UNIVERSIDADE DE SÃO PAULO
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Liquidity and Working Capital Management of Brazilian Electric Distribution Companies – A Comparative Study with US Market

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You can never cross the ocean until you have
the courage to lose sight of the shore.

(Christopher Columbus)

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ABSTRACT

Keywords: Energy. Electricity market. Distribution companies. Working Capital. Liquidity.

The electricity market is considered one of the main sectors in the economy. Without its infrastructure, no other industry can flourish. Given this importance, and the intrinsic characteristics of a natural monopoly in some segments of the sector (transmission and distribution), the presence of the government has been remarkable strong, special in Brazil. In this sense, this paper aims to analyze and compare the electricity distribution markets of Brazil and USA. However, rather than compare them in terms of engineering infrastructure, this paper relies on financial liquidity metrics. Besides that, the thesis explains the dynamic of the electricity industry in Brazil and run across multiples approaches to understand working-capital behavior. Lastly, it proposes a recast in terms of the distribution business model to be addressed by ANEEL in order to improve the regulation.

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LIST OF ABBREVIATIONS

Abradee	Brazilian Association of Electric Energy Distributors
ACL	Free Contracting Environment
ACR	Regulated Contracting Environment
ANEEL	National Electricity Agency
CCC	Cash Conversion Cycle
CCEE	Chamber of Commercialization of Electric Energy
CDE	Energy Development Account
CFR	Cash Flow Ratio
CFS	Cash Flow Statement
CGD	Working Capital
CIC	Cash Interest Coverage
CMSE	Energy Sector Monitoring Committee
CNPE	National Energy Policy Council
Discos	Distribution Companies
EA	Economic Assets
EBIT	Earnings Before Interest, Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation
EPE	Energy Research Company
ESS	System Service Charges
FY	Full Year
Gencos	Generating Companies
IGP-M	Market General Price Index
IPC-A	Wholesale Price Indexes
IRT	Annual Tariff Adjustment Index
MME	Ministry of Mines and Energy
MP 579	Provisional Measure 579
NCG	Working Capital Requirement
NWC	Net Working Capital
ONS	National System Operator
PLD	Difference Settlement Price
PROINFA	Alternative Sources Incentive Program
RAB	Regulatory Asset Base
ROA	Return on Asset
ROE	Return on Equity
ROIC	Return on Invested Capital
RTA	Annual Tariff Adjustment
RTE	Extraordinay Tariff Review
SEB	Brazilian Electrical System
SIN	National Interconnected Grid
ST	Treasury Balance

Transco	Transmission Companies
WACC	Weighted Average Capital Cost
WC	Working Capital

SUMARY

1. INTROUCTION

1.1 PROBLEM AND MOTIVATION

The growth of the countries' domestic production is largely due to the infrastructure sector, which has a significant impact on the general productivity of the economy and the well-being of the population.

The electricity sector constitutes one of the main pillars of the infrastructure system, as the growth of the nation is conditioned by the supply of electric energy. Therefore, without adequate energy infrastructure, the dynamism of a country's economy is not possible.

In this sense, this thesis aims to study the Brazilian segment of Distribution from the financial perspective and compare it with the American electricity market.

What motivates this study is the current public and private effort in shaping up a new sector model. Since 2016, public consultations were launched aiming to improve the regulatory framework for power utilities towards a new business environment.

The need of improvement is based on the consensus that (i) Brazil owns one the most expensive tariffs worldwide, despite having an easy access to a cheap source of energy (hydropower and wind); (ii) due to political motivation, tariffs have been manipulated, harming even more the sustainability of the sector; (iii) private investing are discouraged in the sector due to high regulation model.

Therefore, facing the existence of a no longer effective regulatory structure, this thesis aims to contribute to an improvement of Brazilian power sector regulation, by analyzing the impacts of government interference in the distribution segment and providing a model that favors companies’ financial sustainability.

1.2 OBJECTIVES

The two main objectives of this thesis are:

(i) Identify how government interference impacts liquidity and working capital indicators of electricity distribution companies;
(ii) Compare the Brazilian and American distribution segments from the perspective of the liquidity and working capital indicators.

Besides that, there are secondary objectives, as it follows:

a. Depict an industry overview of the Brazilian electricity sector;
b. Discuss the main liquidity and working capital indicators;
c. Depict the different models of distribution segment worldwide;
d. Understand the financial behavior of both Brazilian an American distribution companies;
e. Provide options for improvement in the current power utilities model.

1.3 METHOD

This work consists on a descriptive research and its method is divided into three main activities.

The first technical procedure used was the bibliographical research for the theoretical basis of liquidity and working capital, including materials with general knowledge of accounting.

In addition, documentary research was carried out by the collection of information about the electric power market, in particular the distribution sector, in order to capture its main characteristics. Due to the continuous changes in the sector, the research of this topic was not only based on academic papers, but also on materials from Investors Relations departments of listed companies of the sector and research reports from investment banking.

In order to analyze the distribution market in each country (Brazil and USA), data from the main companies were gathered as a good representation of the total market. Therefore, an experimental research was putting in place to collect specific public data of the company under analysis. For this purpose, it was used the Capital IQ, a platform provided by Standard & Poor's.

1.4 WORKPAPER STRUCTURE

The paper is divided into seven chapters, plus references and annexes. The first chapter, the Introduction, focus on explaining the goals of the paper, the motivation and the structure.

The second chapter consists of an industry overview of the Brazilian electricity sector, describing its four segments and its agents. Also, it highlights the political interference in the industry through the Provisional Measure 579 (MP579). The chapter ends with a brief description of the distribution business model in selected countries, focusing on the American market.

The next three chapters consist of a literature review about different methodologies to calculate liquidity and working capital. Chapters four and five illustrate indicators that are obtained from the Balance Sheet, using static and dynamic models, respectively. Chapter five includes other methodologies that could not be included in the previous chapters, such as bankruptcy prediction models and indicators that are obtained by Cash Flow Statement.

Chapter six shows how the data were gathered, including period of analysis and companies studied. The chapter also includes the results and a brief discussion of both Brazilian and American markets.

The last chapter summarizes the main insights found on the previous chapter and proposes an improvement regard the current regulation model.

2. BRAZIL ELECTRIC UTILITIES AND THE DISTRIBUTION SEGMENT

2.1 THE SEGMENTS

Supplying electricity to industries, commercials and homes across the country requires basically three key segments: generation, transmission and distribution. In Brazil, companies in electricity sector can be both private or public, and work in any of those different activities. Companies that have operations in more than one segment are called integrated.

2.1.1 Generation

Generation is the segment of the electricity industry responsible for generating electricity and inject it into the national transmission network to reach consumers. Most electricity is generated at large power stations spread throughout the country, but it can also be generated in smaller scale power stations nearby regional distribution networks.

Brazil has one of the most renewable electrical systems in the world since more than 60% of the installed generating capacity comes from hydroelectricity (ANEEL, 2018), a clean and cheap source of energy. However, it is subject to hydrological risk, which requires a complementarity from other sources, such as thermoelectric power plants.

Specially in Brazil, the generation segment is quite spread. It currently counts on 4.916 units in operation (ANEEL, 2018). Besides most of these units being of thermo source, the country's supply relies mainly on hydropower sources. The Table 1 depicts the installed capacity of the country in February of 2018 by source; it excludes the importation of energy from other South American countries.

According to ANEEL (Brazilian Electricity Regulatory Agency) the hydropower source portrayed at the table below is segmented into 3 divisions: (i) UHE: hydroelectric plants with an installed capacity of more than 30 MW and with a reservoir up to three square

kilometers; (ii) PCH: hydroelectric plants with an installed capacity between 5 MW and 30 MW and with a reservoir less than three square kilometers; (iii) CGH: hydroelectric plants smaller than the PCH, both in terms of size and power with an installed capacity of less than 5MW.

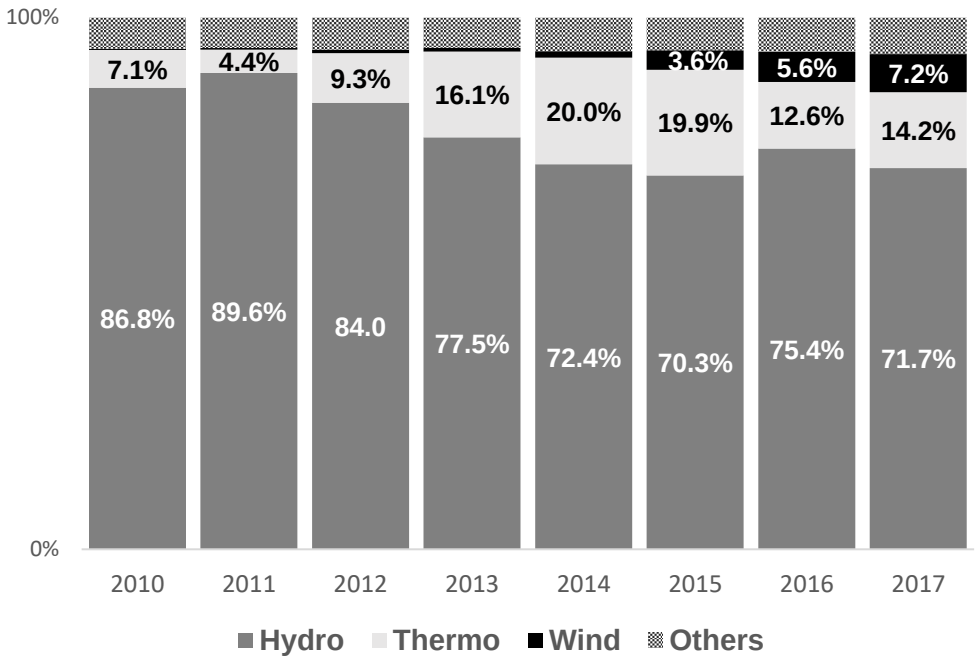
Table 1 - Installed capacity on 2018 in Brazil by source

Units in Operations				
		Quantity	**Installed Capacity (MW)**	**Share**
Hydro	UHE	218	95,619	60.4%
	PCH	429	5,043	3.2%
	CGH	668	624	0.4%
			Total Hydro	**64.0%**
Thermo	Fossil	2.451	26,813	16.9%
	Biomass	550	14,536	9.2%
			Total Thermo	**26.1%**
	Wind	510	12,510	7.9%
	Solar	87	1,080	0.7%
	Other	3	1,990	1.3%
Total System		**4.916**	**158.214**	

Source: ANEEL (2018).

It is important to understand that installed capacity is different from electric energy generation, which represents the real usage of our capacity by source. Below, in Figure 1, it is shown the increased importance of thermal dispatch in the last couple of years.

Figure 1 - Electric energy generation by source (% of total)



Source: ANEEL (2018).

According to Brito (2017), before the provisional measure MP579 (which will be properly discussed in the topic 2.5.1), the generation segment was the less regulated segment among the sector. Moreover, since electric power is homogeneous, as all commodities, the segment, together with the commercialization, is the one that face more competition among its players.

An important point about the production and consumption of electricity is that, unlike other utilities services, electricity cannot be stored in an economically viable way, which requires a constant and instantaneous balance between everything that is produced and consumed.

2.1.2 Transmission

There are two types of electricity network responsible to deliver the energy for the final user. The first one is the transmission, which carries electricity through long distances around the country at high voltages (equal to or higher than 230 kV) until the consumer centers. The second one is the distribution network, which delivers electricity from the

transmission system to homes and businesses running at lower voltages (lower than 230 kV).

Transmission is considered a low risk business in the utilities world as risks are mostly connected to the construction stage. After commercial operation date (COD), transmission lines become available to the national system operator (ONS) and they begin to receive guaranteed revenue according to their availability, not to electricity flow.

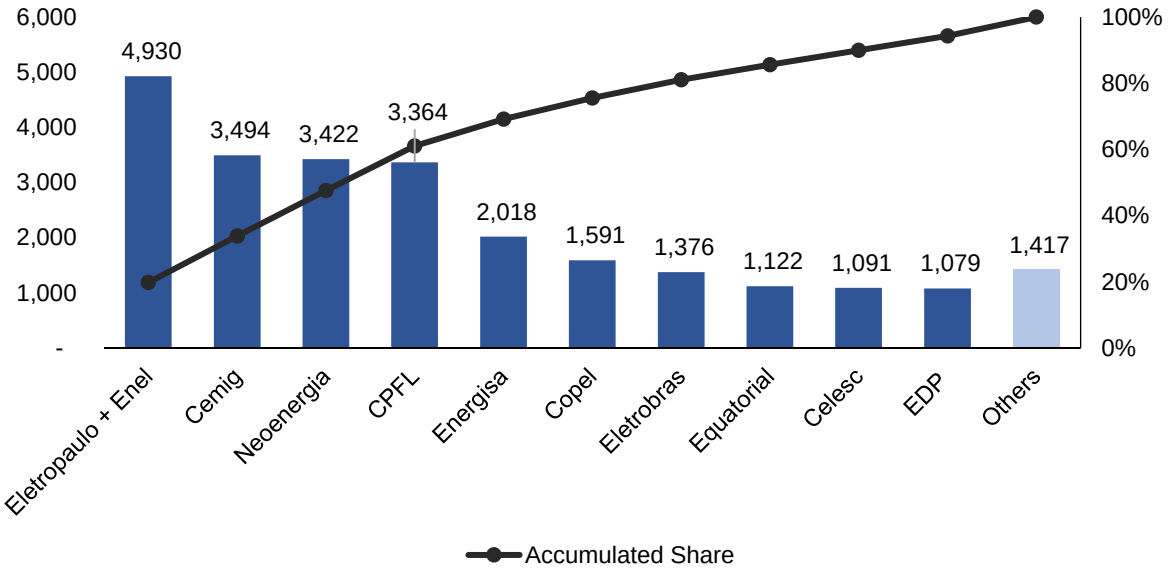
According to Abradee (Brazilian Association of Electric Energy Distributors) there are 77 companies acting on the transmission activity, mostly state-owned.

Unlike the generation segment, the transmission and distribution of energy in Brazil has its prices regulated by ANEEL. They are considered natural monopolies, since the required physical structure turns economically unfeasible a competition between two agents in the same concession area. As a result, these companies must practice tariffs stipulated by the regulatory agency. The mechanism of definition and adjustments of tariffs will be better discussed in the topic 2.4.

2.1.3 Distribution

The distribution activity consists on (i) the delivery of energy to the final customers of both the captive market and the free market, relying on strong capillarity; (ii) the sale of energy to the customers in the captive market The distribution segment is the one with the largest private capital participation but a relative market concentration. Approximately 90% of all electricity consumed in the captive market is distributed by the ten largest companies in the segment.

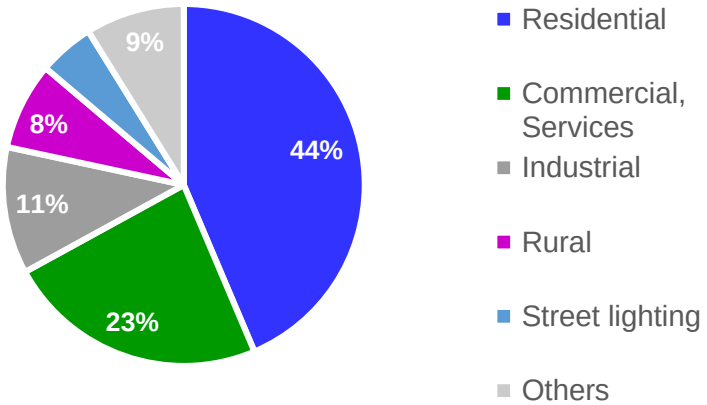
Figure 2 - Electricity consumption at August 2018 (GWh)



Source: own elaboration based on ANEEL data

In Figure 3 it is possible to visualize the share of Brazilian electricity market consumption supplied just from distribution companies (it does not consider free market consumption), highlighting the contribution of residential and commercial activities.

Figure 3 - Type of consumption over distributed energy (Brazil FY2017)



Source: ANEEL (2018)

It is important to understand that Figure 3 shows strictly the consumption of energy sold by the distributors (i.e. consumers that are in the regulated market). If considered

the total amount of energy consumed in Brazil, the industrial segment still being the segment that most demand electricity.

The Table 2 shows the main listed companies acting in Brazilian market, divided into: Integrated; Gencos (Generating Companies); Transco (Transmission Companies) and Discos (Distribution Companies).

Table 2 - Main public companies in the electric sector

Sector	Company	Ticker
Integrated	Alupar	ALUP11
	Cemig	CMIG4
	Copel	CPLE6
	CPFL	CPFE3
	EDP	ENBR3
	Light	LIGT3
Genco	Cesp	CESP6
	CPRE	CPRE3
	AES Tietê	TIET11
	Engie	EGIE3
Transco	Taesa	TAEE11
	CTEEP	TRPL4
Disco	Eletropaulo	ELPL4
	Equatorial	EQTL3
	Energisa	ENGI11

Source: own elaboration (2018).

Despite the existence of integrated companies, since 2004 it is forbidden *self-dealing* contracts, which consist of contracting electric energy from generation companies belonging to the same economic group of distributors in bilateral negotiations.

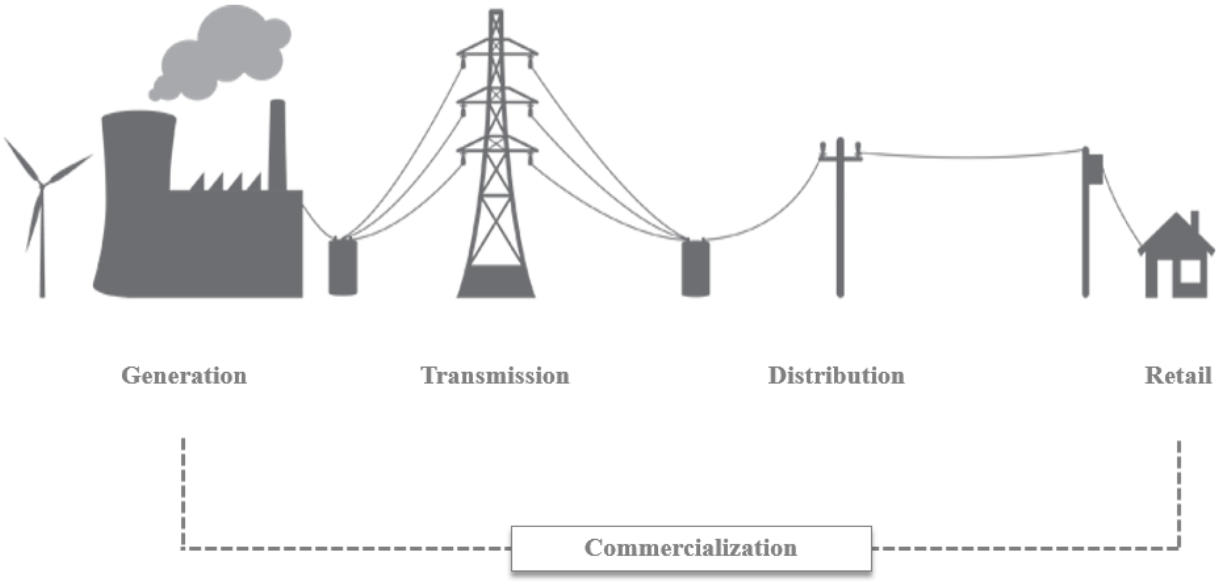
2.1.4 Commercialization

The commercialization has a more recent existence. It does not act in a physical process of generating or transporting energy, but merely as a trading agent acting as intermediary between power plants and free consumers. To be considered a free

consumer it is necessary a demand greater than 500 kW. According to Abradee (2018), there are currently more than 100 electric energy trading agents in Brazil.

These free clients may purchase power from any generator/trader, freely negotiating the price and duration of the electricity supplied, in accordance with the specific legislation and regulations. To sum up, the picture below illustrates the segments of the electric sector.

Figure 4 - Industry segments



Source: adapted from Government of South Australia website (2018)

2.1.5 Natural Monopoly

As previously mentioned, there is a competition on the generation and commercialization segments; but there is not on the distribution and transmission segments, since they are considered natural monopolies. Therefore, it is natural for the state to regulate it.

According to Ozorio (2015), the pursue of efficiency occurs in a different way in the segments that compose the electrical system. In the generation segment, efficiency is the natural result of the competition inherent in procurement electricity auctions. In the

distribution and transmission activities, efficiency is obtained by technical and economic regulation, done by ANEEL. In the transmission business, there is competition only in auction that grant the authorization of new transmission systems.

Brito (2017) says that the activity of electricity distribution, due to large economies of scale, constitutes a natural monopoly, since the initial investments are quite high, and the attendance of an additional consumer has a small marginal cost.

Therefore, a natural monopoly is a type of monopoly that exists as a result of the high fixed costs, and a roughly constant and small marginal cost of producing an addition one customer.

Baumol (1982) exemplifies a natural monopoly by the following statement.

> *"Given the cost function for a typical firm, it is ultimately a matter of calculation to determine how many firms will produce a given output most efficiently. For example, if economies of scale hold throughout the relevant range and there are sufficient complementarities in the production of the different commodities supplied by the firm, then it is an old and well-known conclusion that single firm production will be most economical-that we are dealing with a natural monopoly."*

Therefore, this thesis aims to analyze the state intervention itself, giving suggestion for some improvement in the regulation, but not to propose a zero intervention in the distribution segment.

2.2 SECTOR AGENTS

In Brazil, the main authority of the electric energy sector is the **Ministry of Mines and Energy (MME)**. It was created in 1960 and its mission is to elaborate the energy policy, acting on behalf of the federal government. The MME also assume part of what was once ANEEL's responsibilities, which is define guidelines for granting concessions and standards for electric power project bidding process. The industries of competences of the Ministry also include geology, mining and metallurgy, oil, fuel and nuclear power energy.

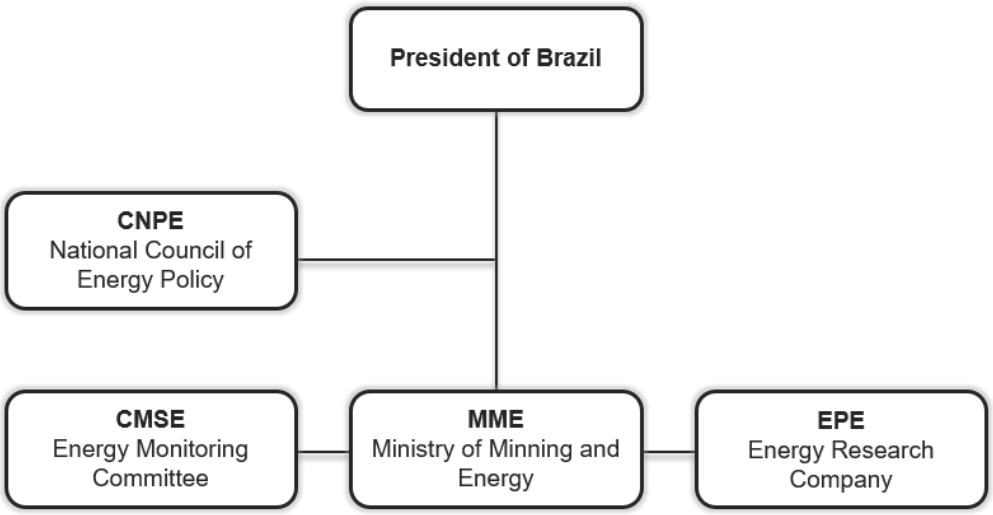
EPE (Energy Research Company) was created in 2004. It is focused on providing studies and research to support the MME in the energy sector's planning and to

guarantee the security of energy supply, by analyzing the dynamic growth of demand and supply of electric energy.

CNPE (National Energy Policy Council): chaired by the MME, the committee provides advisory service to the President of Brazil in order to formulate policies and guidelines for energy planning and expansion. It aims to develop a national energy policy to optimize the use of Brazil's energy resources and to guarantee the country's energy supply.

CMSE (Energy Sector Monitoring Committee): The CMSE is an institutional body under the direct coordination of the MME, created with the function of monitoring and evaluating electricity supply continuity and security of electric supply throughout the national territory. Its main attributions include: monitoring the development of the activities of generation, transmission, distribution, commercialization, import and export of electric energy; assessment of supply and service conditions; periodic analysis of the integrated reliability of supply and service; identification of difficulties and obstacles that affect the sector’s regularity and safety of supply and expansion; and elaboration of proposals for adjustments and preventive actions that can restore reliability in supply and electric service.

Figure 5 - Sector agents: government and planning



Source: adapted from CAPPA (2014)

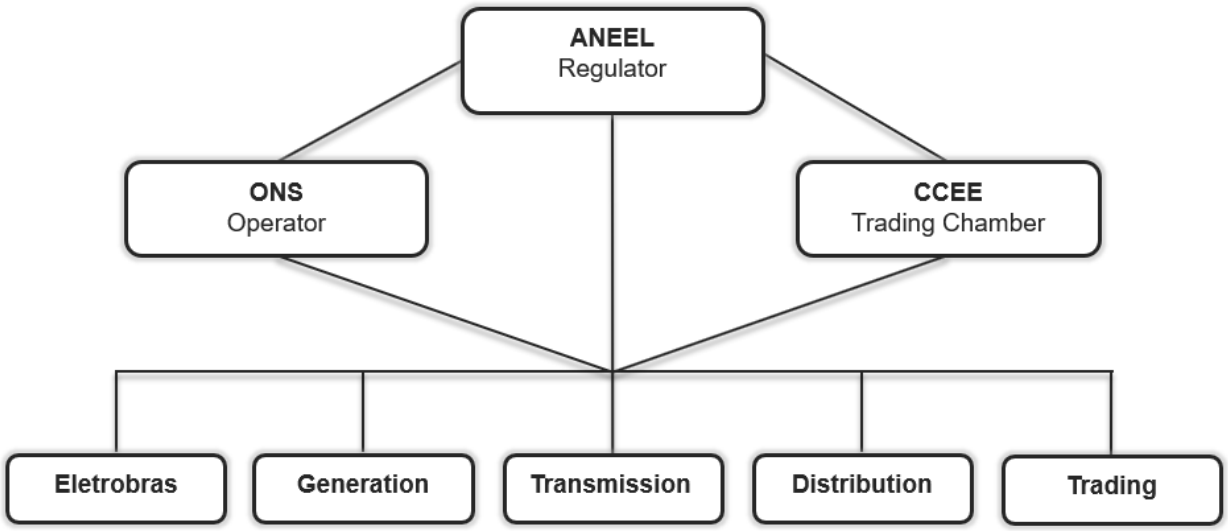
To improve synergy and to explore the diversified hydrological regimes presents in such a wide territory, it was created the **SIN (National Interconnected Grid)**, a network of interconnected transmission lines that connect generation and consumption of different regions of the country. The SIN transmission system allows energy transfers between different hydrographic basins that complement each other, allowing a transfer of energy between subsystems, reducing a probability of system deficit. Vasconcellos (2017) states that about 98% of the actual electricity market is under the SIN system, which represents more than 100 companies and is divided into 4 regions: South, Southeast/Center West, Northeast and North.

The SIN is ruled by the **ONS (National System Operator)**. Under ANEEL supervision, ONS is the institution responsible for operating, supervising and controlling electricity generation in the SIN, and for managing the basic electric power transmission network in Brazil. The main objectives of ONS are to meet the load requirements, optimize costs and guarantee the system dispatch reliability. Another responsibility of the institution is to define conditions of access to the high voltage transmission network through the ONS Network Procedures.

ANEEL (Brazilian Electricity Regulatory Agency) is an independent regulator. It is responsible for regulating and supervising the activities of production, transmission, distribution and commercialization of energy. ANEEL is also in charge of to ensure the quality of services provided, to promote the bidding process for new concessions, to regulate the exploitation of energy sources and to determine tariffs to captive consumers.

Finally, **CCEE (Chamber of Commercialization of Electric Energy),** the Chamber acts in the measurement of the energy generated and effectively consumed, in the accounting and financial settlement of purchase and sale contracts in the short-term market, making feasible the purchase and sale of energy in the country. The institution is responsible for calculating and disclosing the Difference Settlement Price (*Preço de Liquidação de Diferenças* – PLD, or spot market price), used to value the purchase and sale of energy. It also promotes procurement electricity auctions, under special delegation from ANEEL.

Figure 6 - Sector agents: regulation, supervision, operation and regulated agents



Source: adapted from CAPPA (2014)

2.3 ENERGY CONTRACTING ENVIRONMENT

Ozorio (2015) states that the Electric Sector Law, enacted in 2004, defined significant changes in the electricity sector, one of them was the creation of three contracting environment: the regulated market, the free long-term market and the short-term free market (spot market).

Brito (2017) and Vasconcellos (2017) clarify well the functioning of each market, as depicted below.

ACR (Regulated Contracting Environment). Segment of the market in which operations for the purchase and sale of electricity are carried out between generation and distribution companies. This market is restricted to distributors through regulated public electricity procurement auctions that guarantee the supply of energy to captive consumers (consumers who may only acquire energy from the utility they are connected).

ACL (Free Contracting Environment). ACL is the free long-term market, in which electricity commercialization is carried out under bilateral contracts freely negotiated, in accordance with the specific commercial rules and procedures set by ANEEL.

Gencos can sell electricity in both ACR and ACL. On the other hand, Discos are forbidden to buy electricity into the ACL so they have to acquire enough power in the ACR to meet 100% of their demand. Besides, *self-dealing* (purchase its energy needs through bilateral contracts with related parties out of the regulated procurement electricity auctions) is not allowed.

PLD (Difference Settlement Price). It is used to value the purchase and sale of electricity on the short-term market. The spot market is the environment for the commercialization of non-contracted energy, in order to settle any differences between bilateral contracts and the actual supply, whose price would be defined based on energy dispatch optimization models. In the spot market, Discos, Gencos and free consumer can operate.

Based on the forecast of future consumption, Discos and free consumer buy the amount of energy they estimate they will consume on forward contracts with different expiration dates. If the consumer uses less energy than it contracted for a given month, this surplus is valued at the PLD for each week and the amount is credited for the next month at the CCEE. This liquidation system also works for overconsumption and for the generation segment.

2.4 TARIFFS

Firstly, it is important to distinguish electricity bill from tariff. According to MME, tariff is the composition of the calculated values that represent each portion of the investments and technical operations carried out by the agents of the production chain and the necessary structure so that the energy can be used by the consumer. Calculated by ANEEL, tariff is the sum of all components of the industrial process of generation, transport of electric energy, added of sector charges. On the other hand, the electricity bill, which is the value paid by the final user to Discos, is the tariff calculated by ANEEL plus taxes not include in the electricity energy costs, such as ICMS, PIS and COFINS.

As previously mentioned, the distribution segment consists of a natural monopoly. Therefore, seeking to avoid pricing abuses and low-quality services, a regulatory process is put in place in order to simulate the effects brought by competition to a market that is a natural monopoly.

In this sense, Discos does not decide the price to be charged to its customers, the tariff is calculated by ANEEL.

2.4.1 ANEEL Tariff regulation Methodology

The following section is based on the ANEEL's Normative Resolution nº 435/2011, known as PRORET (Tariff Adjustment Procedures).

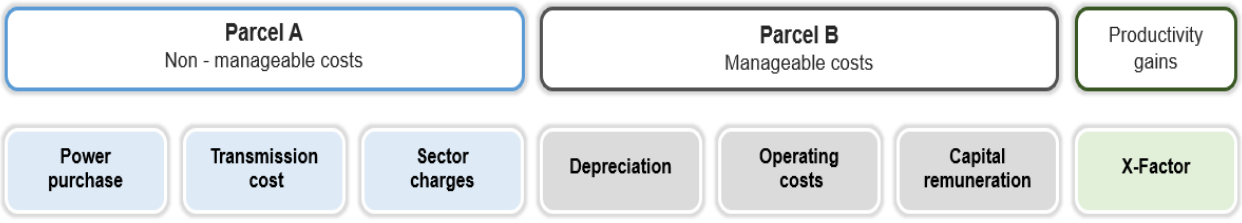
To define the distribution tariffs, ANEEL classifies the Discos expenses as:

(i) **Parcel A:** non-manageable costs, such as the cost of acquiring electricity (purchased at public procurement electricity auctions promoted by ANEEL, from the Itaipu hydroelectric plant and from old bilateral contracts); sector charges, and transmission costs.

(ii) **Parcel B:** manageable costs, which includes costs under control of the companies, such as operation and maintenance of the distribution system; depreciation and remuneration.

The costs of the Parcel A are fully passed-through final consumers. Parcel B components are determined in the tariff review process and are readjusted by inflation on a yearly basis, deducted by the X Factor, which captures gains of productivity.

Figure 7 - Tariff calculation structure



Source: adapted from Vasconcellos (2017)

According to Arango apud Ozorio (2015), immediately after undergoing a revision of its tariffs, a distribution company should generate a zero economic value added (EVA), which would correspond exactly to the case of return equals to the cost of capital for such companies.

This workpaper does not seek to demonstrate the ANEEL methodology to obtain the *WACC* (Weighted Average Capital Cost), but it is important only to bear in mind that the cost of capital is unique for the whole distribution segment.

2.4.2 Tariff Readjustment and Revision

Readjustment and revisions are mechanisms by which electric power tariffs can be changed.

Ozorio (2015) clarifies that the annual tariff readjustment - made by the IRT (Annual Tariff Adjustment Index) - is based on a parametric model, defined in the concession contract, in which the costs related to Parcel A are generally fully passed through to the tariffs. Parcel B costs are adjusted by inflation variation (IGP-M) and adjusted by a factor called X-Factor, which is based on two components: (i) Projected productivity gains; and (ii) inflation variation (IPC-A) on the labor share of operating costs. According to the MME, the function of the X-Factor is to pass-through the consumer the estimated productivity gains of the concessionaire due to the growth of the market and the increase of the consumption of the existing customers. At the year readjustment, ANEEL updates the values of the Regulatory Asset Base by inflation and incorporate the investments made by the companies over the cycle so to meet investment needs as a means of assuring the continuity of future operations.

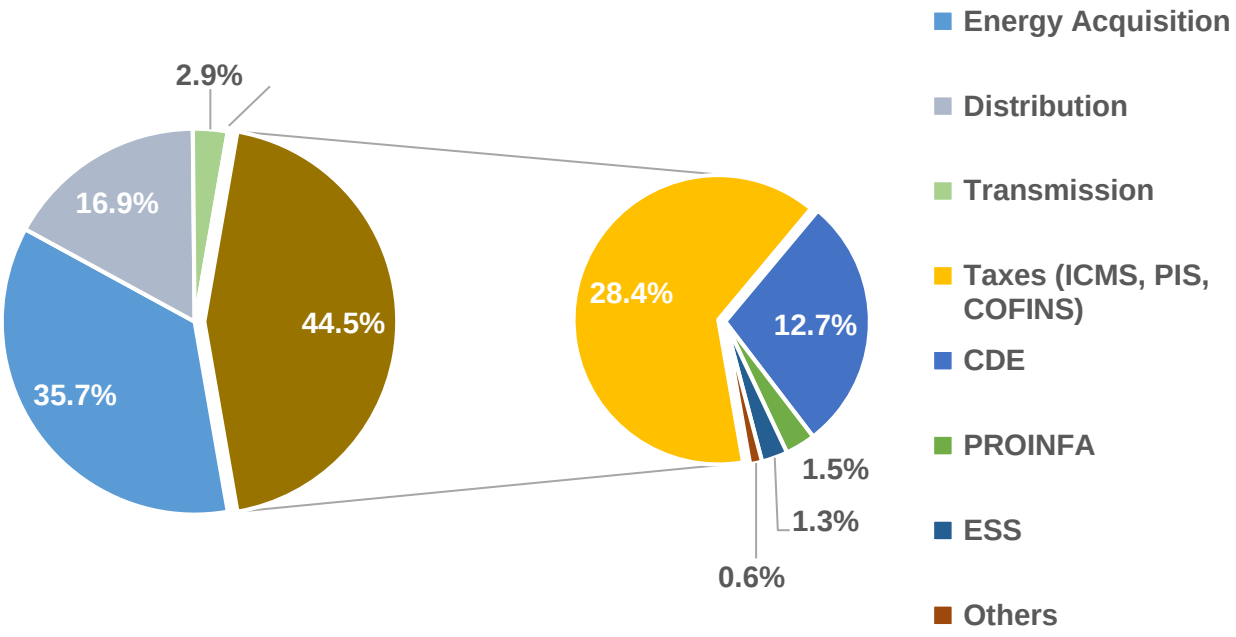
Following the terms of the concession contracts, the regulator reviews the distributors' tariffs every 3-5 years, to adjust for updated market conditions. These revisions aim to provide the companies with the necessary revenue to cover efficient manageable costs and an adequate compensation for investments necessary for the distribution services.

Tariffs may also undergo extraordinary reviews in exceptional cases, aiming to maintain the financial equilibrium of the distributors and compensation for unforeseen costs that significantly modify their cost structure.

2.4.3 Breakdown of costs

The chart below portrays the breakdown in percentage of the total cost of the electricity bill (tariff + tax) in Brazil.

Figure 8 - Breakdown of electricity cost (2015/16)



Source: adapted from ABRADEE (2018)

The previous chart allows obtain the following interpretation:

(i) Almost 45% of the total cost of the electricity is merely taxes, contributions and sector charges. This occurs due to the easy of taxing electricity, which prevent tax evasion and assures more revenue for municipalities, states and federation.

The main sector charges are:

CDE (Energy Development Account): fund used to promote energy development from alternative sources; to provide the universalization of the energy service; and to subsidize the tariff of low-income residential consumers.

PROINFA (Alternative Sources Incentive Program): subsidize alternative energy sources, generally more expensive than conventional ones.

ESS (System Service Charges): subsidize the maintenance, the reliability and stability of the SIN.

(ii) Only 16.9% of the cost of electricity comes from the distribution component. Therefore, Discos are heavily exposed both in cost (which are mainly non-manageable) and revenues (that are defined by ANEEL).

As it will be better explained in the topic 2.5, in recent years, a series of events have greatly raised the non-manageable costs of distributors and, due to temporary mismatch between costs and revenues in the electricity distribution sector, Discos were impacted by working capital problems and high operating leverage.

2.4.4 Public Bidding - Cost of Energy Acquisition

As previously mentioned, Discos can only buy energy at the ACR, and this buying process occurs by public bidding. Abradee (2018) defines the electricity public bidding as a competition promoted by the public power with the aim to offer electricity in the future by the acquisition of two types of energy:

(i) Old energy: energy generated in plants that are already in operation. These processes are destined to serve the distributors in the following years of the contract, with agreements that can go up to 15 years.

(ii) New energy: Energy contracted from plants under construction or project, which may provide energy in 3 (called A-3) to 7 (A-7) years after hiring.

For Abradee, this segmentation is necessary because the capital costs of the existing plants are not comparable to those of new power sites that still have to be paid. However, it is worthy mention that after the promulgation of the Law 12.783 from 2013

(it will be better discussed in the topic 2.5.1) a considerable part of the "old" energy, coming from hydroelectric projects with more than thirty years, started to be sold with prices regulated by ANEEL, and, therefore, no more selling electricity through ACR auctions.

In a very succinct way, the bidding process works as Acende (2012) describes:

(i) The MME sets the guidelines for each bidding process supported by studies prepared by the EPE and ONS; based on these guidelines, the ANEEL elaborates the bidding notice and the execution is delegate to the CCEE.

(ii) The energy demanded is defined through the declaration of need of purchase from the electric power distributors. The generation companies with the lowest prices win the auction.

(iii) Regardless the acting region, the cost of energy (BRL/MWh) is equal to all Discos at the bidding, even if a region of the country may have a lower cost of generation.

As an illustrative example the following table depicts the results from the 13th public bidding as an example (an “old” energy auction). It occurred in 2014 and consisted in a five years supply contract.

Table 3 - 13th electricity public bidding

Seller	Generation Plant	Source	Total (GWh)	Selling Price (R$/MWh)
BTG PACTUAL	BTG PACTUAL	Hydro	7.406	270,68
EDP C	LAJEADO	Hydro	249	270,79
ELETRONORTE	TUCURUI	Hydro	13.917	271,00
FURNAS	PEIXOTO	Hydro	7.406	271,00
FURNAS	SERRA DA MESA	Hydro	18.987	270,80
ITIQUIRA	ITIQUIRA I	Hydro	1.243	269,78
QUANTA GERACAO	AREAL	Hydro	50	270,80
QUANTA GERACAO	FAGUNDES	Hydro	99	270,80
QUANTA GERACAO	TOMBOS	Hydro	50	270,80
TRACTEBEL	SALTO SANTIAGO	Hydro	7.455	270,69
VOTENER	BARRA GRANDE	Hydro	2.485	270,70
VOTENER	CAMPOS NOVOS	Hydro	8.151	270,79
VOTENER	CAPIM BRANCO 1	Hydro	646	270,69
VOTENER	PIRAJU	Hydro	2.088	270,75
VOTENER	SALTO RIO VERDINHO	Hydro	2.883	270,75
PETROBRAS PIE	BARBOSA LIMA SOBRINHO	Natural Gas	2.883	262,00
PETROBRAS PIE	EUZÉBIO ROCHA	Natural Gas	2.783	262,00
PETROBRAS PIE	GOV. LEONEL BRIZOLA	Natural Gas	12.575	262,00
PETROBRAS PIE	LUIS CARLOS PRESTES	Natural Gas	10.289	262,00
SAO BORJA	SAO BORJA	Biomass	50	260,80
			Average Price (BRL/MWh)	**268,33**

Source: CCEE (2018)

2.5 POLITICAL INTERFERENCE

2.5.1 MP579

As Cappa (2014) highlights, in 2015, the terms of several concessions in the three segments of the SEB would expire in the following two years: generation, about 20% of the installed capacity; transmission, about 80% of the SIN network; and distribution, 37 concessions, representing more than 30% of the energy supplied at the ACR.

By law, once the concession period has expired, the assets should be reverted to the Union, unless a new legal instrument allows the renewal of the respective contracts.

The government, therefore, tried to solve the problems of the upcoming concessions expirations and the high tariffs that the country faced at time by one single measure.

As the author describes as a watershed for the sector, by September of 2012, the federal government released the provisional measure MP579, which was turned into law in the earlier part of 2013 (Law nº 12,783/13). Seeking an average and immediate reduction of regulated tariffs by 20%, a percentage that would become a political commitment of the federal government, the MP579 established the renewal conditions for all concessions' contracts signed prior to February 2013 for the generation, distribution and transmission businesses. But, as Brito (2017) criticizes, the issue of MP 579 would lead to a serious financial crisis into SEB.

Gencos with contracts expiring between 2015 and 2017 were able to renew their concessions on the condition that, with the renewal, companies would be reimbursed for operation and maintenance costs. Therefore, Gencos that once operated in a competitive environment began to have their prices regulated, in the same way that it already happened with the distributors and transmission companies.

One interest point to be mentioned, as a report from the Brazilian journal "*Valor Econômico*" highlighted, is that the new regulation was imposed by the government, without any input from local companies. Torres (2014) says that on the day the measure was published, executives of the major companies in the industry did not know what to say to their shareholders because they simply did not know what it was about.

As Brito (2017) stated, the government had to enhance the package of promises in order to attract more players. However, Eletrobras was the only company that accepted the conditions on a large scale while CEMIG, CESP and COPEL chose to return their concessions to the union.

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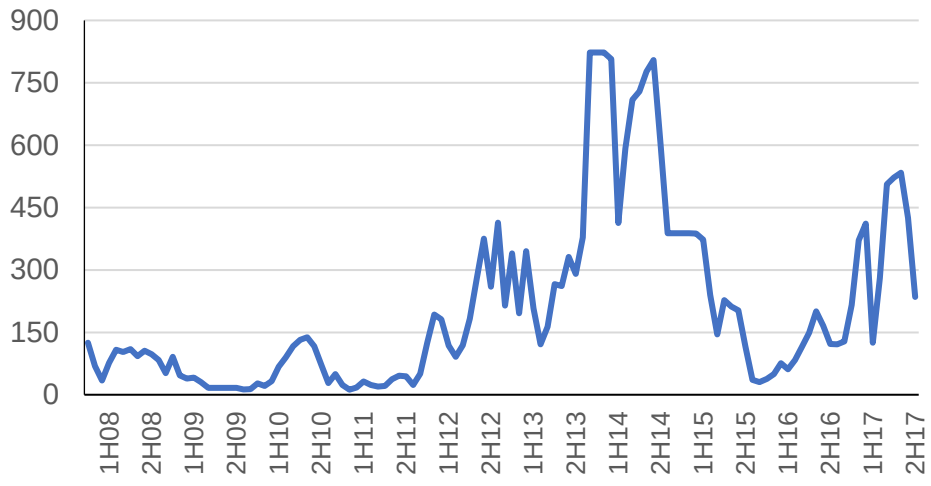
2.5.2 High Spot Prices

Since CEMIG, CESP and COPEL refused to participate at the ACR market, the demand of Discos at public bidding could not be achieved. Therefore, distribution companies had to, involuntary, resort to the spot market to meet demand from its captive market. To make even worse, thermal power was continuously dispatched given unprecedented high temperatures, low reservoir levels and delayed rains.

The chart below shows the spot prices at southeast region. Spot prices have reached an alarming level of BRL823/MWh (the maximum allowed by law), and, as Cappa (2014) point it out, government plans to reduce energy prices were not coming to fruition. This situation increased working capital needs for distribution companies while creating a short-term opportunity for generators with subcontracted energy, such as Cemig, Cesp and Copel.

Indeed, the tariff price would have risen anyway, due to hydrological problems. However, the contracts could have been traded on the captive market before the drought, at a less exorbitant price.

Figure 9 - PLD Prices (BRL/MWh) at Southeast region



Source: Own elaboration based on CCEE data (2018)

2.5.3 Financial Support

In 2013, ANEEL, through a RTE, approved the new energy tariffs to be applied to the final consumers served by the distributors. In many localities, the percentages of reduction of the tariffs for the residential class surpassed the 20% initially desired by the federal government.

However, according to Brito (2017) if there were no involvement of the National Treasury through contributions, the reduction would have not reached the 20% disclosed. There was a clear determination from the federal government to maintain tariff rebates during the year 2013, even if artificially. Thus, in order to achieve the objective of keeping tariffs at a level below their effective cost, the government started to use not only National Treasury resources, but also those from CDE, therefore, socializing part of the costs of generation with all system agents.

In 2014, R$ 4 billion from the National Treasury and R$ 17.8 billion from the CONTA-ACR (ACR count) were injected in Discos in order to settle the operation in spot market from that year (CONTA ACR was a count managed by CCEE that aimed to raise funds for Discos with a pool of banks. The interest rate of this loan surrounded CDI + 3.0%).

In other words, since the Distributors were involuntarily exposed to the PLD and that the spot price was high, this extra cost of the Discos could be legally passed through consumers. However, as the government had recently announced a reduction in tariffs, it did not allow ANEEL to carry out an extraordinary review of tariffs to seek the economic-financial balance of the Distribution concession contracts. Therefore, the government had to keep the value of the tariff low (in spite of the increase of the cost of generation) and not let the distributors bankrupt. The alternative found was to finance the generation costs at an artificially low tariff, by using treasury resources and debt obtained with a pool of banks.

As example, the table below shows COPEL’s cost of acquisition of energy. Highlighted, it is the public capital injection into the company to keep the tariffs artificially low.

Table 4 - Electricity purchased for resale - Copel

Consolidated (thousands BRL)	**2012**	**2013**	**2014**	**2015**
Purchase of Energy in the Regulated Environment	1,927,903	2,305,809	3,394,222	3,812,509
Itaipu Binacional	503,335	610,404	739,002	1,567,844
Electric Energy Trade Chamber	312,125	663,936	2,281,328	982,388
Program for incentive to alternative energy sources – Proinfa	143,587	166,653	183,617	177,946
Bilateral contracts	203,115	217,069	177.149	30,557
(-) Transfer CDE and ACR Account	**-**	**(294,085)**	**(1,253,436)**	**-**
(-) PIS/Pasep/Cofins taxes on electricity purchased for resale	(282,330)	(333,427)	(441,288)	(538,328)
	2,807,735	3,336,359	5,080,594	6,032,916

Source: Copel Financial Statement (2015)

It is worthy mention that this financial rescue provided by the government and its attempt to reduce the tariff was part of the daily newspaper discussion, given its relevance. Figure 10 highlights 2 headlines of 2014 that portrays the chaos generated into the sector.

Figure 10 - Headlines of Brazilian Newspapers

Source: Pereira (2014), Rittner, Camarott (2014)

The translation of the headlines follows, respectively:

(i) *Estadão*: “Distributors need more R$ 3 billion. Four months after the second loan, of R$ 6.58 bi, accounts for November and December return to red”.

(ii) *Valor Econômico*: “To avoid readjustments, 20 measures and R$ 78 billion”.

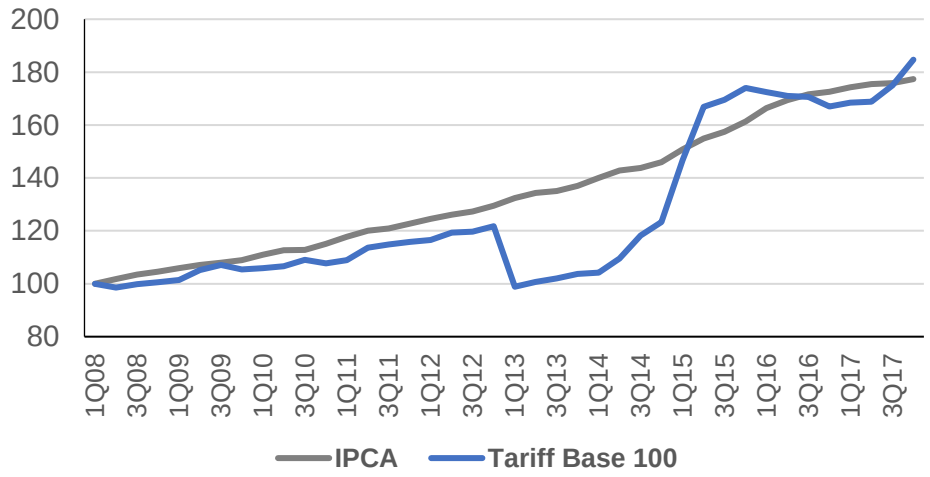
2.5.4 Tariff Flag

By raising a tariff flag, the government has created a mechanism that helps to anticipate the pass-through of generation costs by Discos when the hydrological conditions are not favorable, leading to additional tariff for the following month. There are four bandwidths created: green, yellow, red 1 and red 2.

This mechanism is important for Discos, as reduces the working capital needs. Nevertheless, it is not an additional charge to the consumer bill, as it only anticipates the annual pass-through of non-manageable costs. The new mechanism was expected to come into effect by 2013, but unfortunately has been postponed twice, only beginning at 2015.

Lastly, the chart below illustrates the government attempt to reduce electricity tariff and the consequences in price in the following months.

Figure 11 - Inflation Variation x Tariff Variation



Source: own elaboration with IBGE and ANEEL data (2018)

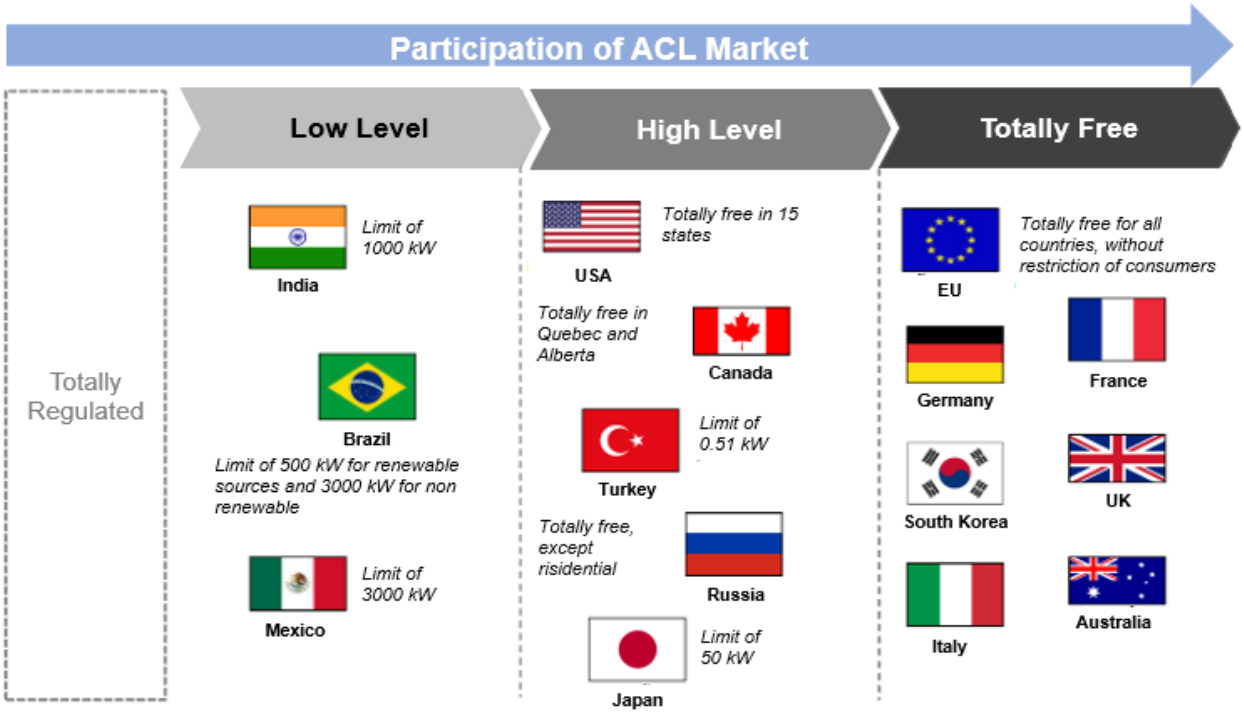
2.6 OTHER MARKETS

In Brazil, as already described, distribution business consists of buying energy through public auctions and selling it at the ACR market. However, what is seen worldwide is that in some countries, distribution have switched to a merely rental of the grid, replicating, therefore, the power transmission model.

As Discos are not exposed to electricity price variation (since they are no longer in charge of buying and selling energy), the companies have a more stable financial position, and a more solid liquidity ratio (this analysis will be better addressed at the section 6.3).

In order to switch the distribution business model is necessary that a larger percentage of the total electricity market consists of free market (ACL). This allows a more efficient electricity pricing formation. Figure 12 shows the degree of flexibility of the free market in different countries.

Figure 12 - Access to Free Market by Country



Source: EDP (2017)

In the US market, the distinguish between Electricity and Grid business is so clear that consumer may face three different types of charges: (i) consumer receives two

accounts - one referring to distribution and one referring to generation; (ii) consumer receives a single account, sent by the distributor, detailing the cost of supply and cost of energy distribution; (iii) consumer receives single account, sent by the electricity provider, including distribution costs.

Moreover, what is observed is that countries in which distribution generation has taken place stronger, Discos were automatically forced to switch for a business of truly grid operation. The distribution generation itself has recast the energy sector, and, together with the improvement of home battery, it can disrupt the entire sector.

Under this different business model of distribution, there are three types of remuneration system for Discos.

Price Cap - Regulates the price cap per MWh, being based on the volume of distributors. It exposes the Discos' revenue to the consumption fluctuation

Revenue Cap - Establishes the fixed revenue of the distributor based on the expected compensation for the investments made**,** eliminating the volumetric risk.

RIIO - RIIO stands for Revenue = Incentives + Innovation + Outputs. A model in with the base revenue can be increased or decreased according to the distributor's performance in specific dimensions.

Lastly, in some countries, the advances on the distribution model go beyond the existence of a totally free market environment. In the Nord Pool (the wholesale electricity exchange that acts in the Nordic Countries) the energy trading occurs mostly in the short-term period, in *Day-Ahead* contracts that negotiate the electricity on an hourly basis. This model reduces the exposure of commercialization companies as they can adjust their cost and tariff on an hourly and daily basis.

3. LIQUIDITY AND WORKING CAPITAL MANAGEMENT

As Crockett (2008) states, “Liquidity is easier to recognize than to define”. Broadly speaking, the author describes liquidity as the degree to which an asset or security can be quickly bought or sold on the market without affecting its price. In the financial universe, the liquidity study can be divided into two scopes:

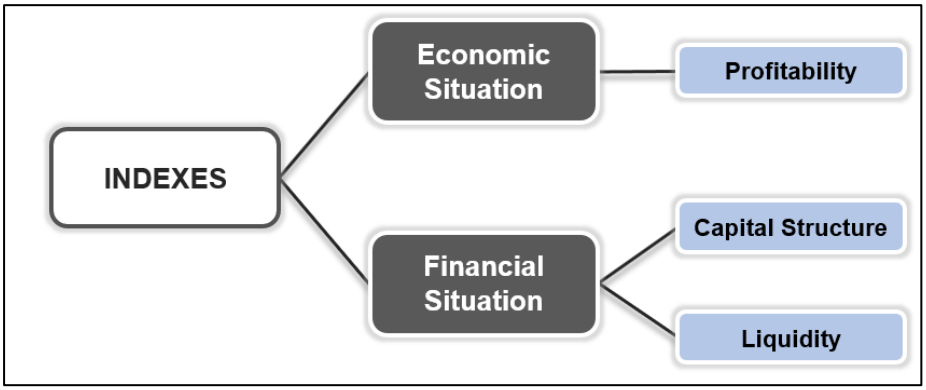
Market liquidity: refers to the ability in which a market (stock market, real estate, etc.) undertake transactions without disturbing underlying prices, ensuring that assets are traded at stable prices (i.e., how easy it is to turn this asset into cash). Naturally, the asset considered most liquid is cash, whereas, real estate, luxury cars, private companies are considered illiquid.

Accounting liquidity: according to Giltman apud Fassina (2006), accounting liquidity refers to the ability of a company to meet short-term obligations as they mature. To put in another way, how easy a company can meet its financial obligations with the available assets on the due dates. Due to the concerns given so far for the liquidity in distribution companies, it is clear that this thesis will deep its understanding over this second concept.

To assess liquidity position, the main tool used is the elaboration of indexes combine with analysis throughout historical evolution and industry benchmarking. But what are indexes?

Assaf Neto (2012) defines indexes as a ratio between accounts of financial statements that are used to analyze certain aspects of the financial and economic situation of a company and its performance. Matarazzo (2010) divides the indexes in two groups, as depicted in Figure 13.

Figure 13 - Economic and financial indexes



Source: adapted from Matarazzo (2010)

Profitability indexes - assess the profits of company regarding:

(i) Income statement variables, aiming to analyze the efficiency in generating profits through its sales, e.g. gross margin, EBITDA margin, net margin.

(ii) Balance Sheet variables, aiming to analyze the return, as a percentage derived from the ratio of profit to investment, e.g. ROA, ROE, ROIC[1].

By mixing the variables, and using, for instance, DuPont identity (a technique used to decompose the different drivers of the ROE), is also possible to address other outputs, such as asset turnover.

Capital structure indexes - assess the sources of capital and analyze how resources are obtained and applied, e.g. debt to equity, and short-term debt to total debt ratios. Matarazzo (2010) states that these indexes address the participation of third-party capital, the debt composition and the immobilization of equity. Solvency and liquidity are both terms that refer to an enterprise's state of financial health; solvency refers to an enterprise's capacity to meet its long-term financial commitments, whereas Liquidity, as will be better discussed, refers to the ability to pay short-term obligations

Liquidity indexes - these indexes show how solid is the financial position of a company. Assaf Neto (2012) says that these indicators are designed to measure a company's ability to correctly meet assumed liabilities. Fassina (2006) states that a

[1] ROA: Return on Asset; ROE: Return on Equity; ROIC: Return on Invested Capital. These ratios measures how profitable a company is relative to its total asset, equity, and invested capital, respectively.

company with good liquidity levels is able to present good capacity of paying its debts, but it does not guarantee the payment of these obligations on time since the liquidity indexes are not obtained from the cash flow.

If a company is solvent, liquidity issue can be resolved with a liquidity injection, since the company can use an asset as collateral to raise cash. If a company is insolvent, a liquidity problem would harm the financial position and force it into a bankruptcy. Therefore, deal with an insolvency problem takes longer. Usually, management must restructure company's operation by selling assets, laying off employees and reducing debt.

It is worthy mention that some papers aim to understand liquidity in companies by evaluating the amount of cash and short-term investments they own. Vasques (2008), for instance, affirms that in a perfect capital market, there would be no need for non-financial firms to maintain liquid assets, as they could resort to external financing whenever resources were needed. In the literature there are a couple of papers that study the reasons why companies have a large amount of an equivalent of cash and how to optimize the minimal level of it.

This thesis, on the other hand, will use the term of liquidity in a broader sense, covering items on the balance sheet of both asset and liabilities, such as receivables, inventories, debt, accounts payable, etc.

3.1 WORKING CAPITAL

To start a new venture, it is necessary to raise capital for the basic structure of the company, e.g., property, furniture, machinery, and so on. This capital is called *Fixed Capital*. However, after this first step it comes the second challenge: keeping it running. To cover the daily operation expenses, it is required the *Working Capital*. It compromises expenditures on raw materials, inventories, payment from suppliers, taxes, fixed costs, etc.

Below, it is described two important terms for the comprehension of liquidity: working capital and net working capital.

Working Capital (WC) refers to current assets, i.e. short-term assets. It is, therefore, the current assets that sustain the day-to-day operations of the company and represents the portion of the investment that circulates from one form to another during the normal conduction of business. Managing the firm's working capital ensures that the firm has resources to continue its operations (ASSAF NETO, 2012).

$$\text{Working Capital} = \text{Current Assets} \quad (1)$$

Vieira (2005) states that industries typically have a higher proportion of fixed assets relative to total assets and tend to focus on long-term cash requirements; commercial companies work with a higher percentage of working capital and are mainly focused on accounts receivable and inventories; the service companies, on the other hand, have few fixed assets and basically focus on accounts receivable.

Working capital needs funds for its financing, so it does for fixed capital. Thus, the greater the working capital, the greater the need for financing, either with company own resources or with resources from third parties (debt).

Sonia (2007) synthesizes different works on the literature and summarizes the characteristics of working capital: (i) *short duration* - the maximum period for the conversion of these assets must not exceed the operating cycle; (ii) *quick transformation and interrelationship* - as each element of the current asset quickly transforms into another form of current assets, there is an inter-relationship between these elements; (iii) *synchronization of activities* – if the three basics activities of a company (i.e. production, sales and receipt) occurred in a perfectly synchronized and integrated way, there would be no need for investment in working capital; (iv) *low profitability* – the profits of a company come mainly from the usage of the fixed capital, which are investment made to meet strategic plans, whereas WC meets daily operational objectives; (v) *divisibility* – distinguished from fixed capital, company can vary the volume of its working capital through marginal increases whenever necessary.

Net Working Capital (NWC) corresponds to the arithmetic difference between current assets and current liabilities (ASSAF NETO, 2012).

$$\text{Net Working Capital} = \text{Current Assets} - \text{Current Liabilities} \quad (2)$$

When the value of the current assets exceeds the level of the current liabilities, it means that the company has positive NWC. In this most common situation, the NWC represents the portion of the company's current assets financed with long-term resources (sum of long-term liabilities with shareholders' equity), which exceed the financing needs of the fixed assets (VIEIRA, 2005).

When the value of the current assets is lower than that of the current liabilities, it means that the company has negative NWC. In this less common situation, the NWC is the portion of the permanent assets of the company that is being financed with current liabilities, that is, with short-term capital.

Viera (2005) also claims that companies' management do not aim to obtain a NWC equals zero, because they cannot match inflows with outflows, moreover, inflows are more uncertain than outflows. Therefore, current assets need to exceed current liabilities, that is, a portion of current assets is often financed with long-term funds.

It is generally understood that the larger the NWC of a company, the lower its risk because its liquidity reduces the likelihood that it will become technically insolvent. Such a premise, however, may be misleading because a very high NWC means that large long-term funds are financing part of the current assets, that are less profitable than fixed assets. As the costs of these long-term resources are higher than those of the short-term, the company may face financial problems. (This issue will be properly addressed in the topic ahead).

3.2 RISK AND RETURN

The objective of short-term financial management is to manage each of the items of current assets (cash, banks, short-term investments, accounts receivable, inventories etc.) and current liabilities (suppliers, accounts payable, loans etc.) in order to achieve a balance between profitability and risk that contributes positively to increasing the value of the company. Too much investment in current assets reduces profitability, while too low investments increases the risk that the company will not be able to honor its obligations within the agreed period. Both situations lead to the reduction of the value of the company.

The relation of profitability and liquidity risk described in the previous paragraph is based on the principle of Financial Balance. Assaf Neto (2012) states that financial balance represents the match between the period of recovery of the funds raised and the resources invested in the assets. For example, the fixed asset, when financed with short-term credits, will bring an imbalance to the company, due to the evident lack of synchronization between the time when the funds raised and the recovery period of these funds, characterized as long term. Therefore, when observed this imbalance, it is said that the company is assuming a greater financial risk, i.e., it has increased the probability, at least theoretically, that the company will not pay its commitments under the contracted conditions.

Vieira (2005) also says that under equilibrium conditions, only seasonally current assets must be financed with current liabilities of the same term. The fixed part of the current asset and all fixed assets must be financed by long-term resources.

By this necessity of match between terms of funds and investments comes up one of the main responsibilities for companies: manage liquidity and profitability, given they vary inversely.

Fixed assets have a major contribution to companies' profits. But to invest in long term assets companies must raise long term debt, which are, generally[2], more expensive than short-term funds. If companies want to reduce its cost of capital, it should borrow short-term funds, which naturally consist on investing it on working capital, that is less profitable than fixed capital.

3.3 STATIC ANALYSIS OF LIQUIDITY

Liquidity studies provide information about the capability of paying and the financial flexibility of the firms. The ratios calculation aims to see whether the company can convert its assets into cash without a loss in value in order to meet its maturing short-

[2] Assaf Neto (2012) highlights the Brazilian peculiarities in terms of cost of capital. On average, the cost of short-term capital has often exceeded the long-term cost, setting aside the risk-return behavior previously described. The main causes for this peculiarity given by the author are: (i) subsidy on long-term credit in Brazil seeking to stimulate certain investments and supply the lack of long-term savings in the economy; (ii) frequent policies of credit restrictions adopted at different times, largely controlling the short-term segment in the national financial system.

term obligations. The ratio indicates the ability to pay for every dollar that is current liable, being a predictor if the company can continue to meet obligations to lenders when faced with an unforeseen event (FASSINA, 2006; TIBOR; VERONIKA, 2011).

The interpretation of the ratios is mainly based on industry benchmarks. When these are not available, analysts resort to historical evolution of the ratio and a rule of thumb obtained in the literature.

The following ratios are built by dividing different portions of the company's current assets by current liabilities taken from the firm's balance sheet. They will differentiate among themselves by the level of the liquidity of the current assets used at the calculations. In general, the greater the level of coverage of liquid assets to short-term liabilities the better, considering, of course, the limitations of risk-return relation previously described.

Current Ratio

$$\frac{\text{Current Assets}}{\text{Current Liabilities}} \tag{3}$$

This ratio reflects the number of times short-term assets cover short-term liabilities, and it should be, preferably, greater than 1. The composition of current assets is a key factor in the evaluation of this ratio. For Tibor and Veronika (2011), the problem with this ratio is that it treats all assets and liabilities as being of equal degree of liquidity. In other words, the company could promptly liquidate its current assets and convert them to cash. This is unlikely, since the company is to remain as a going concern.

Quick Ratio

$$\frac{\text{Cash Equivalents} + \text{Marketable Securities} + \text{Accounts Receivables}}{\text{Current Liabilities}} \tag{4}$$

The quick ratio equation above was obtained at Matarazzo (2010). Assaf Neto (2012) consider the numerator instead as: *Current Assets – Inventory – Prepaid Expenses*

It analyzes the company's ability to settle its short-term financial commitments considering its liquid assets, excluding, for instance, the inventory item. The ideal value of this ratio depends on the industry in which the company operates. A company with a strong sales seasonality will have a low ratio in the period in which it needs to carry high volumes of inventory, without this representing a threat to its financial framework (ASSAF NETO, 2010).

Cash Ratio

$$\frac{\text{Cash} + \text{Marketable Securities}}{\text{Current Liabilities}} \tag{5}$$

The elimination of accounts receivables used at the previous equations allows an analysis that truly sees the level of the firm’s cash and near-cash investments relative to the current liabilities. Given the risk-return relation, large amounts of cash on the balance sheet represents a poor asset utilization.

Defensive Interval Days

$$\frac{(\text{Cash} + \text{Marketable Securities} + \text{Net Receivable}) * 365}{\text{Operating Expenses} - \text{Non Cash Charges}} \tag{6}$$

This ratio calculates the number of days a company can operate without any cash returns while meeting its basic operational costs, i.e., how long can it operate meeting daily expenses without resorting to a bank loan, or to a sale of an asset or equity contribution. In general, this number should be between 30 to 90 days for a typical retail business (THOMSON REUTERS, 2008). Differently from the other ratios, this one compares assets to expenses, rather than comparing assets to liabilities.

3.4 CASH CONVERSION CYCLE

The Cash Conversion Cycle (CCC) comprises the period between the cash outflows related to the payment of suppliers and the cash inflows from sales receipts; i.e., it measures the number of days a company's cash is tied up in the production and sales process of its operations. (SATO, 2007). The calculation of the CCC is as it follows:

CCC = Inventory conversion period + Receivables conversion period - Payables conversion period

$$CCC = \frac{\text{Avg. Inventory}}{\text{COGS}^3/365} + \frac{\text{Avg. Accounts receivable}}{\text{Sales}/365} - \frac{\text{Avg. Accounts payable}}{(\text{Inventory increase} + \text{COGS})/365} \quad (7)$$

Inventory period measures how long it takes to convert the company's outstanding inventory into cash. Receivables period measures how long it takes the company to collect on sales that go into the company's accounts receivable. Payables period measures how long it takes the company to pay its suppliers.

Operational cycle is defined as the sum of the inventory and receivables conversion periods. The operational cycle is the periodic transition from cash to inventory, from these to accounts receivables and back to the company cash, i.e. corresponds to the time interval from receipt of the production materials to the collection of the corresponding sales (FERREIRA et al., 2005 apud SATO, 2007).

Assaf Neto (2012) defines the cash cycle as the operational cycle less the payable conversion period. In other words, defined as the period from the point at which the company makes a disbursement to acquire raw materials to the point where the money is received from the sale of the finished product made from those raw materials. The shorter this cycle, the more liquid the company's working capital position is.

[3] COGS: Cost of Goods Sold

4. DYNAMIC MODEL

This section demonstrates the financial analysis in the light of the Fleuriet dynamic model. The dynamic model was introduced in Brazil by the French professor Michel Fleuriet who worked in the 1970s at the Dom Cabral Foundation in Belo Horizonte, Minas Gerais.

It differs from the traditional analysis of the financial statements made through economic-financial indices by considering the dynamics verified in the companies' working capital, as a function of their operational cycle. Assaf Neto (2012) states that the analysis based on the dynamic model provides a better understanding of the solvency and liquidity of a company, and surpasses the traditional model allowing the predictive character of financial equilibrium. Among the merits of the dynamic model in relation to the traditional one is the ability to understand the present and future performance of a company by analyzing how it invests its resources and obtains its sources of financing.

The reclassification of the balance sheet is the first step in the development of this model. The dynamic model considers that the accounts should be classified according to their cycle. In this way three main groups of reclassifications of the balance sheet accounts are defined as following (FLEURIET; KEHDY; BLANC, 2003):

Permanent or Non-cyclical: accounts with slow movement.

Continuous or cyclical: accounts that are related to the operational cycle of the business.

Discontinuous or erratic: accounts that are not directly related to the operation of the company.

The next figure presents a simplified balance sheet according to the traditional accounting approach and with the reclassification of this balance, as proposed by the dynamic model.

Figure 14 - Balance Sheet Cycles

Fleuriet Dynamic Model BS Reclassification		ASSETS	LIABILITIES
		Current	**Current**
	Erratic	Cash And Equivalents Short Term Investments Deferred Tax	Short-term Borrowings Financing and debentures Income tax and social contribution Dividends and interest on equity
	Cyclical	Accounts Receivable Inventory Prepaid Exp.	Accounts Payable Labor and social liabilities Sector charges and other taxes Provision
	Non-cyclical	**Non-current** **Long-term Assets** Accounts Receivable Loans Receivable Gross Property, Plant & Equipment Other Intangibles Long-term Investments	**Non-current** Long-Term Debt **Shareholder's equity** Capital Treasury stocks Retained Earnings

Source: adapted from Fleuriet, Kehdy and Blanc (2003)

The dynamic model uses essentially three indicators: **NCG** (Working Capital Requirement), **CGD** (Working Capital) and **ST** (Treasury Balance). The concept, application and calculation of these indicators are presented below together with the types of balance sheets that are formed through the use of the model. Moreover, it will be explained the liquidity indicator and the economic asset tool, allowing a joint analysis of the indicators and the financial situation of the company.

4.1 NCG – WORKING CAPITAL REQUIREMENT

NCG expresses the difference between the cyclical assets accounts and the cyclical liability. In this way:

$$\text{NCG} = \text{Cyclical Assets} - \text{Cyclical Liabilities} \quad (8)$$

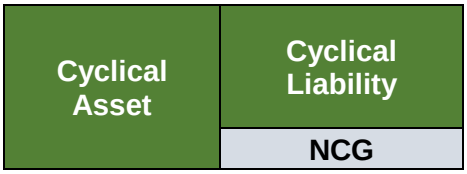
As discussed previously, the operational cycle is the period in which resources are invested in operations without occurring corresponding cash inflows. Part of these investments is financed by suppliers who grant a payment period. Up to the time of payment to suppliers, the company does not have to worry about financing, which is

automatic. After payment to suppliers, the company will have to seek funding to complete its operating cycle.

In case the payable conversion period is greater than or equal to the sum of the inventory and receivable conversion period, the company would not need resources to finance its operational cycle, since the suppliers would be financing it completely. However, as this situation is very difficult to occur, there is a need for funds to keep the business going, due to the lack of operational sources. This demand for resources is called Working Capital Requirement – NCG (VIEIRA, 2005).

Fleuriet, Kehdy and Blanc (2003) highlight that the NCG differs from Net Working Capital because it is composed of only a part of the current assets and liabilities; the one that it is linked to the company's operation. According to Vieira (2005) the NCG can be financed by equity, short and long-term debt.

Figure 15 - Working Capital Requirement (NCG)



Source: adapted from Fleuriet, Kehdy and Blanc (2003).

4.2 CDG – WORKING CAPITAL

The reader must pay attention in the usage of same nomenclature for different concepts. At the section 3.1 (Formula 1) it was explained that Working Capital equals Current Assets. At this section Working Capital (CDG) will be referred as:

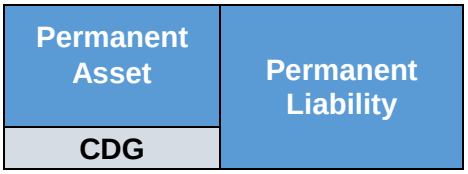
$$\text{CDG} = \text{Permanent Liabilities} - \text{Permanent Assets} \quad (9)$$

To avoid misunderstand, when referring to this new notation, the term *Working Capital* will be followed by the abbreviation *CDG.*

It was shown that the NCG represents the resources needed to keep the business running. Since the NCG has characteristics of permanent and long-term investment, it

must be financed with similar long-term resources, i.e., shareholder's equity and long-term debt. As these sources are primarily used to fund long-term investments and fixed assets, generally only a fraction of them is used to finance the NCG (VIEIRA, 2005).

Figure 16 - Working Capital (CDG)



Source: adapted from Fleuriet, Kehdy and Blanc (2003)

Therefore, in the dynamic model, NCG is financed through the difference between permanent liabilities and permanent assets, commonly known as working capital (CDG).

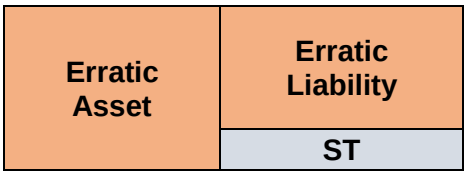
In terms of mathematical result, the CDG has the same value as the Net Working Capital (Formula 2). However, they come up with different conclusions. From the perspective of the traditional model, Net Working Capital shows the ability the company has to settle its short-term commitments. Viewed by the dynamic model, the CDG means a surplus of long-term sources in relation to long-term applications that can be used to finance the NDG (SATO, 2007).

4.3 ST – TREASURY BALANCE

When resources originating from the CDG are not sufficient to meet NCG's demands, the company needs to use short-term sources to supplement funding for its activities. These sources are called treasury balances (ST) and are given by:

$$ST = \text{Erratic Assets} - \text{Erratic Liabilities} \quad (10)$$

Figure 17 - Treasury Balance (ST)

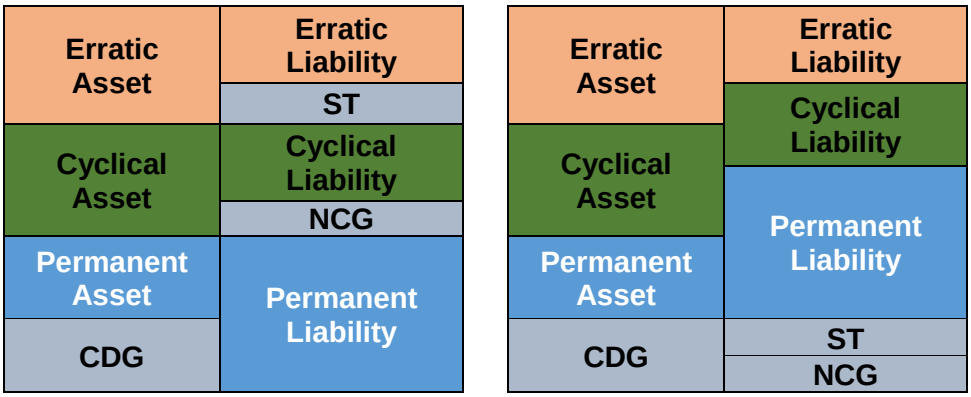


Source: adapted from Fleuriet, Kehdy and Blanc (2003)

From the picture below is also possible to equate that:

$$ST = CGD - NCG \quad (11)$$

Figure 18 - Balance Sheet plus variables



Source: own elaboration

Vieira (2005) verifies that if the ST is negative, it means that the CDG is insufficient to finance the NCG. This indicates that the company finances part of its NCG and/or permanent assets with short-term funds, increasing the risk of insolvency. On the other hand, the author highlights that if the ST is positive, it means that the company has short-term funds that can be invested in securities with immediate liquidity, increasing company's financial security.

4.4 TYPES OF BALANCE SHEET

Once done the reclassification of the accounts and the calculation of the CDG, NCG and ST, the company can be classified into one of the six types of balance sheets, as proposed by Vieira (2005). The classification presented by the author is arranged in a

sequence of liquidity, starting with companies that present a high financial risk (type A) to a situation considered to be financial sustainable (type F). The following table describes the possible classifications.

Table 5 - Company's financial framework according to variables of the dynamic model

Type	Financial Framework	CDG	NCG	ST
A	High risk	-	+	-
B	Terrible	-	-	-
C	Bad	-	-	+
D	Unsatisfactory	+	+	-
E	Solid	+	+	+
F	Excellent	+	-	+

Source: adapted from Vieira (2005) and Fleuriet, Kehdy and Blanc (2003)

The next table exemplifies in numbers the six possible outcomes of the Balance Sheet's types. The table was obtained at Vieira (2005) and the accounts are already reclassified.

Table 6 - Illustrative Example of Types of BS

Description	COMPANY					
	A	B	C	D	E	F
Asset	*100*	*100*	*100*	*100*	*100*	*100*
Erratic	20	20	40	20	30	50
Cyclical	40	30	20	50	50	20
Non-cyclical	40	50	40	30	20	30
Liabilities	*100*	*100*	*100*	*100*	*100*	*100*
Erratic	40	30	20	30	20	20
Cyclical	30	40	50	20	30	40
Non-cyclical	30	30	30	50	50	40
NCG	10	(10)	(30)	30	20	(20)
CDG	(10)	(20)	(10)	20	30	10
ST	(20)	(10)	20	(10)	10	30

Source: Vieira (2005)

Type A: there is total dependence of the short-term resources of the treasury balance (ST <0 = source) for funding the NCG (NCG> 0 = investment) and the CDG (CDG <0 = investment). The situation is critical given the high share of short-term loans in the company's financing framework.

Type B: the company relies on short-term resources (both ST and NDG are negative) to finance its CDG.

Type C: high dependence on the resources provided by the negative NCG to finance both the investments in the CDG and the ST short-term investments.

Type D: according to Vieira (2005), it is the most frequent case in Brazil. NCG funding comes from both short-term (ST) and long-term resources (CDG).

Type E: the company has sufficient CDG long-term resources to finance operational investments at the NCG and to carry out short-term investments (T>0).

Type F: the operation generates resources (NCG <0) which, together with the CDG, will be invested in the financial market in accounts of the treasury balance. It evidences a very solid liquidity situation.

4.5 LIQUIDITY ANALYSIS

4.5.1 Liquidity Indicator

One of the considerations made on the NDG, when positive, is that it must be financed with long-term resources. Therefore, it is natural that the NDG should be financed by the CDG. If the financing comes from the ST (total or partial), characterized by short-term resources, it can create a situation of imbalance. This type of financing (type D), although risky, is very frequent in Brazil, thus deserving constant monitoring, according to VIEIRA, (2005). To this end, another information on the company's financial situation is obtained through the index:

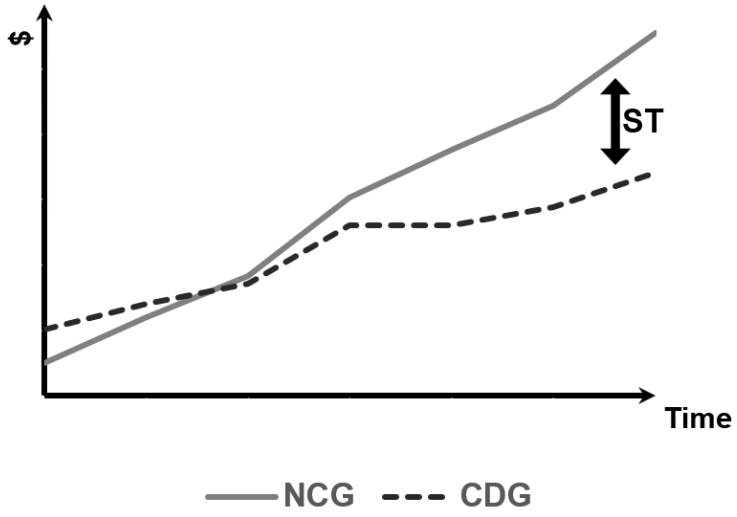
$$\text{Liquidity Indicator } (\text{LI}_{\text{NCG}}) = \frac{\text{ST}}{|\text{NCG}|} \tag{12}$$

According to Vieira (2005), the more negative the value of the indicator, the worse the company's financial situation will be. If there is a trend using this index, it verifies the existence of the “Scissors effect”.

4.5.2 Scissors Effect

According to Vieira (2005), the scissors effect is established when there is a mismatch between the evolution of available long-term sources (CDG) and the investments that need to be financed (NCG), as shown in next figure. The denomination of the scissor effect comes from the fact that, visualized in a graph, when ST becomes negative and assumes a growing trend, produces a gap between the NDG and CDG curves, with a visual effect similar to that obtained by the two parts of a scissors.

Figure 19 - Scissors Effect



Source: adapted from Vieira (2005)

Sato (2007) indicates the main effects that generates the scissors effect:

-High sales growth;

-High growth of the financial cycle;

-Reduced self-financing capacity, either by low profit generation, by excessive distribution of dividends or by the existence of losses;

-Excessive investment in long-term assets without long-term resource availability.

4.5.3 Economic Asset

Vieira (2005) recommends the use of the concept of Economic Assets (EA) for companies whose investments in working capital have low representation (in percentage) of the company's total assets. For Vieira, the LI_{NCG} indicator will show great variations, and will not be, therefore, explanatory.

$$\text{Liquidity Indicator } (\text{LI}_{\text{EA}}) = \frac{\text{ST}}{|\text{EA}|} \tag{13}$$

$$\text{Economic Asset } (\text{EA}) = \text{NCG} + \text{long term assets} \tag{14}$$

The economic asset of a company corresponds to the investments made in its operational investments (NCG) and its long-term assets, representing a permanent financing need that must be met by the company (preferably with long-term resources). Therefore, a negative value of the LIEA implies a greater use of the ST in the financing of the EA, on the contrary, a positive value of this indicator denotes independence of short-term resources such as bank loans (Sato 2007).

5. OTHER METHODOLOGIES

5.1 METHODOLOGIES USING CASH FLOW AND INCOME STATEMENT

Studying cash flow consist in understanding the process of liquidity formation in the company. It is identifying which activities are generating a positive or a negative cash flow. In this sense, the generation of liquidity is more important than the generation of profit since what bankrupts a company is not the lack of profit; is the lack of liquidity (SÁ, 2004).

More than measure how well a company manage its cash position, the Cash Flow Statement (CFS) allows the reconciliation between the accrual basis accounting - present in the Balance Sheet and in the Income Statement - and the cash basis accounting.

For Kajananthan (2014), measuring liquidity by the CFS is more reliable than balance sheet or income statement. The author highlights that the BS, since it is static, measures only single points in time, whereas the IS contains bookkeeping artifice and manipulation, that can be misleading.

Atieh (2014), in a study of companies of the pharmaceutical industry, stated that a conclusion on the liquidity of the company based only on traditional ratios can lead to incorrect decisions and that, therefore, an analysis based on traditional ratios should be compared with cash flow ratios before reaching any conclusion regarding financial liquidity position.

Cash Flow Ratio

$$\text{CFR} = \frac{\text{Net Operational Cash Flow}}{\text{Current Liabilities}} \tag{15}$$

It measures how much cash a company's business operations generates relative to its current liabilities, gauging its liquidity in the short term. Operating cash flow ratio less

than 1.0 indicates a complicated situation, since the company is not generating enough cash to pay off its short-term debt (ATIEH, 2014).

Cash Interest Coverage

$$\text{CIC} = \frac{\text{Net Operational Cash Flow} + \text{Interest} + \text{Tax}}{\text{Annual Interest}} \quad (16)$$

It shows how easily a company can pay interest on its outstanding debt. The cash interest coverage ratio is analogous to the interest coverage ratio (EBIT / Interest), but with a more realistic analysis, since earnings include all manner of noncash charges—depreciation, pension contributions, some taxes and stock options. Any company with a cash interest multiple less than 1.0 runs an immediate risk of potential default. The company must raise cash externally to make its current interest payments. (MILLS; YAMAMURA, 1998)

5.2 CORPORATE BANKRUPTCY PREDICTION MODELS

In order to predict corporate defaults of financial distress status companies, academic studies have developed models aiming to see if the symptoms that a company is on the way to bankruptcy can be noticed before the outcome occurs (ALVES, 2013).

According to Catapan (2005) one of the first to study the topic was Edward Altman, that developed his first model at 1968. In Brazil, the precursor was the Kanitz's model, at 1972, and nowadays there are similar and more current models, such as Elizabetsky, Matias and Pereira.

Due to the accuracy ratios shown by Alves (2013) of each model, it was decided to work thought this thesis with the Kanitz and Matias' models.

Kanitz's Model

Kanitz elaborated the bankruptcy forecasting model by obtaining a number called Insolvency Factor, which determines the tendency of a company to bankrupt or not. To facilitate, it created a scale called the Insolvency Thermometer, indicating three different situations: Solvent, Penumbra and Insolvent (CATAPAN, 2005).

$$\mathbf{Z = 0.05\ X1 + 1.65\ X2 + 3.55\ X3 - 1.06\ X4 - 0.33\ X5} \quad (17)$$

$$\mathrm{X1} = \frac{\text{Net Income}}{\text{Equity}}$$

$$\mathrm{X2} = \frac{\text{Current Assets} + \text{Long Term Assets}}{\text{Current Liabilities} + \text{Long Term Liabilities}}$$

$$\mathrm{X3} = \frac{\text{Current Assets} - \text{Inventories}}{\text{Current Liabilities}}$$

$$\mathrm{X4} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$\mathrm{X5} = \frac{\text{Current Liabilities} + \text{Long Term Liabilities}}{\text{Equity}}$$

0 ≤ Z ≤ 7: Solvent. A company that has a positive insolvency factor is less likely to fail, decreasing as the positive factor is higher.

-3 ≤ Z < 0: Penumbra. Area in which the insolvency factor is not enough to analyze the situation of the company, but that still requires attention.

-7 ≤ Z < -3: Insolvent. Company is under a situation that can leads to a bankruptcy.

Matias' Model

Matias elaborated the model at 1982, configurating as one of the most current and accurate model developed for the Brazilian market. (Alves, 2013). This model was chosen among the others since is one of the few that does not include inventory as a dependent variable. This is important, since inventory is irrelevant in the electricity distribution business.

$$\mathbf{Z = 23.792\ X1 - 8.26\ X2 - 9.868\ X3 - 0.76\ X4 - 0.535\ X5 + 9.912\ X6} \quad (18)$$

$$\mathrm{X1} = \frac{\text{Equity}}{\text{Total Assets}}$$

$$\mathrm{X2} = \frac{\text{Bank Loans}}{\text{Current Assets}}$$

$$\mathrm{X3} = \frac{\text{Suppliers}}{\text{Total Assets}}$$

$$\mathrm{X4} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$\mathrm{X5} = \frac{\text{Operating Income}}{\text{Gross Profit}}$$

$$\mathrm{X6} = \frac{\text{Cash and Equivalents}}{\text{Total Assets}}$$

The critical point for the model is zero, i.e., values with negative score classify the company as insolvent, whereas values with positive score classify the company as solvent (CATAPAN, 2005).

6. APPLICATION OF METHODOLOGIES

6.1 ANALYZED METHOD

To understand the liquidity behavior of distribution companies it was picked the main listed players of the industry. The tables below depict the chosen companies, accompanied by the ranking (in terms of volume of energy supplied) and the total market share of these main companies. Despite the existence of dozens of Discos in Brazil, it was only found twelve companies with available financial information. Therefore, rather than understand companies' individualities, it was decided to do a study in panel data and analyze the twelve companies as a representation of the whole market. For the USA market, there were more companies with public financial information; however, to simplify any statistical analysis, it was decided to use the same sample space for both markets. The financial statements were gathered from the S&P Capital IQ platform and the data were disposed on a quarterly based since 2008.

Table 7 - Main Players in Brazil

RANKING	COMPANY
1	Eletropaulo
2	Cemig Distribuição
3	Companhia Paulista de Força e Luz
4	Light
5	Copel Distribuição
6	Companhia de Eletricidade do Estado da Bahia
7	Celesc Distribuição
16	Energisa Mato Grosso
17	Rio Grande Energia
19	Companhia Estadual de Distribuição de Energia Elétrica
20	Companhia Energética do Maranhão
23	Companhia Energética do Rio Grande do Norte
Market Share of main players in terms of volume of energy supplied	***56.8%***

Source: ANEEL (2018).

Table 8 - Main Players in US

RANKING	COMPANY
1	Southern California Edison
2	Pacific Gas & Electric
3	Florida Power & Light
4	Consolidated Edison Company of NY
5	Georgia Power
6	Virginia Electric & Power
7	Commonwealth Edison
8	DTE Electric Company
9	Public Service Elec & Gas
10	Duke Energy Carolinas
11	Consumers Energy
12	Duke Energy Florida
Market Share of main players in terms of volume of energy supplied	***20.5%***

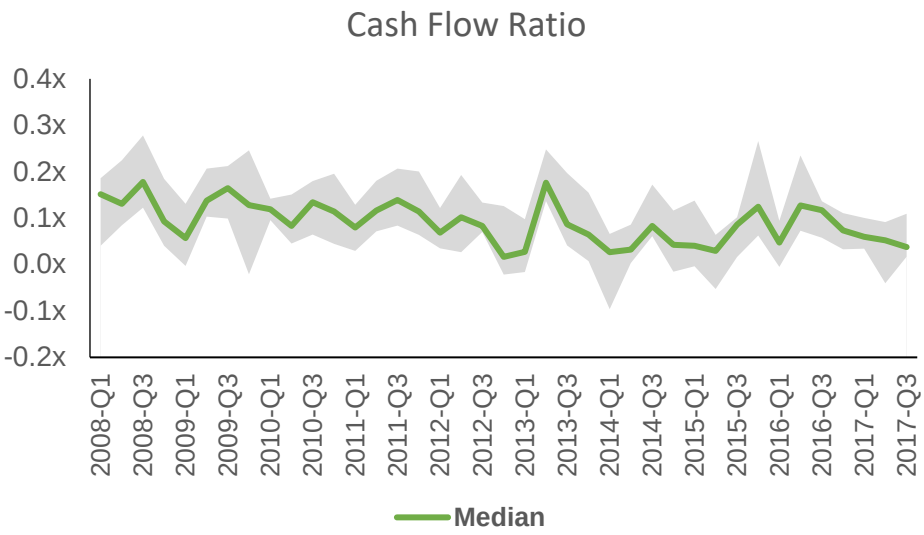
Source: U.S. Energy Information Administration (2018).

6.2 BRAZIL RESULTS

As previously described, Discos faced a substantial increase on the cost of energy acquisition after the execution of the MP 579, but, at the same time, were not allowed to readjust the tariffs. This chapter, therefore, aims to analyze if, and how, this political interference impacted the liquidity of the companies. Another point that must be analyzed ahead is to see whether or not the introduction of the tariff flag in January 2015 mitigated the working capital impact. For these purpose, the tools exhibited in Chapter 3, 4 and 5 will be applied over the twelve companies on the Brazilian market as a good portrayal of the whole sector.

The charts ahead are disposed at the same format. The main line shows the median of the 12 companies, whereas the grey area shows the limits of the first and third quartiles.

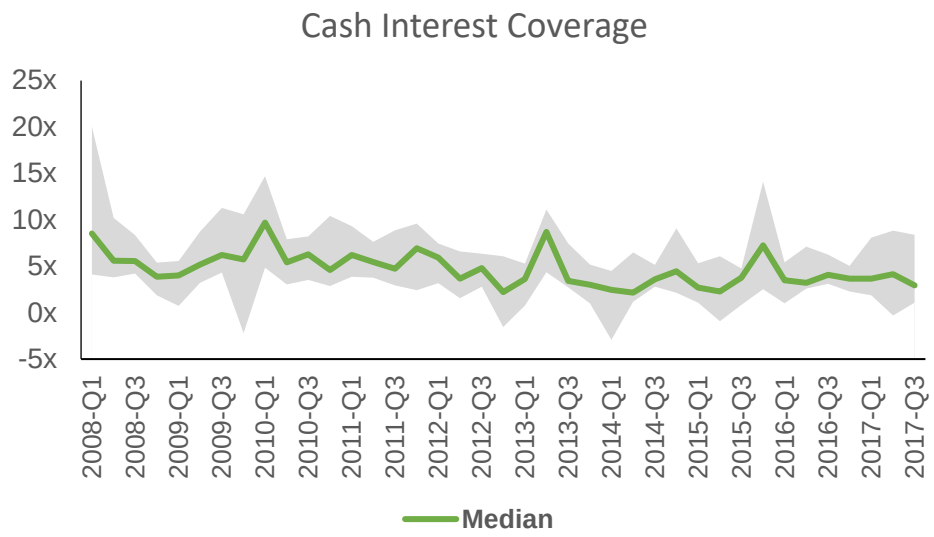
Figure 20 - Cash Flow Ratio - Time Series Brazil



Source: own elaboration

From Figure 20 it is possible to see that the median remained quite constantly between *0.1x* and *0.2x* and that no seasonality pattern is observed. Also, at beginning of 2013 there is an overall increase in the ratio, with a very tied deviation. The peak observed at 2013-Q2 was caused by the change in the Accounts Receivable related to the CDE transfer. After this quarter the ratio decreased once again but remained steady giving the continuity of the transfers by CDE and ACR account. From 2015-Q2 to 2015-Q4 the industry saw an improvement on the ratios due to the tariff flag regulation. The median in this period rose from *0.03x* to *0.12x*. Some companies, for instance Rio Grande, at the same period, faced a progress from *-0.03x* to *0.37x*.

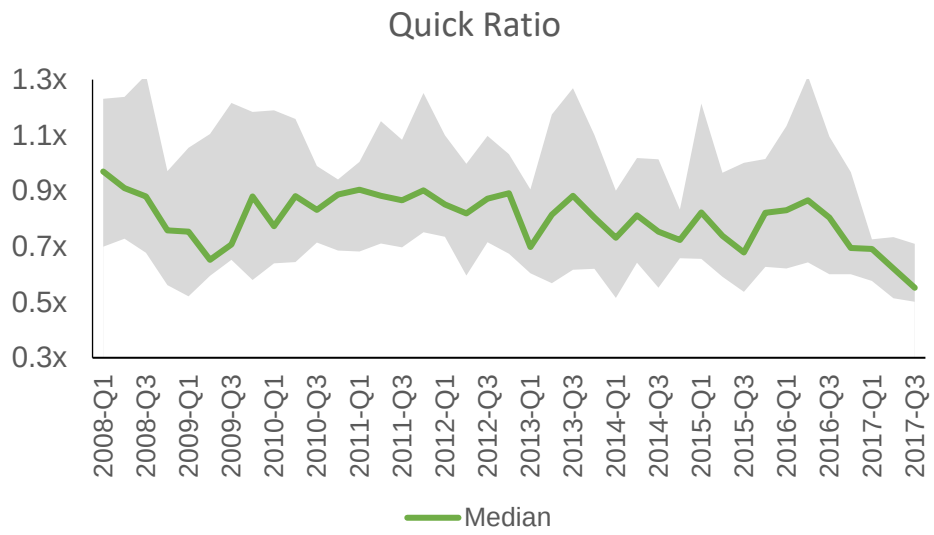
Figure 21 - Interest Coverage Ratio - Time Series Brazil



Source: own elaboration (2018)

Same as seen in the Figure 20, the *Cash Interest Coverage Ratio* shows no significant change throughout the decade and behaved in line with the *Cash Flow Ratio*.

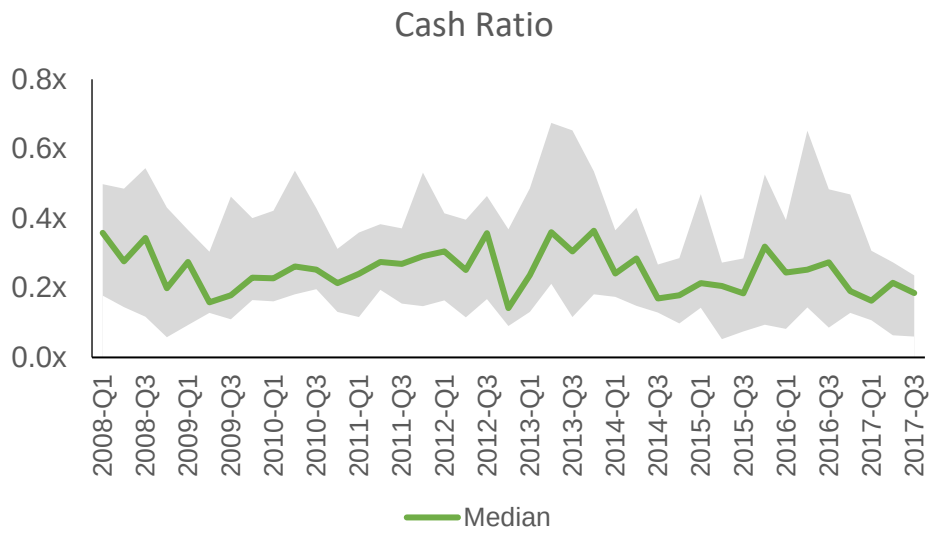
Figure 22 - Quick Ratio - Time Series Brazil



Source: own elaboration (2018).

The quick ratio behaved quite constantly during the time series. Despite the slightly decrease in 2014 comparing with 2012, the data appears to be in line with the period pre-2010. However, since it is calculated using Balance Sheet data, and, therefore, a static number, it was expected to present a more stable behavior, which was not observed.

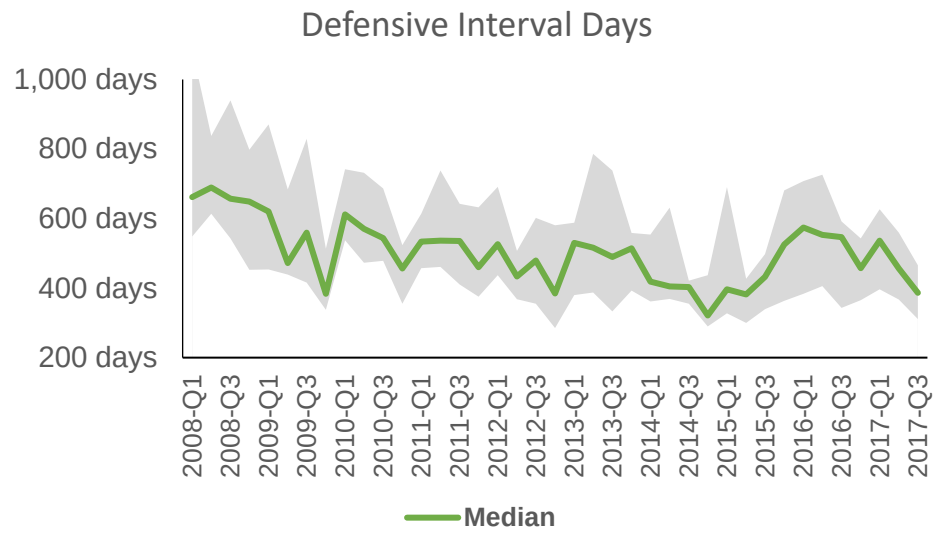
Figure 23 - Cash Ratio - Time Series Brazil



Source: own elaboration (2018)

The *Cash Ratio* decrease observed in 2012-Q4 due to lower cash generation is mainly explained by the peak of thermal dispatch occurred in the second half of 2012 without any fund transfer from government (as occurred in 2013 and 2014). Apart from that, it is possible to notice that whereas the inferior limit (1st quartile) was quite stable, the superior limit (3st quartile) shows significant variation. This happened by the occurrence of irregular upsides from Cemar, Light and CEEE.

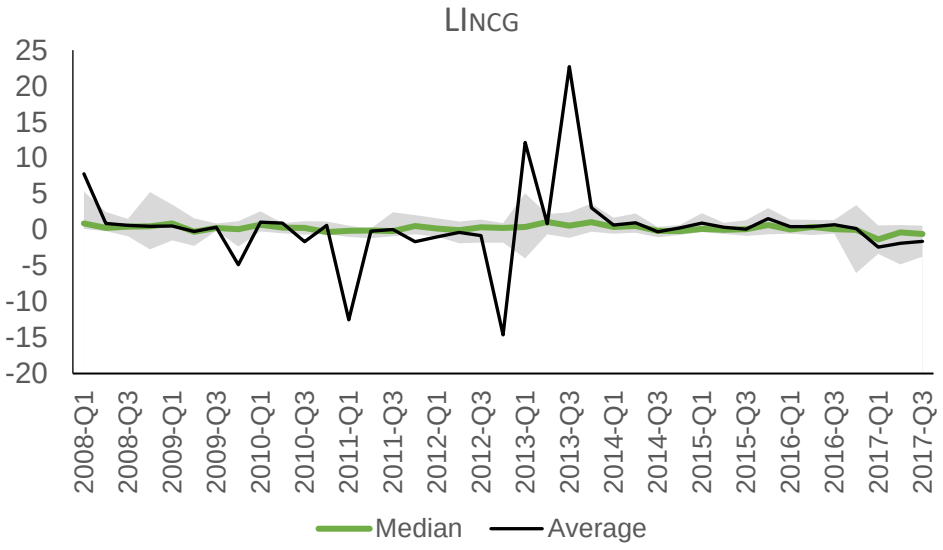
Figure 24 - Defensive Interval Days - Time Series Brazil



Source: own elaboration (2018).

There is no study in the literature suggesting a proper *Defensive Interval Days* for Discos. Ahead, it will be addressed a benchmarking comparison with US market. So far, what can be inferred is that the companies have been decreasing the ratio from 2008 to 2015. Lately, what have been seen is that due to the tariff flag regulation, cash flow generation increased, improving the overall average.

Figure 25 - Liquidity Index (NCG) – Time Series Brazil

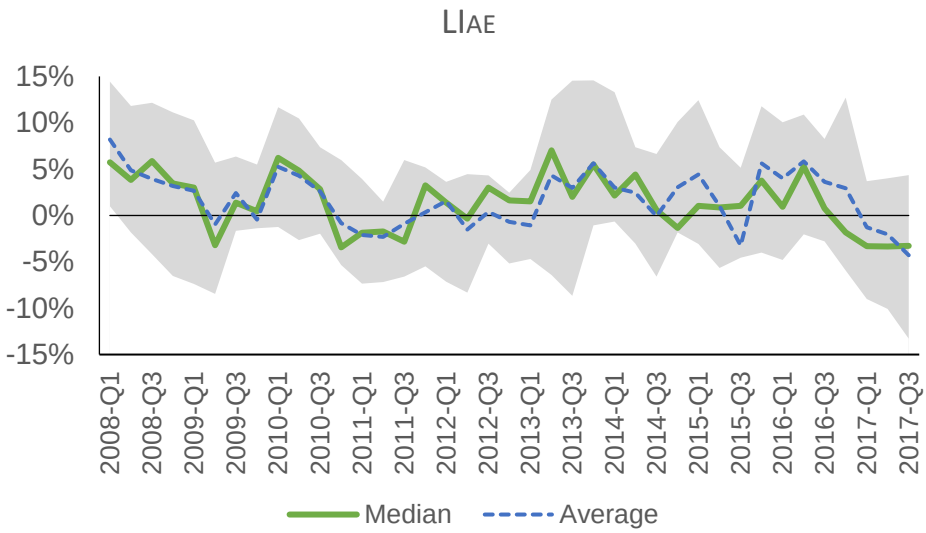


Source: own elaboration

As stated by Vieira (2005), the liquidity index calculated using the Working Capital Requirement (NCG) is not proper for industry with high portion of assets on fixed ones,

such as Discos. The mismatch between median and average at Figure 25 clearly shows how this metric is useless in evaluating this industry.

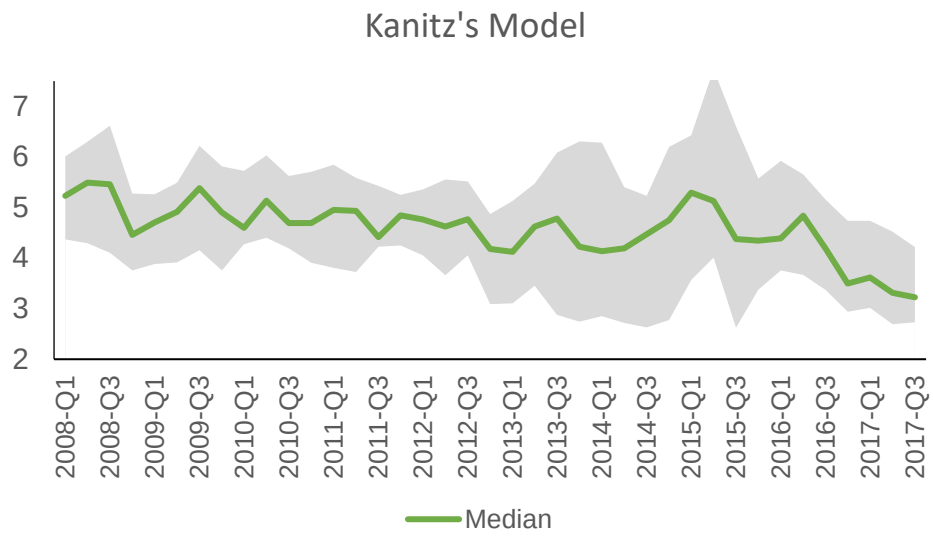
Figure 26 - Liquidity Index (EA) – Time Series Brazil



Source: own elaboration (2018)

A positive value of the LI_{EA} implies independence of short-term resources to finance the EA. Therefore, most of the part of the period analyzed seems that the Discos have operated in a solid financial position. In the last few quarters the industry faced a decrease in the ratio, mainly due to an underperformance from CPFL and Rio Grande.

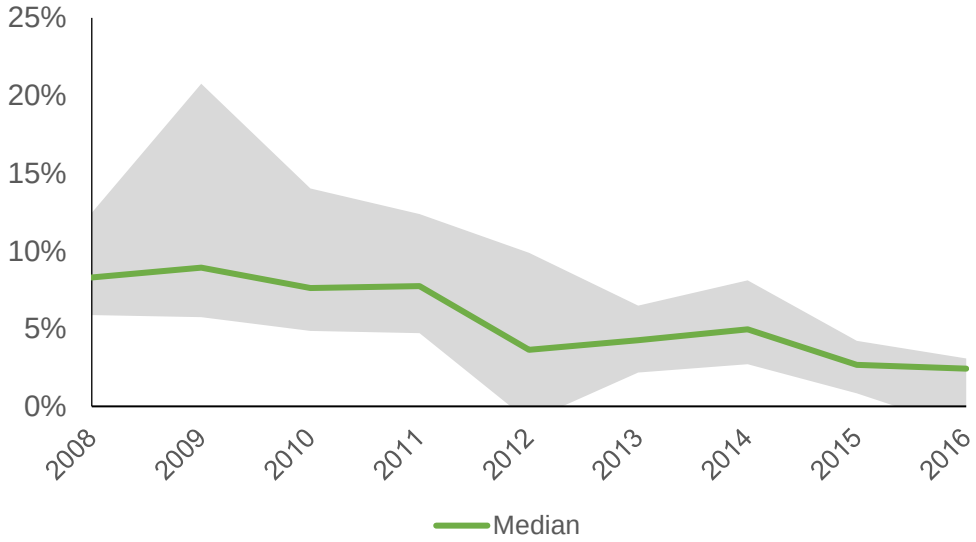
Figure 27 - Kanitz's Model – Time Series Brazil



Source: own elaboration

From the five variables of the Kanitz's Model, only one use a non balance sheet ratio, which is the ROE (*X1*). Therefore, somehow the other four varbiables are already illustrated in the previous charts. From the Kanit'z model is possible to infer that (i) the Discos are considered solvent; (ii) the standand deviation have grown since the beginning of 2013 (when MP 579 was put in place); (iii) from 2016 on, the overall performance have worsened, but followed by a deviation reduction.

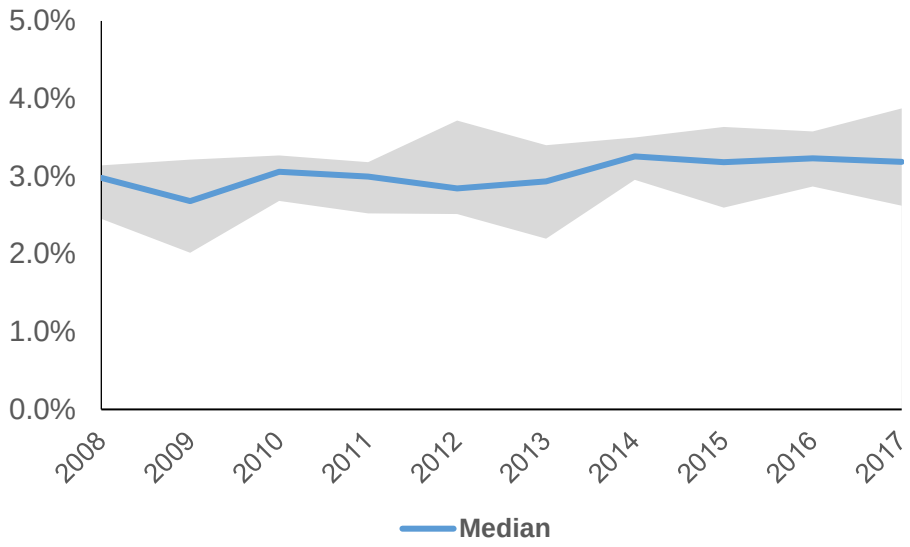
Figure 28 - Annual ROA Discos Brazil



Source: own elaboration

The Return on Assets (ROA) depicted in the Figure 28 shows that the segement is not so linear as it should be. Also, it shows how the current tariff regulation works inefficiently: since one of the metrics to calculate tariff is based on a regulatory *WACC,* companies should have small variations on returns. Figure 29 portrays, on the other hand, the US market, and illustrates how the industry has a very similar beahvour.

Figure 29 - Annual ROA Discos US



Source: own elaboration

Due to limitation on Brazilian companies breakdown of costs in the plataform Capital IQ, the calculation of the variable X5 (Operating Income/ Gross Profit) might give a misleading conclusion. The plataform does not split what is cost of purchased of energy and maintenance expenses, and, therefore, in most cases Operating Income equals Gross Profit.

Given the increase in the spot price observed at Figure 9 after the first semester of 2013 and the political stipulation of tariffs that began on 2013, it was expected that the distributors would have started to face sizeable working capital concerns. However, the data obtained allows a different conclusion.

Despite the mistakes of the government in the execution of the MP579 and its resistance to give a step back, it is clear that it was very efficient to keep Discos financially health. As showed in the section 2.5.3, the National Treasury and the CCEE acted on behalf of the Discos at very first quarter of 2013. Certainly, the final consumer

still paying nowadays for this interference at its tariff (or at its taxes), however, in regard of liquidity concerns, the government acted very efficiently.

Moreover, from the analysis, there is no clear evidence that the industry was benefited by the tariff flag regulation.

6.3 COMPARISON WITH US MARKET

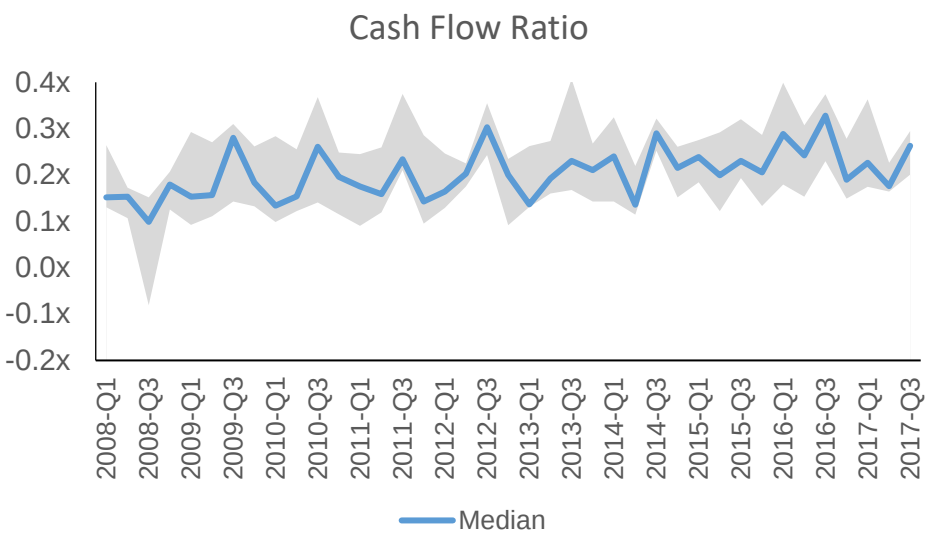
Understood the impact of regulation and intervention on Brazilian Discos liquidity, the second step of this study is to compare the deviation between Brazil and US markets.

As previously described in section 2, despite the electricity industries in both countries sharing a lot of similarities, the distribution segments in each market is a different business and, therefore, may show divergent liquidity behavior.

Ahead, it will be shown the charts related to US market. It is important to emphasize two main points: (i) American companies owns a small proportion of their assets under cash accounts; (ii) in some charts, the deviation among companies is clearly lower than Brazilian companies.

The charts bellowed are shown with the same scale on Y-axis of Brazilian charts, in order to facilitate the comparison.

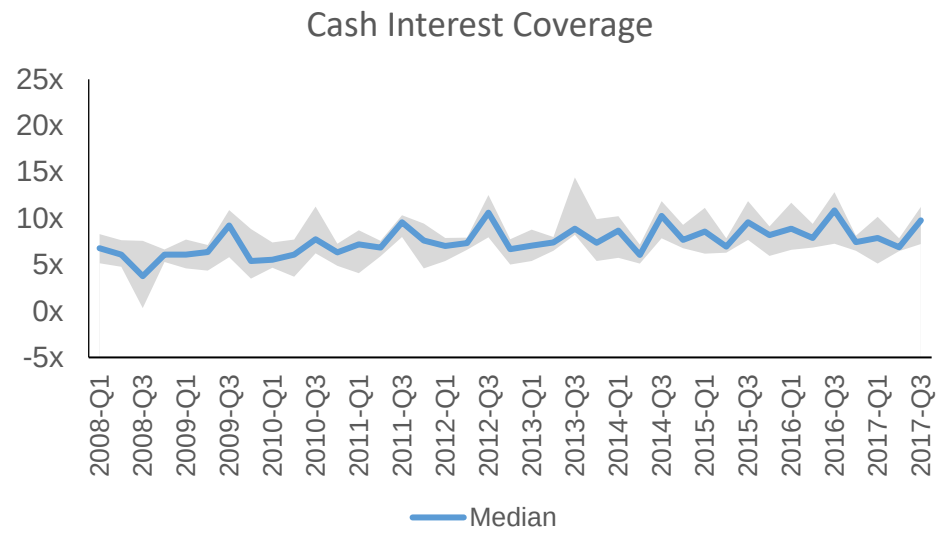
Figure 30 - Cash Flow Ratio - Time Series USA



Source: own elaboration

The deviation of American companies at Figure 30 is lower than the Brazilian ones. It is interesting to notice that cash flow generation is not stable as net income, especially in business that require a great volume of Capex (Capital Expenditure). The cash flow ratio chart also highlights that American companies owns a slightly better return of cash flow to liabilities when comparing to Brazilian ones.

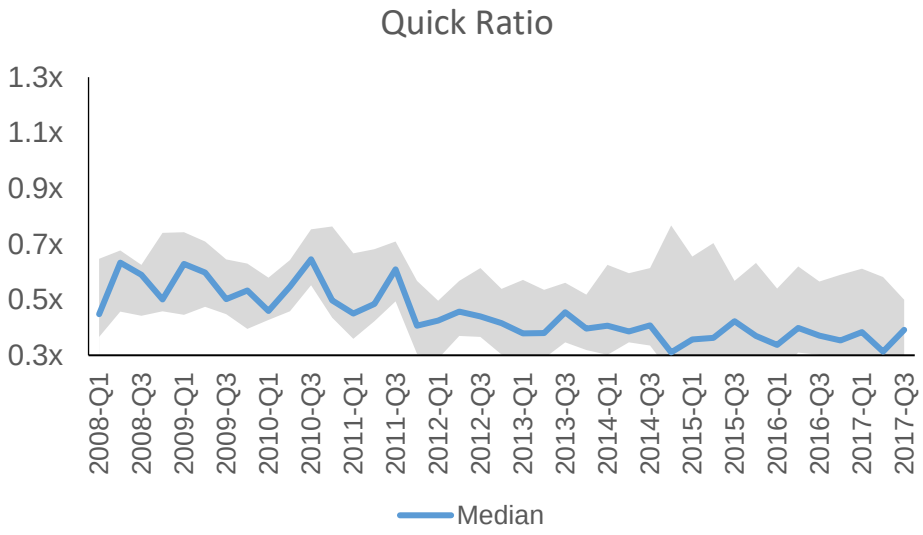
Figure 31 - Interest Coverage Ratio - Time Series USA



Source: own elaboration (2018)

The historical average of both countries in terms of cash interest coverage (as depicted in Figures 21 and 31) does not show strong difference. On the other hand, the deviation of American companies is evidently narrower.

Figure 32 - Quick Ratio - Time Series USA

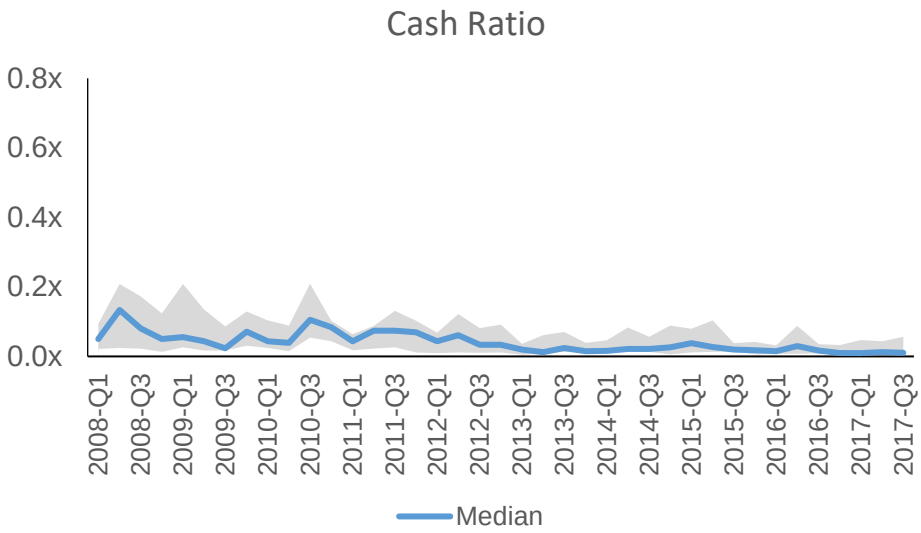


Source: own elaboration

In terms of Quick ratio, it is evident that both deviation and median of American companies are lower than Brazilian; the averages of historical median are, respectively, 0.45 and 0.80. This highlights a better use of resources in the USA

market, which means that companies are most effective in investing in fixed asset rather than working capital.

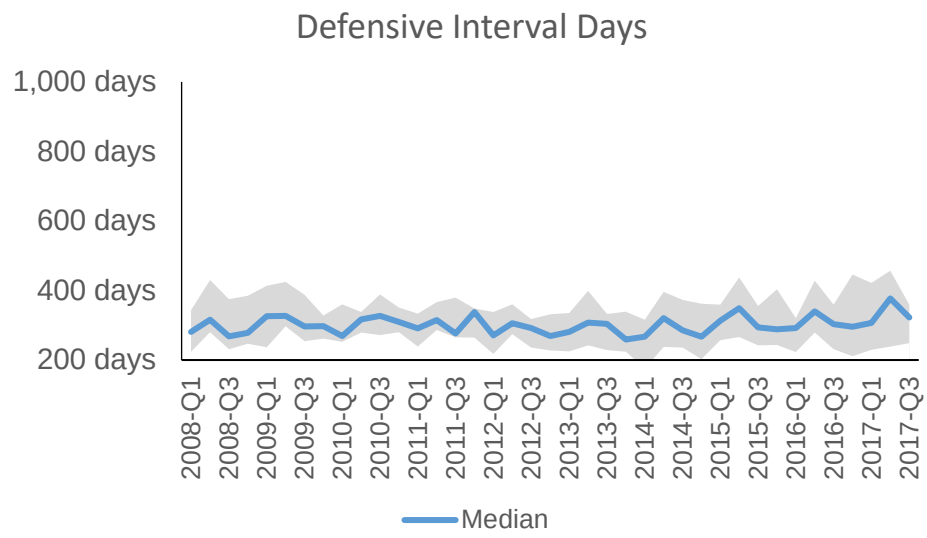
Figure 33 - Cash Ratio - Time Series USA



Source: own elaboration (2018)

Figure 33 speaks by itself. By this chart analysis, it is doubtless that American Discos operate a different business of the Brazilian. Not only it requires small cash proportion but also it is a very predictable operation, since the deviation is almost insignificant. This occurs as American companies do not have to worry about buying electricity in ACR market and having a good cash position in order to face any unforeseen on spot market.

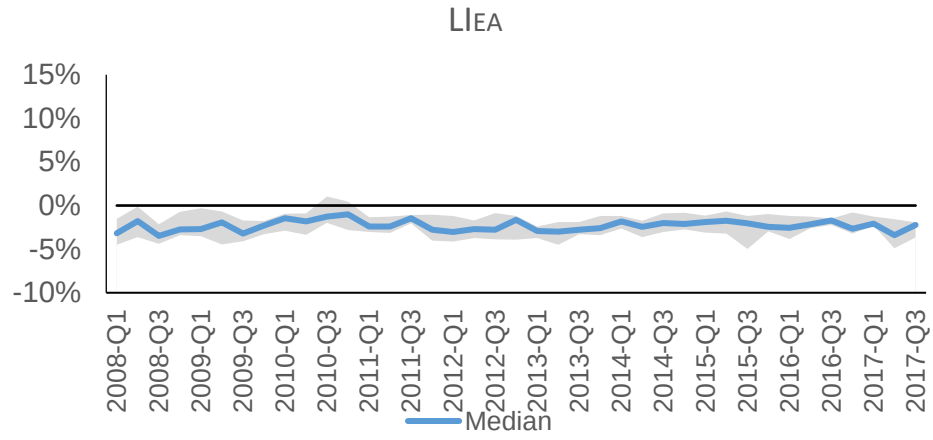
Figure 34 - Defensive Interval Days - Time Series USA



Source: own elaboration

Despite a downward trend of Brazilian companies' Defensive Interval Days, it is clear that Discos in Brazil have a large proportion of cash when compared to operational expenditures than American companies. Also, the deviation of the data in USA is clearly smaller. These facts observed at the variable Defensive Interval Days drive to the same conclusion of the cash ratio analysis: the business model is different.

Figure 35 - Liquidity Index (EA) – Time Series USA

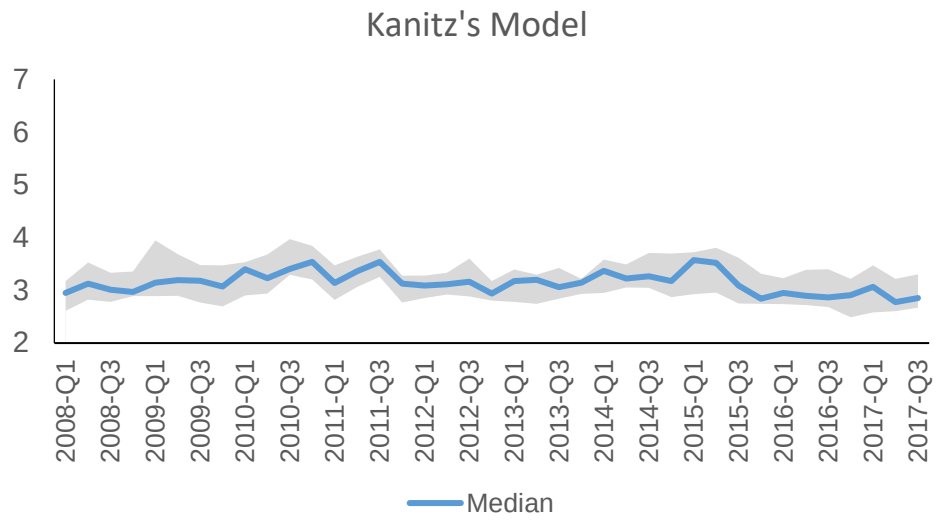


Source: own elaboration

The Liquidity Index (EA) at the chart above demonstrates that despite stable, the index has always been negative. These indicates the companies Erratic Liabilities are higher than Erratic Assets; according to Vieira (2005) this constitutes as an unsatisfactory financial framework. However, since short-term debt in USA is considerably cheaper

than in Brazil, this analysis would probably diverge. Lastly, once again is visible the difference between the two countries on regard of deviation among players.

Figure 36 - Kanitz's Model – Time Series USA

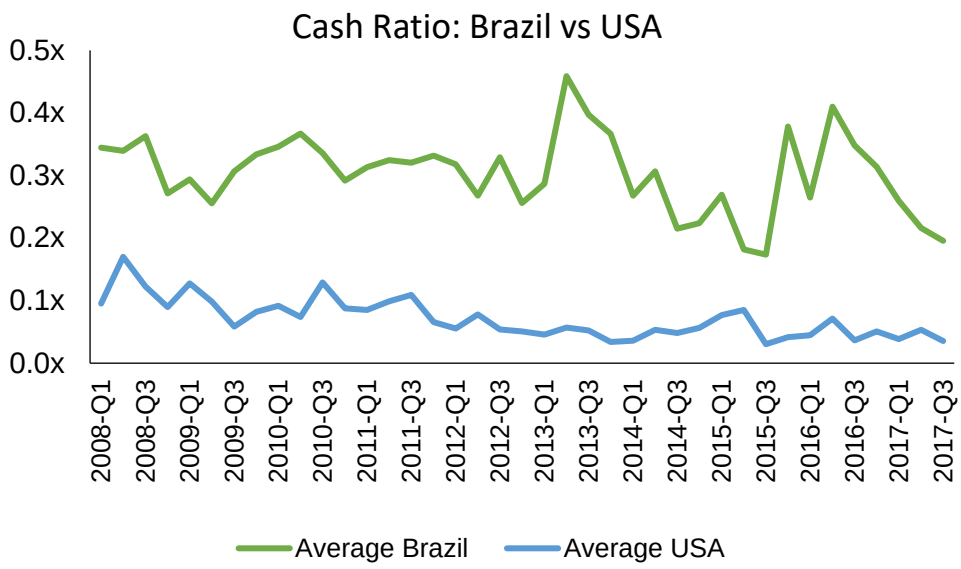


Source: own elaboration

When comparing both countries in terms of the Kanitz's Model, not only American companies had a more stable median but also an evident smaller deviation. Once again, it is clear that American Discos outperformed Brazilian companies in terms of predictability of the industry.

Figure 37 make easier the visualization for the reader in terms of the discrepancies in both market. The Figure depicts in only one chart the average of the twelve companies of each market in terms of Cash Ratio. It is evident not only the lower need for cash in the American sector but also, the stability.

Figure 37 - Cash Ratio – Brazil vs USA



Source: own elaboration

7. CONCLUSION

At the financial market, investors read the utilities industry as an industry with small risk, therefore, with small, but predictable, returns. This rule clearly applies for US Discos companies, as observed in Figure 29. However, when it turns to Brazil, the reality does no stand in the same way. As Figure 28 depicts, not only the median of returns was not steady over the years, but also the standard deviation among players were high. It seems that the previous rule described does not apply for Brazil.

After all, despite the fact that government prevented the bankruptcy of Discos, the level of uncertainty that surrounds the Brazilian market helps to explain the higher risk of the country, as, even when the government brings a solution, it consists on a intervention movement,

Moreover, a reduction in tariffs based on a National Treasury financing, as it happened in Brazil, just change the source of funding. The consumer sees a reduction in the electricity bill, but as taxpayer, its money is, at the end, paying this reduction.

In this sense, there are some studies in the literature that propose a remodeling of the operation for the distribution segment in Brazil. Mostly of the approaches of these studies rely on engineering argument, such as the increase presence of distributed generation. However, none of these studies built an argument based on a financial explanation.

So far, this paper proposed itself to (i) explain thy dynamic of the energy sector, (ii) describe some metrics to analyze liquidity, (iii) study the impact of public intervention on Discos' liquidity and (iv) compare Brazilian and American Discos regard liquidity metrics.

After all, this thesis comes to the conclusion that the electricity sector must be reshaped. It is proposed for ANEEL two different approaches, both with the same purpose: **reduce/extinguish Discos exposure to energy price volatility.**

The first one would be an expansion of the ACL for small consumers, such as residences and small business. This initiative was several times discussed throughout this paper and would truly separate the grid from the energy business.

The second proposal it is a *Day ahead negotiation*. It consists on a step forward in terms of the Tariff Flag that it is already in course. Rather than wait for periodic tariffs adjustments, the *Day ahead negotiation* would allow a cost of energy by hour. Therefore, Gencos and Discos would negotiate prices and volumes for the day ahead, minimizing over/under supply and wrong pricing.

7.1 LIMITATION AND FUTURE STUDIES

The analyzes conducted at the previous chapter are limited in terms of the number of companies studied. The small sample not only reduces the possibility of use of statistic tools but also does not represent the totality of the energy market, as already portrayed in Tables 7 and 8.

As future studies, it is encouraged a similar analyze of Gencos, to understand if the behavior observed at Discos in Brazil and USA is replicated to the generating segment. Moreover, other financial analyzes can be conducted in terms of financial metrics, such as capital structure.

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