation long-term growth rate of  $I$  disclosed in the financial statements for the year  $t$ ;  $NCPI_t$  is the National Consumer Price Index<sup>3</sup>, an inflation rate proxy, accumulated for the year  $t$ .  $ke\_adjusted_{it}$  is the cost of capital of company  $i$  in the year  $t$ , calculated using CAPM<sup>4</sup> model adjusted to Brazilian risk.

$$ke\_adjusted_{it} = R^f + \beta \cdot Risk\ Premium + Brazil\ Risk_t$$

Regulatory bodies require companies to disclose the pension plan's asset allocation, informing the percentage invested in federal bonds, equities, real estate, loans and other. Amir and Bernartzi (1998), Bergstresser, Rauh and Desai (2006) and Chuk (2013) analyzed the relationship that exists between the expected rate of return and the different ways of allocating pension fund assets.

Adapting the study by Chuk (2013), equation (1) aims to explain the expected return on assets (ERR) through their allocations, disclosed in an explanatory note.

$$ERR_{i,t} = \alpha + \beta_1 Aloc_{bonds_{it}} + \beta_2 Aloc_{equity_{it}} + \beta_3 Aloc_{realty_{it}} + \beta_4 Aloc_{loan_{it}} + \beta_5 Aloc_{other_{it}} + \beta_6 ARR_{it} + \sum_{n=7}^{14} \beta_n YEAR + \sum_{n=15}^z \beta_n SECTOR + \varepsilon_{it}(1)$$

<sup>2</sup> Values extracted from <http://estatisticas.cetip.com.br/in> August/2018.

<sup>3</sup> in August / 2018 <https://ww2.ibge.gov.br/in> August/2018.

<sup>4</sup> The risk-free rate and the American risk premium extracted from <http://pages.stern.nyu.edu/~adamodar/> Brazil risk is the annual average of EMBI+ extracted from <http://www.ipeadata.gov.br/> Beta correlated with S & P500 extracted from Economática. Non-tabulated data.

An, Huang and Zhang (2013) showed that companies, depending on the level of unionization, the marginal tax benefit and the need to justify the actuarial assumptions chosen, may be more likely to be exposed to risk when investing the pension fund's assets. In this way, the error term ( $\varepsilon_{it}$ ) is the component of  $ERR_{i,t}$  not explained purely by the performance of company  $i$  in allocating fund's asset in the year  $t$ . Chuck (2013) used the variable  $ERR\_notexplan_{it}$  as a proxy for the manager's unobservable incentives for changes in the ERR rate.

### Regression models

Taking as reference the studies by Billings, O'Brien, Woods and Vencappa (2017), Doyle (2016), Chuk (2013) and Fried and Davis-Friday (2013) it is possible to build a regression model with panel data (with fixed sector and year effect), in order to examine the factors that explain how companies manage their financial, actuarial assumptions ( $Ddesc_{it}$ ,  $Derr_{it}$  and  $Dcr_{it}$ ). In particular, in order to answer the research question, we intend to investigate whether the fact that the company is politically connected in a given year explains the actuarial premise adopted by it and whether the occurrence of majority elections for governor and president influence this choice.

The factors that influence the determination of the expected return on assets are mostly different from those that impact the actuarial obligations side ( $Ddesc_{it}$  and  $Dcr_{it}$ ). Thus, model 3 is proposed to estimate the  $Derr_{it}$  specifically.

$$\begin{aligned} Assumpt = & \alpha + \beta_1 elec_t + \beta_2 conect_{it} + \beta_3 elec_t \cdot conect_{it} + \beta_4 elec_{t-1} + \beta_5 elec_{t-1} \cdot conect_{it} \\ & + \beta_6 PIE_{it} + \beta_7 SOLV_{it} + \beta_8 ADJ_{it} + \beta_9 funding_{it} + \beta_{10} DUR_{it} + \beta_{11} CONT_{it} \\ & + \beta_{12} MIX_{it} + \beta_{13} SIZE_{it} + \beta_{14} ROA_{it} + \beta_{15} LEVER_{it} + \beta_{16} BIG4_{it} \\ & + \beta_{17} CPC33_t + \sum_{n=18}^z \beta_n YEAR + \sum_{n=z+1}^t \beta_n SETOR \quad (2) \end{aligned}$$

$$\begin{aligned} Derr_{it} = & \alpha + \beta_1 elec_t + \beta_2 conect_{it} + \beta_3 elec_t \cdot conect_{it} + \beta_4 elec_{t-1} + \beta_5 elec_{t-1} \cdot conect_{it} \\ & + \beta_6 PIE_{it} + \beta_7 SOLV_{it} + \beta_8 ERR_{notexplan_{it}} + \beta_9 PENSENS_{it} + \beta_{10} lnFVPA_{it} \\ & + \beta_{11} ARR_{it} + \beta_{12} ARR_{it-1} + \beta_{13} ROA_{it} + \beta_{14} BIG4_{it} + \sum_{n=15}^z \beta_n YEAR \\ & + \sum_{n=z+1}^t \beta_n SETOR \quad (3) \end{aligned}$$

Table 1. Definition of variables for models 1 to 3

Variable	Definition	Obs.
$ERR_{it}$	Actuarial assumption of expected return on fund pension assets at the beginning of the year (= end of the previous year)	Model 1 (Chuk, 2013)
$Aloc_{bonds_{it}}$	It is the % of the assets of the DB fund allocated in: - Bonds - Equities - Real Estate - Loans to beneficiaries of the fund itself - Others	Model 1 (Chuk, 2013)
$Aloc_{equity_{it}}$		
$Aloc_{realty_{it}}$		
$Aloc_{loan_{it}}$		
$Aloc_{other_{it}}$		
$ARR_{it}$	= Actual return on assets/ $FVPA_{t-1}$ When not informed by the company, calculated as:	Models 1 and 3 (Chuk, 2013)

	$= (\text{Actuarial result} + \text{interest on assets}) / \text{FVPA}_{t-1}$	
<i>Ddesc<sub>it</sub></i>	$= \text{DR}_{it} - \text{ke\_adjusted}_{it}$	
<i>Derr<sub>it</sub></i>	$= \text{ERR}_{it} - \text{DI}_t$	
<i>Dcr<sub>it</sub></i>	$= \text{CR}_{it} - \text{NCPI}_t$	Models 2 to 3
	These are financial actuarial assumptions informed by the companies in an explanatory note, subtracted from the respective benchmarks.	(See section 3.1)
	Where DR (Discount Rate); ERR (Expected Rate of Return); CR (Compensation Rate)	
<i>elec<sub>t</sub></i>	Dummy variable = 1 in election year and 0 otherwise Election in 2010 and 2014	Models 2 to 3 Kido, Petacchi and Weber, 2012; Naughton, Petacchi and Weber, 2015
<i>conect<sub>it</sub></i>	Dummy variable = 1 if government holds control of company <i>i</i> in year <i>t</i> , and 0 otherwise	Models 2 to 3
<i>elec<sub>t</sub>.conec</i>	Variable to capture the incremental effect of being a connected company in an election year	Models 2 to 3
<i>elec<sub>i,t-1</sub></i>	Lagged dummy variable of <i>elec<sub>t</sub></i> . It will be equal to 1 in the years prior to the election and 0 otherwise	Models 2 to 3
<i>elec<sub>t-1</sub>.con</i>	Variable to capture the incremental effect of being a connected company in the year before the election	Models 2 to 3
	Pension Income Effect	
<i>PIE<sub>it</sub></i>	The aggregate of pension plan entries to the income statement and the statement of recognized gains and losses, divided by book value of equity	Models 2 to 3 Billings, O'Brien, Woods and Vencappa, 2017
<i>SOLV<sub>it</sub></i>	$= \frac{\text{FVPA}_t - \text{PBO}_t}{\text{Total Asset}_t} = \frac{\text{Funded Status}}{\text{Total Asset}_t}$	Models 2 to 3 Byrne, Clacher, Hillier and Hodgson, 2013; Fried and Davis-Friday, 2013
<i>ADJ<sub>it</sub></i>	It is the difference between the FS and the amount that was disclosed in the Balance Sheet = $\frac{\text{Funded Status} - \text{Net value Recon.}}{\text{Total Asset}_t}$	Model 2 Fried and Davis-Friday, 2013
<i>funding<sub>it</sub></i>	$= \frac{\text{FVPA}_t}{\text{PBO}_t}$	Model 2 Chaudhry et. al., 2017; Chuk, 2013
<i>DUR<sub>it</sub></i>	Proxy for the Duration of the obligation (PBO) $= \frac{\text{Current service cost}_t}{\text{Current service cost}_t + \text{Interest expense}_t}$	Model 2 Fried and Davis-Friday, 2013
<i>CONT<sub>it</sub></i>	$= \frac{\text{Contributions made by the firm}_t}{\text{PBO}_{t-1}}$	Model 2 Fried and Davis-Friday, 2013
<i>MIX<sub>it</sub></i>	$= \frac{\% \text{aloc\_equity}_t}{\% \text{aloc\_bonds}_t}$ , proxy for greater risk-taking	Model 2 Chuk, 2013
<i>SIZE<sub>it</sub></i>	$= \ln(\text{total asset}_t)$	Model 2 Fried and Davis-Friday, 2013
<i>ROA<sub>it</sub></i>	$= \frac{\text{net income}_t}{\text{Total Asset}_t}$	Models 2 to 3 Fried and Davis-Friday, 2013
<i>LEVER<sub>it</sub></i>	$= \frac{\text{Longtermdebt}_t}{\text{TotalAsset}_t}$	Model 2 Fried and Davis-Friday, 2013
<i>BIG4<sub>it</sub></i>	Dummy variable = 1 if company <i>i</i> is audited by Big4 in year <i>t</i> and 0 otherwise. Proxy for corporate governance.	Models 2 to 3
<i>CPC33<sub>t</sub></i>	Dummy variable = 1 if the year <i>t</i> ≥ 2013 and 0 otherwise. As of 2013, the adoption of the CPC33 (r1) became mandatory.	Models 2 and 3
<i>ERR_noexp</i>	See section 3.2 It is the estimated error of the regression (1).	Model 3 Chuk, 2013
<i>PENSENS<sub>it</sub></i>	Pension Sensitivity $= \ln \left( \frac{\text{FVPA}_{t-1}}{\text{EBIT}_t} \right)^2$	Model 3 Comprix and Muller, 2011; Doyle, 2016
<i>lnFVPA<sub>it</sub></i>	$= \ln(\text{FVPA}_t)$	Model 3 Comprix and Muller, 2011; Doyle, 2016
<i>ARR<sub>it-1</sub></i>	Lagged variable of <i>ARR<sub>it</sub></i>	Model 3 Doyle, 2016

### Collection and sample selection

Table 1 shows the survey of the database for this research was based on hand-collected data. It was necessary to collect the information individually in the financial footnotes<sup>5</sup>.

Table 2. Sample selection procedure

<i>Source</i>	<i>Observations (firms/year)</i>
Firm/year observations between 2010 and 2017, with sufficient information to prepare the pension fund accounting, of companies listed on the B3 that are SPONSORED to defined benefit plans.	456
<u>Minus</u>	
Observations companies/year between 2010 and 2017, with insufficient information to calculate the dependent variable and those independent of the model (missing values)	(144)
Negative book value or negative FVPA	(16)
Firm/year observations used to estimate the model	296
Number of observations per year	
2010	31
2011	37
2012	37
2013	36
2014	38
2015	37
2016	40
2017	40
Total	296
<i>Number of observations divided by sector per year</i>	
<i>SECTOR</i>	2010 2011 2012 2013 2014 2015 2016 2017 Total
<i>Foods</i>	2 2 2 2 2 2 2 2 16
<i>Electric Power</i>	9 11 10 10 11 11 13 14 89
<i>Finance and Insurance</i>	3 5 5 5 5 5 7 6 41
<i>Mining</i>	1 1 1 1 1 1 1 1 8
<i>Non-Metal Minerals</i>	2 2 2 2 2 2 2 2 16
<i>Others</i>	2 2 2 2 2 2 2 2 16
<i>Oil and Gas</i>	2 2 2 2 2 2 2 2 16
<i>Chemistry</i>	2 2 1 1 2 2 1 2 13
<i>Steel &amp; Metallurgy</i>	3 3 3 3 3 3 3 3 24
<i>Telecommunications</i>	2 3 3 3 2 2 2 2 19
<i>Textile</i>	1 1 2 2 2 1 1 1 11
<i>Vehicles and parts</i>	2 3 4 3 4 4 4 3 27
	31 37 37 36 38 37 40 40 296

Based on the Theory of Political Connections and the study by Macedo, Silva and Machado (2015), the sample was divided into two subgroups: a) sponsoring companies that have political connections with the government and b) sponsoring companies that do not have political connections with the government. Faccio (2010) and Chaney, Faccio and Parsley (2011) consider that, in order to have a political connection, the company would need to have in its board of shareholders with, at least, 10% voting capital, someone from Congress or at least very close to influential parties and politicians. In this research, we adopted the control criterion, that is, politically connected companies are controlled by the government or by any other organization linked to the government.

The classification used is quite different from that made by Economática. For example, Vale S.A., on Economática is classified as private; however, in this study, it is classified as politically connected since the controlling shareholder is the company LITTEL, which in turn, it is

<sup>5</sup> The post-employment defined benefit information was collected in the financial reports of each company, through the link: [http://www.bmfbovespa.com.br/pt\\_br/produtos/listados-avista-e-derivativos/renda-variavel/empresas-listadas.htm](http://www.bmfbovespa.com.br/pt_br/produtos/listados-avista-e-derivativos/renda-variavel/empresas-listadas.htm).

controlled by the pension funds PETROS and PREVI, which are pension funds controlled essentially by the government.

Table 3. Forms of political connection and the criteria used to classify the sponsoring companies

Types of Political Connection		Criterion used for $Conect_{it} = 1$
<i>Explicit</i>	Government and its organizations as shareholders of the company	Government holds control of the company (majority of the voting capital or shareholders' agreement)
<i>Implicit</i>	Participation in companies through a pyramid structure, that is, the government is a partner in one company and that owner/partner in another.	

Source: Macedo, Silva and Machado (2015) Adapted by the author

## Analysis of results

### Descriptive statistics

In analyzing Table 4, it is observed that the three actuarial assumptions are, on average, greater than the respective benchmarks. At first, it could indicate some downward of the funds' solvency. However, both  $SOLV_{it}$  as well as  $Funding_{it}$  indicate that, on average, present value obligations are greater than the present value of assets.

In the words of Brown and Pennacchi (2016, p.7) “the appropriate discount rate to use for measuring funding shortfalls is the default-free rate, even if the liabilities are not default-free”. However, the mean of the variable  $Ddesc_{it}$  is about 2% higher than the cost of equity (benchmark used) which, by definition, already has a risk premium associated with it. This result is an indication that the sponsoring companies are using, on average, discount rates higher than that indicated in CPC033.

In Table , it is observed that the dependent variables are different, on average, between the two subgroups, which suggests the different treatment given the premises depending on the political control environment to which the company is subject. Politically connected companies adopt higher discount rates, on average, which would tend to management to obtain smaller actuarial deficits. Although Wilcox and Brown (2009) defend the use of risk-free default discount rates, they argue that the governments' taxing power provides a long-term view of the funds it controls and that, thus, it encourages the government to adopt higher actuarial rates (with embedded risk) to support the market risk and the sponsor's entire business cycle.

Table 4. Descriptive statistics

	<i>N</i>	<i>Mean</i>	<i>St. deviation</i>	<i>Min</i>	<i>P10</i>	<i>P50</i>	<i>P90</i>	<i>Max</i>
<i>Ddr<sub>it</sub></i>	296	0.021	0.028	-0.047	-0.024	0.026	0.052	0.069
<i>Derr<sub>it</sub></i>	296	0.001	0.025	-0.071	-0.030	0.001	0.036	0.044
<i>Dcr<sub>it</sub></i>	296	0.002	0.024	-0.058	-0.035	0.005	0.032	0.051
<i>Elec<sub>it</sub></i>	296	0.233	0.424	0.000	0.000	0.000	1.000	1.000
<i>Conect<sub>it</sub></i>	296	0.405	0.492	0.000	0.000	0.000	1.000	1.000
<i>Elec<sub>it-1</sub></i>	296	0.250	0.434	0.000	0.000	0.000	1.000	1.000

### CONTROLS

Definition of variables according to Table 1. All variables were winsorized to 2.5% two-tailed

Regarding the expected rate of return on assets ( $Derr_{it}$ ), considering the data of the entire sample (Table 4), it is practically equal to the DI rate used as a benchmark, which suggests that, on average, assets are not allocated to risky investments. However, when separating the sample (Table 5), the average test indicates that companies with a political connection have  $Derr_{it}$  positive (negative for the other subgroup).  $Derr_{it}$  directly impacts company revenue, and part of the rate difference between subgroups can be explained by the variable  $Pensens_{it}$ . This

variable captures how much of the expected return on fund assets impacts on companies' Ebit. Even with  $Derr_{it}$  higher, politically connected companies are less solvent on average.

Another explanation for the adoption of different assumptions between these two groups is the incentive to the Moral-Hazard problem. Pennacchi and Rastad, (2011) called this problem “accounting arbitration”, that is, a pension fund has an incentive to contract more risk in investments (greater  $Derr_{it}$ ) to justify the adoption of discount rates ( $Ddesc_{it}$ ) and thus reduce their actuarial deficits.

*Model results: actuarial financial assumptions*

Table 5 presents the results of the estimates of models 2 and 3, considering estimation in a panel data, with fixed effect, controlled by time and sector.

Table 5: Mean difference test in sponsors subgroups

Sponsor	Politically Unconnected (N=176)	Politically Connected (N=120)	Difference test	
	Mean	Mean	t test	Standard Deviation
Panel A: Actuarial assumptions (dependent variables)				
Ddr <sub>t</sub>	0.018	0.026	**	(0.0033)
Derr <sub>t</sub>	-0.003	0.007	***	(0.0028)
Dcr <sub>t</sub>	-0.002	0.006	***	(0.0029)
Panel B: Independent variables				
SOLV <sub>it</sub>	-0.005	-0.026	***	(0.0049)
DUR <sub>it</sub>	0.120	0.050	***	(0.0133)
MIX <sub>it</sub>	0.191	0.345	***	(0.0510)
Pensens <sub>it</sub>	-1.138	2.249	***	(0.337)
lnFVPA <sub>it</sub>	13.080	15.450	***	(0.227)
Panel C: Control variables of the sponsoring company				
SIZE <sub>it</sub>	16.700	17.630	***	(0.197)
LEVERAGE <sub>it</sub>	0.306	0.371	**	(0.0323)
ROA <sub>it</sub>	0.052	0.023	***	(0.0063)

Variables definition, according to Table 1. Non-significant differences were not tabulated.

The results suggest that it is not possible to reject H1 hypothesis that politically connected Brazilian companies manage actuarial assumptions in order to increase the deficit of their DB pension plans and also corroborate the results by Begley, Chamberlain, Yang and Zhang (2015), Comprix and Muller (2011); Klumpes, Whittington and Li (2009) and Stefanescu, Wang, Xie and Yang (2018).

The variable  $Elec_{it}$  is significant only for the expected rate of return on assets. The pre-electoral year, although significant for the three actuarial assumptions, presented signs contrary to expectations for the discount rate and the compensation rate suggesting managers adopting an expansionist behaviour since the year before the elections.

The variable  $Elec.Conect_{it}$  separates the effects of the elections only in the subgroup of politically connected companies. This result suggests that, although elections are not a decisive factor for all companies, at least for this group, it is an important time to present numbers that please voters. Thus, it is not possible to reject the hypothesis H2b. However, the previous analysis assumes that the three financial assumptions are independent of each other; that is, companies define them without the influence of one assumption on the other.

Table 6. Estimation of models 2 and 3 in panel data

Variable	Expected Sign	$Ddr_t$		$Dcr_t$		$Derr_t$	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
$Elec_t$	(+) / (-) / (+)	0.002	(0.46)	-0.002	(-0.83)	0.048***	(37.02)
$Conect$	(-) / (+) / (-)	-0.042***	(-4.02)	0.03***	(4.97)	0.001	(0.94)
$Conect*Elec_t$	(+) / (-) / (+)	0.009**	(2.41)	0.000	(-0.11)	0.002*	(1.74)
$Elec_{t-1}$	(+) / (-) / (+)	-0.032***	(-6.60)	0.078***	(35.20)	0.027***	(16.45)
$Conect*Elec_{t-1}$	(+) / (-) / (+)	0.006	(1.23)	0.000	(0.23)	0.001	(0.97)
<b>CONTROLS</b>							
Companies-year		296		296		296	
$R^2$		0.56		0.893		0.976	
Sector Fixed Effect		YES		YES		YES	
Year Fixed Effect		YES		YES		YES	

Estimated regression with robust error, clustered by firm. All variables were winsorized to 2.5% two-tailed. The symbols “\*\*\*”, “\*\*” and “\*” indicate that the coefficient is significant at the level of 1%, 5% and 10%

Billings, O’Brien, Woods and Vencappa (2017) argue that the premises can be defined together and, thus, there is some correlation between them. Although he argues that the empirical models are well specified, they suggest using the econometric method no longer with panel data, but in SUR (Seemingly Unrelated Regression). This method assumes that the independent variables of the regressions are correlated through their error terms. Results not tabulated in SUR were partially divergent from those in panel data regression. Asthana (1999) and Chaudry et al. (2017) put as a possible explanation the problem of endogeneity between the dependent variables when defined simultaneously. One way to eliminate the possible endogeneity is to use an instrumental variable. Chuk (2013) proposed to estimate the discount rate using the expected return on assets (ERR) as the proportion of asset allocations. Table 6 presents the results for the regression of  $Ddr_t$  in the instruments of  $Derr_t$ .

Table 7. Estimation using instrumental variable

Instrumented variable: $Derr_{it}$			
Instruments: $Aloc_{bonds_{it}}$ $Aloc_{equity_{it}}$ $Aloc_{realty_{it}}$ $Aloc_{loan_{it}}$ $Aloc_{other_{it}}$			
Variable	Expected Sign	Discount Rate ( $Ddesc$ )	
		Coef.	z-stat
$Derr_t$	(+)	1.072***	(3.43)
$Elec_t$	(+)	-0.008	(-1.49)
$Conect$	(-)	-0.025**	(-2.28)
$Conect*Elec_t$	(+)	0.009*	(1.64)
$Elec_{t-1}$	(+)	-0.033***	(-3.37)
$Conect*Elec_{t-1}$	(+)	0.004	(0.76)
<b>CONTROLS</b>			
Companies-year		296	
$R^2$		0.3299	
Sector Fixed Effect		YES	
Year Fixed Effect		YES	

Estimated regression with robust error, clustered by firm. Definition of variables according to Table 1. Controls are defined in model 2. All variables were winsorized to 2.5% two-tailed. The symbols “\*\*\*”, “\*\*” and “\*” indicate that the coefficient is significant at the level of 1%, 5% and 10%. Over-identification test performed (Sargan statistics, p-value=0.1925).

The results are very close to those found considering the assumptions as independent (Table 5); therefore, it is not possible to reject hypotheses H1 and H2b. Again, the elections have only proved significant for politically connected companies.

It is observed that  $Derr_t$  was significant and positive, indicating that the two premises are jointly managed for the same intended result, that is, both increase or both decrease the actuarial deficit. It does not seem to have an offsetting effect.

### Robustness analysis

Finally, following Fried and Davis-Fried (2013), I propose a robustness test for the model. Two new dependent variables were elaborated:  $Change\_DR_t = DR_t - DR_{t-1}$  and  $Change\_CR_t = CR_t - CR_{t-1}$ , where DR is the discount rate, and CR is the compensation rate. The intuition is to measure the factors that change actuarial assumptions from one year to others. The model will be well specified if these factors are the same factors that explained the variables  $Ddr_t$  and  $Dcr_t$ .

Two points deserve attention concerning the results presented in Table 8. When using as a dependent variable the change in the actuarial assumption from one year to another, the problem of endogeneity is solved and, thus, it is possible to use the other actuarial premises as a regressor. Instead of using  $Derr_t$  as an independent variable, it was proposed to use  $ERR\_notexplan_{it}$  because the interest is to obtain the result controlled by the performance of the manager that cannot be explained from one year to another. Therefore, this variable captures behaviour that is not observable (Chuk, 2013). Although mostly results confirm prior analysis suggesting models are well specified, they indicate the prevalence of the manager's discretion in changing the discount rate about the change in the compensation rate assumption. It seems that manager changes the compensation rate just looking the discount rate changes.

Table 8. Estimation of the model for the analysis of robustness

Variable	Expected Sign	Change_DR <sub>t</sub>		Change_CR <sub>t</sub>	
		Coef.	t-stat	Coef.	t-stat
<i>ERR_notexplan<sub>it</sub></i>	?	0.184	1.37	0.0602	1.63
<i>CR</i>	(+)	0.100	1.23	-	-
<i>DR</i>	(+)	-	-	0.107**	2.46
<i>Elec<sub>t</sub></i>	(+) / (-)	0.009**	2.45	-0.003	-1.38
<i>Conect<sub>it</sub></i>	(-)	-0.0053	-0.73	0.002	0.55
<i>Conect*Elec<sub>t</sub></i>	(+)	0.007**	2.49	0.001	0.2
<i>Elec<sub>t-1</sub></i>	(+) / (-)	-0.023***	-11.0	-0.001	-0.61
<i>Conect*Elec<sub>t-1</sub></i>	(+)	0.005**	2.1	-0.003	-0.95
<b>CONTROLS</b>					
<i>Companies-year</i>		296		296	
<i>R<sup>2</sup></i>		0.647		0.174	
<i>Sector Fixed Effect</i>		YES		YES	
<i>Year Fixed Effect</i>		YES		YES	

Estimated regression with robust error, clustered by firm. Controls are defined in model 2. Definition of variables according to Table 1. All variables were winsorized to 2.5% two-tailed. The symbols “\*\*\*”, “\*\*” and “\*” indicate that the coefficient is significant at the level of 1%, 5% and 10%

The variable *Conect<sub>it</sub>*, although it was not significant; its signal appeared as expected. Once again, the electoral election appears as an important moment in changing actuarial premises, suggesting that managers tend to improve the actuarial deficit and that the reduction of this deficit is even more pronounced in companies that have a political connection. When analyzing the factors that influence changes in the premises, for the first time, the significance of the interaction is noted *Conect\*Elec<sub>t-1</sub>*. Even though in the previous year, the election was contrary to expectations, the interaction showed a positive sign, suggesting that the influence of political connections to change the discount rate.

### Conclusion

This research aims to investigate which factors the companies listed on the stock exchange,

politically connected, are used to manage their defined benefit plans, specifically in the determinants of the three financial actuarial assumptions: Discount Rate (DR), Expected Rate of Return (ERR) and Compensation Rate (CR). Empirical analyzes were performed with a sample of 296 firms/year, from 2010 to 2017. Results shed light on Moral Hazard problem faced by politically connected companies which manage their actuarial assumptions similar to the management made by the government. These companies are less effective in managing the funds solvency or, according to Kido, Petacchi and Weber (2012) act intentionally to justify the company's financial stress. This result is in line with Faccio (2010) that found results that showed that this group of companies is less efficient.

On the other hand, elections only influence the determination of financial actuarial assumptions in politically connected companies and, as well as in Naughton, Petacchi and Weber (2015) the manager acts to improve the solvency (reduce the deficit) of the pension fund in these periods. The hypothesis that politically connected companies have an incremental adjustment in actuarial assumptions in electoral years has shown results consistent with the theory suggesting that this group of companies manages the reduction of the actuarial deficit in election times more incisively.

Although results did not indicate that the electoral election has a direct influence on companies that recognized post-employment benefits with DB characteristics, the same cannot be said for the year before the elections. This fact is justified because the actuarial assumptions considered here are influenced by the future perspective of inflation and interest rates. It should be noted that the sense of managing the assumptions in the year before the election was contrary to what was expected; that is, managers, increase the actuarial deficit. One possible explanation would be, according to Faccio (2010), the high levels of corruption in Brazil in this period, which would increase the “benefits” that the political connection would bring to the company/manager, thus resulting in a variable with the same direction of *Conecti*.

Political bias is costly for taxpayers and beneficiaries of defined benefit pension plans (Bradley, Pantzalis, & Yuan, 2016). This research highlight the need for more efficient public policies and regulation in post-employment accounting to protect beneficiaries. It can be seen that the accounting standards in this area, although they are constantly evolving, leave space for manager’s discretion especially those who have a greater political connection.

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