

Análise do uso de títulos conversíveis para financiamento de projetos de energia solar

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Agradecimento à órgão de fomento:

Ao CNPq que financiou a dissertação de mestrado do autor principal e que originou este artigo

ANALYSIS OF THE USE OF CONVERTIBLE BONDS FOR FINANCING SOLAR ENERGY PROJECTS

ABSTRACT

This paper analyzes the use of convertible bonds to finance the power generation from solar sources. The first step, exploratory, verified which mechanisms support the issue, as well as the conversion rules. The second one, with simulation of scenarios, verified the impacts of a conversion on the financial performance of the project with measures of interest, price volatility and time for conversion. The results point to two forms of conversion: those that facilitate and those that make conversion difficult. This varies according to the purpose of the issue, that is, the motivation to issue convertible securities is what defines the rules for balancing the risks between the parties involved.

Keywords: Convertible bonds; Solar Energy; Energy Financing.

RESUMO

Este trabalho analisa o uso de debêntures conversíveis no financiamento privado de produção de energia elétrica por fontes solares. A primeira fase, exploratória, verificou quais os mecanismos que suportam a emissão, bem como, as regras de conversão. A segunda, com simulação de cenários, verificou os impactos de uma conversão no desempenho financeiro do projeto com medidas de juros, volatilidade de preço e tempo para conversão. Os resultados apontam para duas formas de conversão: as que facilitam e as que dificultam a conversão. Isso varia de acordo com o objetivo da emissão, ou seja, a motivação para emitir títulos conversíveis é o que define as regras para equilibrar os riscos entre as partes envolvidas.

Palavras-chaves: Debêntures conversíveis; Energia Solar; Financiamento de Energia.

INTRODUCTION

Convertible bonds (CB) are long-term debt securities that give the creditor the right to convert the debt into shares of the issuing company (ETTENHUBER; SCHIERECK, 2015). The granting of this right to the creditor aims to reduce the payment of interest on the financing to the issuer, since the latter grants the former the option of converting the debenture and consequent participation in the business, provided that the creditor deems it appropriate to exercise this option. (LUO; ZHANG, 2019).

The Academy has endeavored in proportionate solutions that are suited to the profile of broadcasters and local legislation, however, most of the research is aimed at pricing the title (CHOE; JANG; NA, 2019; LIN; ZHU, 2020; LUO; ZHANG, 2019) and analyze only part of the problem (HACKNEY; HENRY; KOSKI, 2020; SAE-SUE; SINTHAWAT; SRIVISAL, 2020). The works in general ignore the key factor for this type of title, which is the relationship between the parties and the convert right (SAE-SUE; SINTHAWAT; SRIVISAL, 2020; SILVA; D'ALMEIDA, 1974). The analysis of the relationship between the parties, that is, how the conversion affects the issuer and the creditor, can provide alternatives that make the use of the instrument more appropriate.

There are researches that analyze the performance of the issuers after the announcement of the issue of the bonds, and in some studies this issue is considered bad due to the problem of information asymmetry and, in others, it can be good when the company has investment plans in the future that represent cash flow increases (CHANG et al., 2019). Some studies look at the possibility of trading the security or the stock on the secondary market or what would lead to

the effective conversion (HOMAIFAR; MICHELLO, 2020; SAE-SUE; SINTHAWAT; SRIVISAL, 2020).

What is still open for discussion, in this sense, is to demonstrate the relationship between issuer and investor in order to guide the yields, that is, a distribution of risks among those involved (JANG; JIA; ZHENG, 2019). This is interesting to check not only the performance of the broadcaster after the issuance of the bonds, but the reflection of the conversion to its results (SAE-SUE; SINTHAWAT; SRIVISAL, 2020). It is worth noting that there aren't many researches that evaluates the performance of the post-conversion broadcaster (HIMMELBERG; TSYPLAKOV, 2020; KAŻMIERCZAK, 2018) and that the literature recognizes the importance of clear conversion mechanisms that better support the emission decision (SILVA; D'ALMEIDA, 1974).

Thus, to elucidate these issues, the energy sector was chosen to subsidize financial data to support the analysis. Furthermore, as will be seen in the course of this paper, the energy market in Brazil and the world gives rise to new financing mechanisms, as well as greater participation by the private investment market to support its development (JAMES; MAJID, 2020; TORINELLI; SILVA JUNIOR; ANDRADE, 2018).

Considering that convertible bonds are instruments sensitive to the conversion criteria, this study analyzes the impact of conditions that affect the conversion decision for the issuer. Thus, considering the availability of data from winning projects of reserve auctions of the National Electric Energy Agency - ANEEL for solar energy, this research seeks to answer the question: what are the characteristics of the convertible bonds and how can these characteristics be exploited in financing solar energy projects?

To address this issue, a research was made of the conversion aspects of public issues of convertible debentures in Brazil in the last twenty years and a financial assessment of the design of convertible bonds was made with testing of production scenarios and energy prices to verify the applicability of the instrument. The premise of this study is that convertible bonds are financial instruments that are feasible to use in the Brazilian market to finance renewable energy projects.

Financing of the Brazilian Energy Sector

Financing by loans from loans from the National Bank for Economic and Social Development - BNDES and issuance of debentures are currently the main lines of long-term capital raising in Brazil (CONFESSOR; SANTOS, 2020). Bonds have two advantages over loans, bonds typically have more attractive rates and provide greater transparency between creditor and debtor than loans (ANTON; AFLOAREI NUCU, 2020). The bonds are classified as fixed income investments, where the remuneration is previously defined in the application, that is, you estimate the profitability by pre- or post-fixed rates and, therefore, protect the investments in relation to the risk (JAHANI; MOHAMMADI; MASHREGHI, 2018).

The Brazilian electricity sector was largely financed by public banks, especially with BNDES, which allowed for a rapid expansion of the activities of renewable energy generation, security of energy generation and distribution and efficiency research (CONFESSOR; SANTOS, 2020; MENDONÇA et al., 2019; TORINELLI; SILVA JUNIOR; ANDRADE, 2018).

As for debt securities, the energy market is the one that obtains the most financial contribution from green bonds and incentive debentures in Brazil in recent years (BRASIL, 2020; CLIMATE BONDS INITIATIVE, 2020). The issuance of bonds of this nature continues to increase, despite being below the volume of issuance of green bonds, and are part of a process of relieving public banks from the role of financing these specific types of projects (BRASIL, 2020; CRUZ, 2020; TORRES FILHO, 2017).

Green bonds, which are on the rise in financing renewable energy projects, are also debt

securities, but the funds raised can only be used in projects to repair or mitigate climate damage (BARUA; CHIESA, 2019; GIBON et al., 2020). These bonds play a decisive role in large-scale and long-term sustainable actions, which has stimulated their demand and growth in emissions in recent years, mainly for the renewable energy market (BARUA; CHIESA, 2019; CHIESA; BARUA, 2019; TOLLIVER; KEELEY; MANAGI, 2020).

In China, subsidies have guaranteed the development of renewable energy, however, the maturing of the market demonstrates the need for changes in these policies to meet the country's full generation potential (FAN et al., 2020). In addition, price regulation, a market characteristic regulated by the government, limits the growth potential of the energy market today (BESSEMBINDER; SPATT; VENKATARAMAN, 2020).

It was through energy auctions, power generation and distribution contracting contests, that governments developed their markets around the world (MACGILL; BRUCE; YOUNG, 2019; PINTO et al., 2020). However, this market regulated by the Government through an economic policy that has been practiced for a long time has made financing more expensive by suppressing potential long-term investors from developing and establishing themselves in the country (AMORIM; ORTIZ, 2020).

The development of the renewable energy generation market is highly dependent on public incentives and it's insufficient to cover the entire potential (TORINELLI; SILVA JUNIOR; ANDRADE, 2018). In recent years, on the other hand, a more modern energy market model based on the privatization of generation, transmission and distribution agents has been developing in order to create a more agile and efficient environment (MEYER SOARES et al., 2020). This new market format gives rise to the support of private actions for its development, that is, ways of raising funds in the private market (JAMES; MAJID, 2020).

New investment instruments are cited as a way to overcome existing barriers in energy markets, so there is an opportunity to issue convertible bonds (IRENA; CPI, 2020). Because they are more dependent on the projects' performance, convertible bonds get better pay when higher project results (MARQUES; GOMES; BRANDÃO, 2018). Thus, to obtain participation in this result, it is interesting to purchase debt securities, as the payment of interest may be linked to the performance of the project. Taking the performance of companies into account in the investment decision is consistent if you expect positive returns (LOBO MIRANDA; ALVES, 2018). In developing countries, financial attractiveness is the main barrier to greenhouse gas emission projects (BUFONI; FERREIRA; OLIVEIRA, 2018).

The convertible bonds is also a debt security, but the fundamental difference from the other types is the right to a second remuneration option, the conversion of the nominal value into shares (ANBIMA, 2018; ETTENHUBER; SCHIERECK, 2015). While common bonds are remunerated via interest until their maturity, the convertible gives the creditor the right to convert the invested amount, within a specified period, into a number of shares previously defined in the deed of issue (LUO; ZHANG, 2019).

With the increased price volatility, the project's result can vary considerably, because in times of greater energy supply, the price falls, and in times of greater demand, the price increases (CCEE, 2021). This new dynamic among energy market players forces new financing mechanisms to absorb or minimize these effects. To that end, convertible bonds can be an assertive maneuver to seek financing at lower rates and make the conversion to the crisis minimization mechanism.

In this sense, flexibility in the design of the convertible bonds, as well as its triggers and conversion rules are useful to minimize the effects of a price drop on the financial performance of the energy park. When in times of crisis, the issuer may compulsorily convert the securities and excluding the right to amortization and interest received by the creditor. This way of predicting crisis scenarios and automatic conversion is characteristic of a specific type of convertible bonds, the CoCos, which will be discussed below.

Convertible Bonds Market

From the creditor's point of view, convertible bonds can reduce investment risk by suggesting more than one way to receive the amount invested (HUERGA; RODRÍGUEZ-MONROY, 2019; JI; JOSEPH, 2019; SAE-SUE; SINTHAWAT; SRIVISAL, 2020). In addition to working as a common bond, receiving periodic remuneration, the holder may have extra gains such as the receipt of dividends, when converted, or even with arbitrage in the stock market (HACKNEY; HENRY; KOSKI, 2020; HIMMELBERG; TSYPLAKOV, 2020; HUERGA; RODRÍGUEZ-MONROY, 2019; SAE-SUE; SINTHAWAT; SRIVISAL, 2020).

This flexibility in the design of the convertible bond, in terms of remuneration and the conditions for the conversion itself, makes it an excellent instrument for risk mitigation for the issuer (ETTENHUBER; SCHIERECK, 2015). It is not uncommon, therefore, that funding is cheaper than other conventional means of financing (LIN; ZHU, 2020). In addition, nothing prevents the design of a green bond, widely used for financing the energy market, to offer the option of converting. These options are not mutually exclusive.

With the global financial crisis - GFC of 2008, banks were forced to think about capitalization instruments that would help them to minimize losses due to unpredictable and impacting events of that period. (CHOE; JANG; NA, 2019; PENNACCHI; TCHISTYI, 2019). The issuance of hybrid debt securities was the most considered and, out of this movement to minimize impacts caused by crises, convertible contingent bonds emerged, a new type of classic convertible bonds (HIMMELBERG; TSYPLAKOV, 2020). In Brazil, they are called Debt Instruments Eligible as Capital (ZANON; DANTAS, 2020).

Also known by the acronym CoCos, the conversion into stock of this type of security is automatic and based on criteria agreed in the deed of issue in order to safeguard the financial health of the bank. (HIMMELBERG; TSYPLAKOV, 2020). The issue of CoCos is particular to banks also due to the volume and impact on the financial health of other companies and the financial system as a whole (CHOE; JANG; NA, 2019; PENNACCHI; TCHISTYI, 2019). Its issuance also aims to avoid financial support from the government, which through the mobilization of public resources can help them in facing crises, but at the expense of investments in other sectors (ZANON; DANTAS, 2020). The convertible bond behaves no longer just as a fundraiser, but as a crisis control mechanism.

It must be considered that the title design may encourage or undermine the conversion depending on the purpose of the issue and be adjusted through conversion mechanisms and rules. The bond with an early redemption clause, the issuer's right to redeem the bonds before the expected maturity, can act as a maneuver to capture cheaper resources and not allow the effective conversion (HOMAIFAR; MICHELLO, 2020). Although this is not illegal, since it is up to the broadcaster to establish the criteria that allow early redemption, these scenarios must, however, allow the conversion, which is the main function of the convertible bond (SILVA; D'ALMEIDA, 1974).

The debate about the motivations for issuing convertible securities is one of the most intriguing questions in the financial literature (LI; RHEE; SHEN, 2018). However, in a scenario of high volatility in the share price, the issue of convertibles is more attractive than the direct stock market (DONG; DUTORDOIR; VELD, 2018; ETTENHUBER; SCHIERECK, 2015; JANG; JIA; ZHENG, 2019).

Another reason why that would lead to the issuance of bonds of this nature is related to the issuer's financial health, since indebted companies are prone to issuing convertibles (GONCHARENKO; ONGENA; RAUF, 2020). Debt, however, is not synonymous with financial difficulty, but generally, companies with a low credit rating issue convertible bonds (HOMAIFAR; MICHELLO, 2020). The low credit index limits the issuance of funding by the issuer, suggesting the issuance of this type of security at that moment as the most viable. It makes sense, since what would it take a company to share its earnings when there is a favorable

situation in taking capital by other means?

Thus, companies with a high standard for issuing securities do not need to sweeten their debt offerings with convertible clauses to reduce the cost of debt (LI; RHEE; SHEN, 2018). It is worth noting that it is feasible that convertible bonds are suitable for financing new projects so that the issuer's results are better (KAŹMIERCZAK, 2018).

Investors can have subjective and the most diverse objective motivations for conversion option, among them, the return of the stock above the security's remuneration (JOON KIM; HUN HAN, 2018; MALTAIS; NYKVIST, 2020). Investors opt for convertible bonds because they generally have more significant return values than other fixed income securities (DEL VIVA; EL HEFNAWY, 2020; KIM; HAN, 2019). Recent research of important contribution to the field of sustainable finance also suggests a new parameter for conversion, the achievement of sustainable goals (GONZALEZ-RUIZ et al., 2019). This research recommends that the interest in participating in a company involves environmental responsibility by the broadcaster. On the other hand, more objectively, the creditor can consider the conversion when the dividends per share exceed the remuneration interest of the securities (HIMMELBERG; TSYPLAKOV, 2020).

METHODS

Step One

The information summarized on the website of the CVM, the body responsible for registering public issuances of securities in Brazil, was accessed to identify the issuing companies. 212 emissions between 1988 and 2020 are available for public access. After that, the documents, issuance deeds, of the launches of the last 20 years were searched in order to identify the mechanisms of conversion and motivation of the emission (application of the resource) of these emissions. Only 12 documents were found, since the companies no longer existed or sometimes, they did not make the oldest documents publicly available. However, the survey was sufficient and ended when the information began to repeat itself, exhausting the new aspects.

These materials were cross-checked with information such as date of issue and volume issued with the results obtained by the CVM in order to confirm the authenticity of the content. Conversion rules or triggers were also observed when explicit in documents. In addition, the survey serves as a parameter to identify which variables are most interesting and amenable to analysis via the emission design that is discussed in the next research stage.

Step Two

Considering the availability of data on solar energy projects winning ANEEL auctions, and the importance of financing for the development of the renewable energy sector in the country, it was decided to discuss the variables that influence the issuance of convertible bonds to finance this type of project. The availability these projects' data allows us to assess how financing via convertible bonds could change the sector's financing structure, which was attended by the BNDES and which also has the option of issuing debentures without conversion option.

In order to simulate the risk distribution of an issue of convertible securities between issuer and creditor, it was necessary to create issuance scenarios based on cash flows from the data described in Table 1. The price of energy was simulated as a geometric Brownian movement (LIN; ZHU, 2020), with the trend and volatility parameters extracted from electricity prices in the regulated market. The data on costs, initial investment, evolution of the power generation capacity factor of the park were extracted from research by Caldas e Silva Júnior (2019) and Silva Júnior e Ribeiro (2016).

Table 1: Modeling assumptions

Name	Value	Source
Production / Quantity	73.634,40	Annual production capacity of the project in MW
Initial price	R\$ 388,48	Average energy price in the Regulated Market
Initial investment	R\$ 156.636.000,00	Referring to the photovoltaic generation project of EGO BOM DIA, which had more lots contracted (7) and higher initial investment among the winners of Aneel's 6th reserve energy auction in 2014 ¹ .
Maintenance costs	5%	Ruaro e Etges (2018) and Fontanet (2012) apud Caldas and Silva Júnior (2019).
Discount rate	13%	Rounded rate of 12.34% (Normative Resolution No. 608, of March 25, 2014)
Amount financed	R\$ 50.000.000,00	Rounded value to facilitate calculations. Represents 32% of the initial investment (within the limit of third party capital stipulated by Aneel of 38% ²).

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With the data above it is possible to generate scenarios for price and quantity from the Monte Carlo simulation with Brownian geometric movement assuming that these variables have lognormal distribution (JAHANI; MOHAMMADI; MASHREGHI, 2018). The associated price probability distribution for the projection periods is made stochastically and has average and variance of the constant returns over time. Energy production, which is also stochastically designed, is influenced by the variation in irradiation and efficiency of the energy generation modules.

After establishing the values for price and energy for 1000 different scenarios and in 20 periods that correspond to the project's lead time, it is possible to calculate the present values from the discounted cash flows (LEI et al., 2018; RAFIQUE; BAHADARAH, 2019; VIANA et al., 2019). For this purpose, a present reference value is calculated first, which works as the result of the project, being financed entirely with equity (FAN et al., 2020). The referring equation is found below:

$$VPref = (q * p * (1 - Cvar) - Cman) * Fd \quad (1)$$

Where:

VPref is the average reference value that we get as a result;

q is the amount of energy produced generated by the Monte Carlo movement;

p is the price of energy generated by the Monte Carlo movement;

Cvar is a percentage that represents variable costs;

Cman is the fixed cost of maintenance;

Fd is the discount factor that brings the cash flow of the 20 estimated periods to present value.

With the base present value calculated, it is necessary to calculate a PV (AMORIM et al., 2018; VIANA et al., 2019) that considers financing via issuance of convertible bonds. The equation that reflects the calculation method is shown below:

$$VPdc = ((q * p * (1 - Cvar) - Cman) - Jdc) * Fd \quad (2)$$

Where:

¹ Available in <https://www.aneel.gov.br/geracao4> > Editais do ano de 2014 > Leilão 008/2014 > Edital e Documentos Vinculados > Resultado do Leilão.

² Available in http://www2.aneel.gov.br/cedoc/aren2020882_Proret_Submod_12_3_V2.pdf

$VPdc$ is the average present value of the project financed by the interest for convertible bonds that it's obtained as a result;

Jdc are the remunerative interest of the convertible bonds.

The difference for $VPref$ is that $VPdc$ considers the payment of remuneration on the loan, via the issuance of debt securities, to creditors. However, the $VPdc$ presented works like a common debenture because it does not yet include the conversion trigger, that is, cancellation of the debenture holder's rights to receive remunerative interest to become a shareholder. Thus, the $VPdc$ will also take into account the conversion trigger that can be verified in the next equation.:

$$VPdc = ((q * p * (1 - Cvar) - Cman)) * (1 - Conv) * Fd \quad (3)$$

Where:

$Conv$ is the conversion factor generated from the conversion trigger.

The premise assumed to create the trigger was that the bonds would be converted into shares when the percentage of the project that falls to the debenture holders was higher than the interest receivable. To this end, it was assumed that the new shareholders would be entitled to the percentage resulting from the division of the nominal loan amount (amount suggested for the issuance of the debentures) and the PV in year zero. To be clearer, the calculation represents how much of the capital of third parties, that, resulting from the issue of convertible bonds, impacts on the project's result, NPV. This remuneration for new members suggests the allocation of part of the project's result for conversion, as the distribution of dividends requires further investigation that will not be addressed in this research.

For comparison purposes, another present value was calculated to represent the project's financing via other means such as the issuance of a common debt security or a bank loan. This new PV is represented by the following equation:

$$VPc = ((q * p * (1 - Cvar) - Cman) - J) * Fd \quad (4)$$

Where:

J is the common interest owed to the other source of financing.

RESULTS AND DISCUSSION

The empirical analysis shows that the issues of classic convertible bonds here in the country may have characteristics that, according to the literature, belong to the CoCos when establishing not only conditions for voluntary conversion, but also definition of criteria to effect the automatic conversion (BURNECKI; GIURICICH; PALMOWSKI, 2019; GONCHARENKO; ONGENA; RAUF, 2020). The empirical data reveals that the broadcaster can either establish an automatic conversion clause from a date, or define triggers that, when triggered, make the conversion mandatory. The results of the analysis of the empirical data suggest that there are broadcasters that hamper the broadcast by establishing a range of scenarios that if, and only if, reached may allow the conversion (Table).

It is even possible to establish two types of emission according to the destination of the resource or reason for the emission according to the empirical data. The first are issues that wish to lengthen the indebtedness profile. In this type of issuance, the fundraising effort is to benefit the issuer's equity, in which the health of the issuer is observed and its degree of indebtedness is low. Issuances that aim to benefit the issuer's share capital focus on the issuance of premium bonds, with criteria that do not prevent, facilitate or compel conversion. The second type of issue is to finance new projects and guarantee working capital. Therefore, issues of this

type aim at reducing funding costs, balancing risks between issuer and creditor and with criteria that hinder conversion.

Still on the conversion parameters, they were categorized according to the analysis of the mechanisms or the lack of specific criteria for conversion (see Table 2). For that, there are those issues that have no restrictions and leave the discretion of the creditor to choose the time and quantity of securities to be converted. There are documents that, on the other hand, establish minimum time criteria to affect the conversion, but that do not establish other criteria or triggers that hinder the conversion.

On the other hand, there are deeds that seem to hinder the conversion, since they emit bonds with various criteria and restrictions that limit conversion time or link the possibility of issuance to the issuer's financial result. The emissions that hinder the conversion were established with this criterion, because, in comparison to the other documents, they limit the conversion to certain scenarios. It is due to establish and differentiate emissions with mandatory and automatic conversion. Automatic conversion works with a pre-established trigger that, when and if reached, automatically converts securities into shares. Whereas mandatory conversions define that the debentures will convert into bonds at a certain time as defined in the deed.

Table 2: Conversion type by issuer

Conversion rule	Issuer	Type of corporate share	Resource target
Unrestricted	AZUL S.A.	Preferred	Working capital and new project
	IOCHPE-MAXION S.A.	Common	Debt payment and debt profile
	PARANAPANEMA S.A.	Common	Debt profile
	ZAIN PARTICIPAÇÕES S.A.	Common	Debt payment and debt profile
	PROMAN S.A.	Preferred	Debt payment and working capital
	NOVAMARLIM PETRÓLEO S.A.	Common	New project
	MC TRUST S.A.	Common	New project
Time restriction	TUPY S.A.	Common	Debt profile
	CONCESSIONÁRIA RIO-TERESOPOLIS S.A.	Preferred	Debt payment and working capital
Conversion hindered	CEMAR	Preferred	Debt payment and judicial recovery
	INEPAR S.A.	Common	Debt payment and judicial recovery
Mandatory conversion	MINERVA S.A.	Common	Debt payment and new project
Automatic conversion	PARANAPANEMA S.A.	Common	Debt profile

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To discuss the results of modeling financial projects via issuance of convertible securities from the point of view of the issuer, it was necessary before running the model assuming a project submitted to the payment of common interest disregarding the conversion option. The NPV of the 20 periods in 1000 different ones will serve as a measure of the project's performance.

The inversely proportional relationship between interest rate and project performance, that is, the higher the interest, the lower the result of the project is not an innovative finding, however, it serves as a parameter to measure the risks between the parties involved in the issue. Thus, it is necessary to calculate a new NPV that includes a CB emission with a conversion rule to analyze the project's performance with these new variables in order to make comparisons.

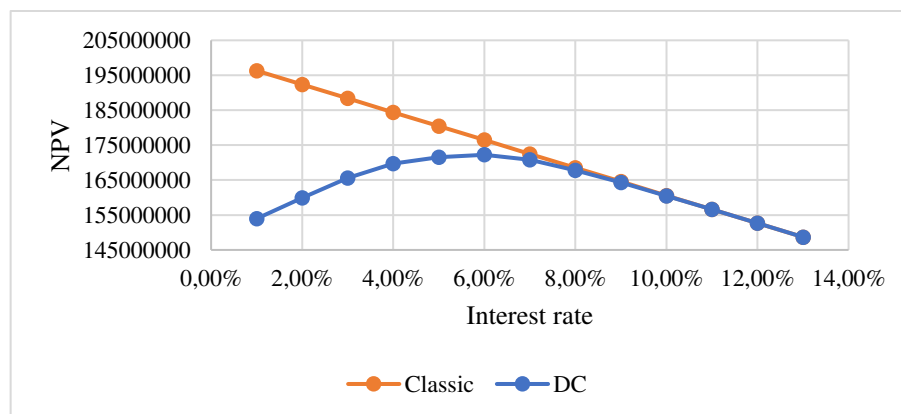
To avoid bias that would benefit the creditor, a simple rule was established to measure the impact of the conversion that took into account only the percentage of the project's performance that would fit the new partners. The performance of the project continues to be measured from the point of view of the issuer as the average of the Present Net Values in the scenarios obtained by the Monte Carlo Simulation, however, with a discount on the percentage related to the entry and new partners. This mechanism suggests the impact on the project's result assuming how much the issuer fails to earn from conversions to different interest rates.

As verified, the conversion decision can be made based on non-financial criteria and by more subjective processes that are difficult to identify, but in order to assess the impact of the conversion, the option assumes a less subjective rule. Taking into account, the supposed conversion criterion and the measure of the project's performance for creditors, the project becomes sensitive to remunerative interest forming a maturity curve. This means that, in principle, the lower the amount spent paying interest payments, the greater the project's performance. At a certain rate of return, around 6%, there is a peak of income representing the greatest performance that the project being financed with CB can achieve. Above this rate, the project will again have the inverse relationship in the same way presented in the previous financing. In this case, the remuneration interest paid around the nominal value would be more advantageous, which undermines the performance of the project and discourages conversion into shares, explaining the drop in the results of the projects at a higher rate of remuneration.

Remuneration interest must, therefore, reflect the real intention of the issue, if a conversion of the securities is necessary to benefit the issuer's share capital, the interest must be lower, considering that the trigger for conversion is the income to the debenture holders, because, even if a higher rate offers, at first sight, a greater advantage for the creditor, he can, for other non-financial reasons, convert the debt into shares. Thus, projects financed by debentures may offer better interest rates to issuers. (ANTON; AFLOAREI NUCU, 2020), but the deed must ensure that the advantage of attracting lower rates is not extinguished with immediate conversion. To be clearer, the benefit of paying lower interest rates that benefit the project may lose value when creditors convert their bonds to participate in the project's best results as partners.

It is notable in Figure 1 that one more interest rate for the remuneration of convertible bonds reaches the same level of earnings. This means that it is up to the issuer to choose the reason for the issue so that it facilitates / encourages the conversion or defines criteria or points in time that restrict / discourage the conversion. In this way, the issuer would choose the best remuneration based on its need for conversion, maintaining to a certain level the expected yields.

Figure 1: Result of the project with common interest and convertible interest



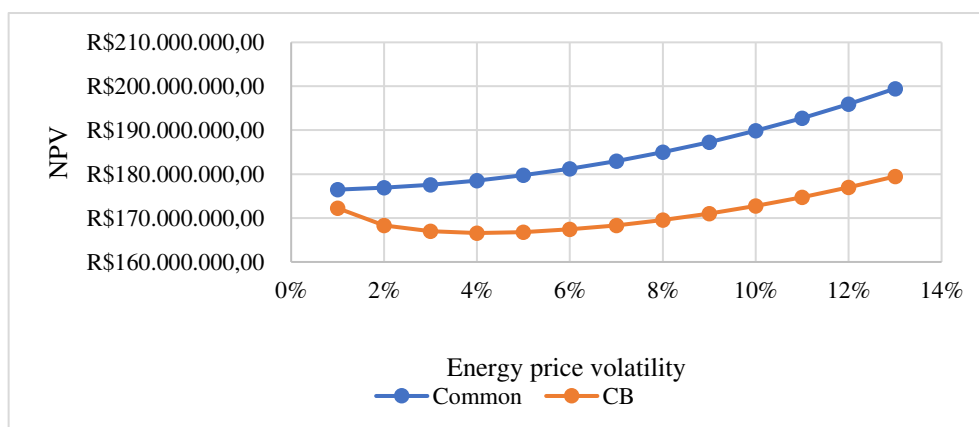
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As for the losses, the most accentuated ones accompany the scenarios in which the interest rate facilitates the conversion, since lower rates benefit the project and the better the result of the project, the greater the chances of the creditors converting their bonds into shares to share in this one. performance. Regarding the better payment for the bonds, both the CB and the common bonds affect the results of the project.

It is interesting to mention that apparently projects financed through the issue of convertible bonds never reach the income of those who access other sources of funds. This is an unfair judgement and does not necessarily implies that effect. This happened because in the results presented so far, it proposes a net and immediate payment of part of the NPV of a percentage agreement financed. This measure is to measure the impact on the NPV via the distribution of results with the new partners. Once a partner, however, the new project participant is subjected to the board's definitions of his remuneration, that is, as a rule and at first, the project with debt converted into shares operates without considering payment of interest and dividends. That is why the conversion price and other rules are important, as they adjust the yields and balance the results, encouraging or not the conversion.

As seen in the literature survey and in the empirical results for electric companies, the price risk directly impacts the operation and the expectation of receiving from the shareholders. To measure the impact of price on project performance, it was necessary to assess the impact of price volatility on project results. The result can be seen in Figure 2.

Figure 2: Effect of price volatility on the income of the project financed via common and convertible bonds



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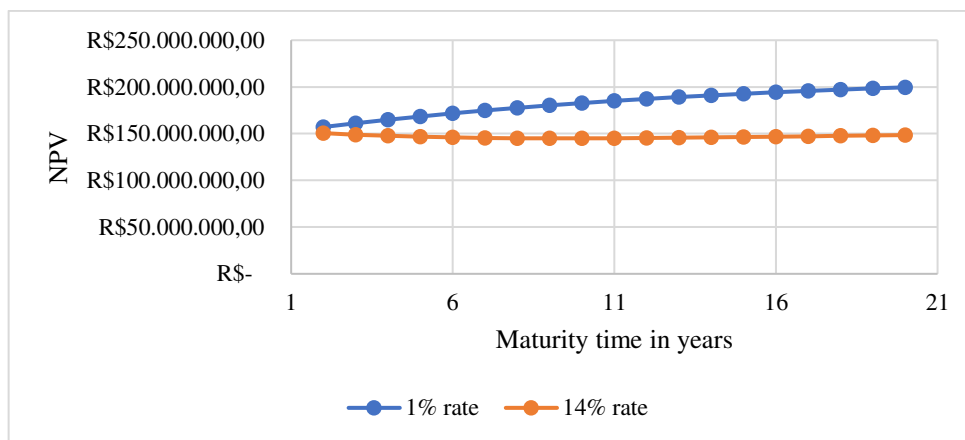
Freezing the interest rate at 6%³, as it refers to the maturity level of the project financed via CB, volatility affects both results in a positive upward manner, but as we increase volatility, performance via convertible bonds has the worst performance compared to projects via issuance of common bonds. This is because conversions, therefore, loss of part of the project by the issuer accompanies the results of the project. Price volatility influences the results of the projects, as seen in Figure 2, but it can be a decisive factor for the design of the deed, establishment of conversion triggers and definition of the option of early debt redemption.

In the case of energy, the high prices would increase the results of the project in order to suggest greater conversions. Once the bond conversion and remuneration rule has been defined, little can be done to prevent good earnings from being distributed. In scenarios like this, even if not started in the conversion rules, they could force the issuer to shield its receipts via early redemption. As seen in the analysis of the scriptures, early redemption is justified by the

³ Approximate percentage of the stipulated by Aneel for remuneration of debentures of 6.21%. Available in http://www2.aneel.gov.br/cedoc/aren2020882_Proret_Submod_12_3_V2.pdf

perceived risk of default by the broadcaster, but it could act as a mechanism to prevent conversions.

Figure 3: Conversions at different rates during the maturity of the issue



Made by the author.

The results in Figure 3 show a reason why some deeds define the term that can be converted after the issue. The time immediately after the start of the operation is less advantageous for the performance of the project financed at lower rates, because in future periods the project achieves better results. When the project is financed by higher rates, no matter time, its result is lower compared to the project financed by lower rates. A similar effect is seen in Figure 1 referring to the conversion in year 1.

Empirical results and modeling demonstrate that it is difficult to design a convertible issue, but the modeling provides the issuer with mechanisms to balance yields.

CONCLUSIONS AND FUTURE DIRECTIONS

Regarding the reason for these issues, the empirical data suggested two types, which benefits social capital, therefore, with ease in conversion and what serves to raise cheaper money that makes conversion difficult.

If the conversion rule is linked to the performance of the project, as suggested in this study, the remuneration interest on the debentures will have a significant impact on the amount converted. As seen, the better the project's performance via cost savings with lower interest payments to creditors, the better the project's performance will be (HOMAIFAR; MICHELLO, 2020; LIN; ZHU, 2020). This also has an impact on the issuer's interest in the conversion, as it can set parameters that induce the conversion at a certain time or create automatic triggers for the conversion.

This research advances and contributes to the literature in at least two aspects, because, first, it analyzes in the same research the distribution of risks between the parties and their effects on the income of each one. It also supports studies that also verify the post conversion impact on the broadcaster's results, which are the most needed in the field. This result is also relevant for decision makers and players in the securities market, as it raises parameters that guide a better issuance more consistent with their objective or destination of the collected capital.

The discussion, then, starts with the relationship and influence of issuers and creditors in the issuance process, since, to ensure that the main quality of the convertible bonds to conversion is preserved, a fair distribution of benefits between the parties is necessary. Therefore, it is concluded that the distribution of risks via remunerative interest can balance the

result expected by the issuer with the project and maintain a future remuneration or expectation of receipts for creditors. The emission design must be unique and reflecting each context, but all emissions, as we have seen, can serve as a basis for repetition or exclusion of factors.

Thus, the issuance of debentures is an efficient mechanism to absorb risks in the financing of solar energy projects, provided that the motivation for the issuance that impacts on the debenture design in favoring or impairing the conversion is established.

Despite reaching its objective, this study has some limitations that do not minimize its conclusions, but it needs improvement in future studies. Although this work proposes a fair division of risks, it did not take into account the financial health of the issuing companies, that is, the motivation, in addition to attracting lower costs for a convertible issue. Nor did it consider subjective aspects that support the creditors' conversion decision. Thus, I suggest that similar works keep being produced in order to make the analysis that supports better investment decisions via this type of security more robust.

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