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Analysis on the profitability of Green Bonds in Mexico

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Abstract

Mexico reciently issued Green Bonds (GBs) in 2015. The great importance which represents climate change on the planet resulted in a stronger commitment of countries in the mitigation of effects produced by the emission of Greenhouse Gases (GHG) into the atmosphere. Issuing GBs implicates investing in projects of environmental protection and in addition, a financial profit is given to investors. This article aims to comparatively analyse the performance of GBs in Mexico. Since the GBs, like government bonds, are low yield and low-risk debt instruments, it is interesting to know which instrument offers a better performance. To obtain these results inflation rates based on historical rates were projected and compared with yields and Sharpe's ratio, which leads to determine that from a financial standpoint GBs are unattractive to investors at least over a time horizon of five years.

Green bond, performance, rate of return

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Introduction

The financial system of a country can generally be divided into two parts: the banking system and the stock exchange system. For financial product claimants both offer different alternatives. The securities sector offers, on the one hand, transactions in short-term debt securities such as the Treasury Certificates (CETES) of a government issuer or commercial papers of private companies and financial institutions. On the other hand there is the capital market where the interested investor can invest in stocks or bonds (Ross, Westerfield and Jordan, 2014).

The Green Bonds (GBs) are debt instruments that are used to finance projects whose objective is to reduce and / or mitigate the effects of climate change through energy regeneration projects, alternative energy use, waste management, reforestation, others (IBRD, 2015).

In the last decades, the effects of climate change have become more and more acute. As a result, global awareness of the protection of the environment and its actions, such as the implementation of renewable energies, energy efficiency, others. This allows for the creation of new economic opportunities to reduce the impact of environmental pollution.

The link between green finance management and sustainable business development not only impacts economic development but also social and environmental balance, because governments, organizations and individuals are expected to produce environmental impacts.

Green finance is a concept that encompasses all the instruments that can finance environmental sustainability projects, which will generate a better quality of life for the present and future generations (Garay and Ticas, 2013).

According to the importance of the protection of the environment that is already evident by the actions registered worldwide to promote it, it is known that much of a decade has been financed large green projects. This means that it is a new area of opportunity; a fertile field of investment for Mexican investors and other countries that wish to contribute to reducing the impact of climate change, through VHLs.

The approach of the problem arises in knowing what is the profitability that the investors would have to bet in Mexican GBs, since within the categories of bonds they are instruments of new presence in investment. The objective is to compare the performance and performance of the Mexican GBs listed on the Mexican Stock Exchange (BMV) with the Federation Treasury Certificates (CETES), so the research question is how attractive are the GBs, considering their performance and performance against CETES?

Also reviewing the investment in GBs worldwide in 2007 was US $ 0.81bn and until 2015, US $ 65.90bn was reported and if the growth trend in the inter-years is carefully reviewed, it has gone up (IBRD, 2015).

The methodology used to achieve the objective of this article is to compare the performance of BV with the use of CETES as a proxy variable, due to the lack of information about the behavior of GBs in the market.

For the comparative study between GBs and CETES, the yields and the Sharpe ratio were considered based on data from the period between 2015 and 2019.

According to the results obtained, it can be seen that GBs in Mexico are no more attractive than CETES. However investors do not run the risk of having a loss on investment.

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The relevance of the investment is to support the financing of green projects.

Theoretical Framework

Nature of the bonds

According to Van Horne and Wachowicz (2012), bonds are defined as fixed-income debt instruments paid by an issuer (hence the name Payable) at a certain future date, which is often referred to as the maturity date. On this date the issuer agrees to pay the principal of the bond and the buyer recovers its investment. The buyer of the bond obtains periodic payments generated by the interest and charges at the end the nominal value of the interest; that is, on the due date that can be from less than a year to a period of more than five years.

Financial transactions are carried out on the stock exchanges, either directly or through brokerage firms registered with such exchanges. The public or private institutions issuing the instruments, come to these spaces to make them available to investors. This initial transaction between the issuer and the investor is known as the primary market. Subsequently, the instruments are bought and sold among investors in the stock market, often referred to as the secondary market (García, 2014).

Fixed income paid by the bonds has two conditions, the first of which refers to the periodicity of payments, which are usually quarterly or half-yearly, and secondly, is defined by the interest that will have to be paid in each of the intermediate dates and previously agreed (quarterly or semiannually). (De Gregorio, 2007).

The investor expects a return on the capital invested in the bonds purchased and the yield depends on the interest rate that the instrument will pay.

The types of bonds according to the issuers are:

- Bonds of public issuers, these are offered by the state, country, territory, city, local government or their agencies and are tax free.

- Private issuer bonds are offered by private companies, independent government agencies.

Normally, public issuers have to pay lower returns to investors than private sector issuers. This is due to a better solvency and therefore a lower risk than public issuers compared to private issuers. (Ross, Westerfield and Jordan, 2014).

This research focuses on the GBs that are issued by Nacional Financiera (NAFIN), a Mexican government agency.

Green bonds

Green Bonus Concept

GBs are debt securities that are issued to generate capital in order to sustain environmental projects or related to climate change, this makes the difference between the bonds common to the GBs. In addition to evaluating the standard financial characteristics such as maturity, coupon, price and credit quality of the issuer, investors also value the specific environmental objective of the projects to be financed with the bonds (IBRD, 2015).There is no variation between standard bonds and GBs, for example: they have the same pricing use the same resource for the issuer, apply on equal terms. The only distinguishing feature is that the BV generates a positive result in the environment (Initiative Climate Bonds, 2016).

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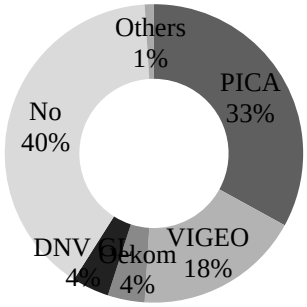
The main investors worldwide are in Europe, Japan and the American continent. In Europe, pension funds and insurance companies invested. In the United States, companies with an environmental focus. With the passage of time the diversification of investors has grown as a function of the increase in the amount of emissions. In addition, it can be observed that investors spread their purchase through the media to acquire adepts in the market as recognition for having an environmental awareness (greenwashing) (IBRD, 2015)

The issuers may be private companies, government enterprises or a hybrid or public-private entity (Econometria consultants, 2016), in addition to multilateral banks such as the African Development Bank (AfDB), the European Investment Bank (EIB), the International Bank for Reconstruction and Development (IBRD) and the International Finance Corporation (IFC), among others. Multilateral banks were the first to issue bonds for the financing of the GBs.

Issuers have developed their processes to allow GBs to adapt to their business profiles. Investors in turn expect to obtain the information needed to evaluate GBs. The market is governed by information provided by issuers, second opinions and academic comments, investment advisors, auditors, technical experts, the media and non-governmental organizations eg CICERO, Climate Bonds Initiative, DetNorskeVeritas, Norway (DNV) Oekom, Sustainalytics and Vigeo (IBRD, 2015).

These NGOs set criteria for evaluating green projects so that they are those financed with GBs and that investors are assured that their investment is serious and contributes to environmental protection.

Figure 1 shows the participation of NGOs in the evaluation of VHL, with CICERO standing out with 33%, followed by VIGEO with 18%. In a minimum percentage Oekom and DNV GL with 4%. 40% indicates that there is no revision of the projects to offer them.



Graphic 1 Percentage of review of second opinions on Green Bonus offers by NGOs
Source: Climate Bonds Initiative (2015)

The GBs were only initially generated by international organizations in 2007 and already in 2008 formally started the issuance of GBs in Europe (IBRD, 2015). It is possible to say that Mexico took its first step in 2015 (NAFIN, 2015).

Types of Green Bonds

Table 1 shows the classification of different types of GBs that Bloomberg New Ernergy Finance does.

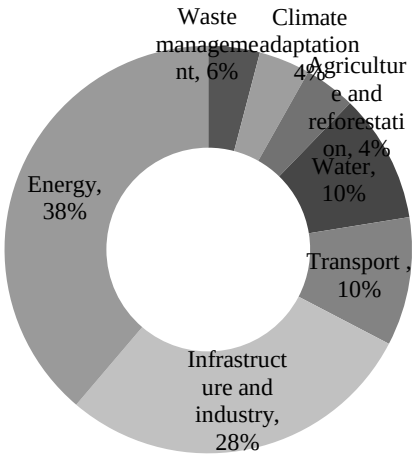
Type	Definition
Corporate self-labeling	Bonds issued by corporations and explicitly labeled as green
ABS Green	Actively backed securities whose cash flows come from a portfolio of underlying receivables such as loans and leases. Accounts receivable are associated with green projects (eg renewable energy, energy efficiency, etc.).
Supranational / International	Bonds issued by supranational or international organizations such as multilateral banks, development banks and export credit agencies.
government	Bonds issued by national, regional or local governments to finance green projects. This includes, for example, US municipal bonds.
Project Bonds	Bonds backed by cash bonds from an underlying renewable energy project or project portfolio.

Table 1 Types of Green Bonds by Bloomberg New Energy Finance
Source: Bloomberg Finance L.P (2014)

The role of GBs is to support projects for mitigation and adaptation of climate measures, some of which are mentioned below: (World Bank Group, 2013).

- Regeneration of power plants and transmission facilities to reduce greenhouse gases (GHG).
- Projects of solar and wind installations.
- Appropriation of new technologies to reduce GHG emissions.
- Energy efficiency in transport using fuel that reduces GHG.
- Waste management reducing the emission of polluting gases, as well as the construction of buildings and houses with energy efficiency.
- Reforestation projects that impact on the reduction of carbon emissions.
- Greater protection in food security by cultivating stress-resistant products, which would delay deforestation.
- Implementation of sustainable treatments of green areas.

Some of the examples of green projects are autonomous photovoltaic solar systems, which make use of alternative energy. Systems that make use of fossil fuel power in some countries already pay for this extra generation of energy with GBs that is discounted according to the current regulations in order to continue to finance projects that contribute to reduce the effects of climate change (Figueroa- Cuello, Pardo-García, and Díaz-Rodríguez, 2017). It is also possible to mention architectural constructions for multifamily housing designed with bioclimatic strategies: rainwater recycling, use of sunlight and natural ventilation (Castiblanco-Salcedo, 2017), which can be done in the same way with investment of GBs.



Graphic 2 Use of Green Bond funds worldwide
Source: Climate Bonds Initiative (2015)

Graphic 2 shows that funds obtained through GBs are used mainly in seven sectors: climate adaptation (4%); agriculture and reforestation (4%); waste management (6%); transport (10%); water (10%). The sectors that receive the largest amount of funds are industrial infrastructure with 28% (projects that focus on energy efficiency where investment is made in research and development for the replacement of machinery and equipment) and energy with 38% energy sources for industry) (Cimate Change Information Center, 2015).

Green Bonus Launch

The European Investment Bank (EIB) issued the first climate-oriented bonus in the form of a structured product in 2007 (IBRD, 2015).

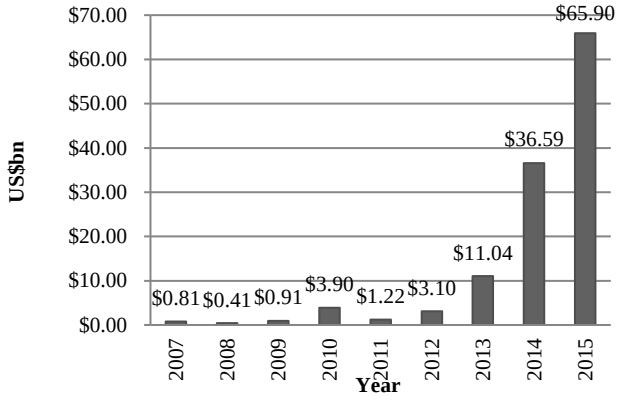
The first green bond was issued in 2008 by the IBRD in partnership with Banco Scandinavia (SEB) for SEK 2,325 billion, which had a maturity of six years, with an annual amortizable interest rate of 3.4 %, more than Swedish government rates, with an annual yield of 3.15% (World Bank Group, 2013).

According to the World Bank (2007) for the issuance of the first BV, the following was considered (IBRD, 2015):

- It was a specific demand from the Scandinavian pension funds that had the objective of sustaining projects concerning the protection of the environment through a fixed income product. In coincidence with investors interested in investing in sustainable and responsible issues.
- Support was given to the IBRD's strategy of implementing innovation in the financing of climate change initiatives.
- With regard to the concentration of projects related to climate change, GBs helped raise awareness in the financial community about climate change.

International and national bond market

The world market has grown since 2007 that issued the first EIB bond channeled to environmental protection issues in the amount of US $ 0.81bn to US $ 65.90bn in 2015, as seen in Graphic 3. Global investment in the GBs market that has been realized from 2007 to 2015, simply in this last year represents 53.19% of its totality. From 2012 to 2014 has tripled growth. In 2015, almost doubled, but the trend of this market as shown in Graphic 3 continues to rise.



Graphic 3 Growth of the Green Bond market
Source: own elaboration with information obtained from Climate Bonds Initiative (2015)

The Paris Agreement, which entered into force on 4 November 2016, is transforming the world economy in order to mitigate the effects of climate change, seeking financial strategies to meet the objectives set by the 195 countries that signed it since December 2015 (Carlino, Netto, Cabrera and Serra, 2017).

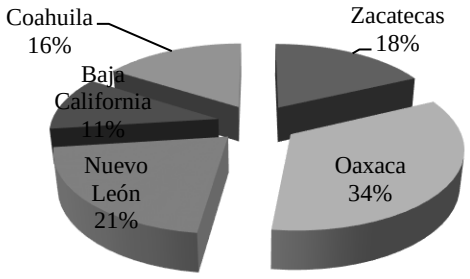
An essential feature of the Agreement is climate finance. The Division of Capital Markets and Financial Institutions (IFD / CMF) of the Inter-American Development Bank (IDB) in conjunction with the Latin American Association of Financial Institutions for Development (ALIDE) announces the National Development Banks (BND) opportunities and challenges in financing green projects that are presented today; BNDs can contribute to exploring the growing potential of the GBs market as they are global assets that drive a climate future in GHG reduction (Carlino, et al., 2017).

In Mexico, the BMV in 2015 outsourced a financing initiative with GBs in alliance with the Mexican Carbon Platform, MexiCO2. Also, NAFIN made a placement of GBs for 500 million dollars (Sanders, 2016).

On October 29, 2015, NAFIN issued the first BV in the amount of US $ 500 billion with a five-year maturity and a yield of 3.41% per annum, which meant a spread of 190 bps on the five-year US Treasury bond and 56 bps on the bond denominated in dollars to the equivalent term issued by the Federal Government (UMS), a differential that became an increase in the demand of GBs for a value of 2,500 million dollars. More than 100 investors from Asia, Europe, the United States and Latin America participated. This BV is supported by Sustainalytics B. V. who evaluated the instrument for the alignment of BV Principles. This BV will finance nine wind farms in Oaxaca, Nuevo Leon and Baja California and is certified by Clilmate Standard (NAFIN, 2015).

By government provision the only institution to place GBs in the stock market in Mexico is the Bank of Mexico (BM). NAFIN requested the BM to issue GBs to finance several power generation projects. According to the IBRD (2015) for the development of green markets, it is necessary to create environmental policies and strategies in the public and private sector. As well as carrying out the feasibility analyzes in the execution of projects and how it can increase the profitability of the execution of the same ones. On the other hand, there are nongovernmental organizations (NGOs) that NAFIN as the first Latin American development bank to issue GBs, becomes a strategic bank for the fulfillment of environmental projects of the Federal Government in Mexico (NAFIN, 2015).

The balance of NAFIN's portfolio as of September 30, 2016 is US $ 332.1 mm and is distributed in five states of the country with different participations, directly related to the amount of individual projects, as can be seen in Graphic 4 (NAFIN, 2016).



Graphic 4 Green Portfolio by Geographic Sector
US $ 332.1mm
Source: NAFIN (2016)

On August 31, 2016, NAFIN issued a BV in 2,000 million pesos to seven years of performance with a coupon of 6.05%, which becomes the first coupon issued in Mexican pesos (NAFIN, 2016).

In December 2016, the government of Mexico City issued a BV in 1 billion pesos over a period of five years and was 2.5 times over defendant. With an interbank interest rate of 42 basis points. This bonus will finance about 15 projects in the Mexico City, such as the expansion of the metrobus, water collectors, pumping and storage plants. This release made the government of the cd. of Mexico as the first subnational and Latin American organism to issue this type of instrument. (Rodriguez, 2016). Carlino et al. (2017) mention that by November of this year, with the boost of the Agreement, Mexico is preparing a cap and trade pilot considering that by 2018 the national emissions trading market will be constituted.

Methodology

The approach of the problem arises in knowing what is the profitability that the investors would have to bet in Mexican GBs, of which the research question is derived how attractive are the GBs, considering their performance and performance against CETES?

The objective is to compare the performance and performance of the Mexican GBs listed on the Mexican Stock Exchange (BMV) with the Federation Treasury Certificates (CETES).

The proposed hypotheses are to identify the following:

H0: GBs are more attractive than CETES in Mexico.

H1: GBs are no more attractive than CETES in Mexico.

The research design is structured in three sections:

First, a comparison of predicted inflation versus the performance of GBs is performed. With data provided by INEGI (2016) from 2001 to 2016, a forecast is made to compare it with the annualized performance of GBs from 2015 to 2019. Forecasted inflation was calculated using the double exponential smoothing method, which corrects the error of the linear regression with which the behavior of inflation is initially calculated.

Second, we compare the performance of CETES over a five-year horizon versus the performance of GBs. With information obtained from INEGI (2016) and BM (2016).

It was decided to make a comparison of the Mexican GBs only with CETES because the two instruments are highly comparable because they have the same type of issuer (Mexican governmental institution) and therefore show similar risk profiles that attract similar types of investors. Consequently, the present study does not consider a comparison of GBs with other investment instruments of private issuers (stocks or corporate bonds, among others) because they represent very different alternatives.

Finally, the performance of the GBs is determined by comparing the results obtained from the annualized performance using the Sharpe ratio. The Sharpe ratio or Sharpe indicator is a value that relates the profitability of one instrument per unit of risk. It has an inversely proportional variation, that is, the greater the result, the lower the risk.

Results

In order to determine whether GBs are a more attractive investment than CETES, it is necessary to perform an analysis of the yields they offer in the same or similar terms.

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CETES are instruments with fixed maturities at 28, 91, 182 and 365 days established by the Bank of Mexico and the GBs have been issued with five-year maturities. The demand of the latter, after its first issue, has raised the possibility of making new issues with longer terms, which reach even thirty years.

The Mexican government through the Bank of Mexico issues instruments that describe maturities ranging from 28 days to 30 years. The term is specified at the time of its acquisition, provided that it is established within the stated basic terms that can be multiples of 28, 91 or 182 days. Government securities denominated in local currency are typically considered risk-free by private investors as they are backed by government credit (Álvarez and Santaella, s.f.). Government instruments use the 28-day CETES reference rate as the interest rate.

For the comparative analysis of performance and performance of GBs, the behavior of CETES with annualized maturity has been selected, relating them to annual inflation in order to show a performance above this indicator.

Comparison of predicted inflation with the performance of Green Bonds

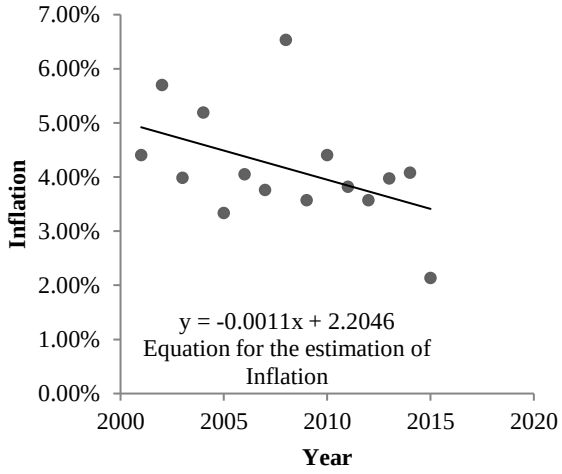
The first data reported are shown below:

Year	2001	2002	2003	2004	2005	2006	2007	2008
Real Inflation	4.40 %	5.70 %	3.98 %	5.19 %	3.33 %	4.05 %	3.76 %	6.53 %
Year	2009	2010	2011	2012	2013	2014	2015	2016
Real Inflation	3.57 %	4.40 %	3.82 %	3.57 %	3.97 %	4.08 %	2.13 %	3.36 %

Table 2 Annual inflation
Source: INEGI (2016)

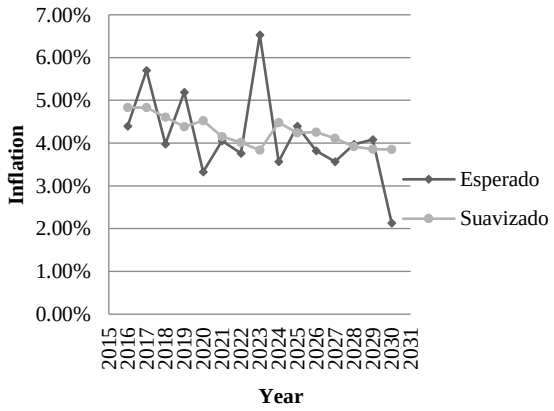
Table 2 shows the annual behavior of inflation during the period from 2001 to 2016. Inflation in previous years was very irregular and erratic, little useful for establishing trends.

The behavior can be seen in Graphic 5:



Graphic 5 Annual inflation
Source: own elaboration with data of INEGI (2016)

The linear equation that represents this trend is useful to establish a trend in the short term and would show a constant downward, reason why it was decided to use the method of double exponential smoothing, whose results are shown in Graphic 6:

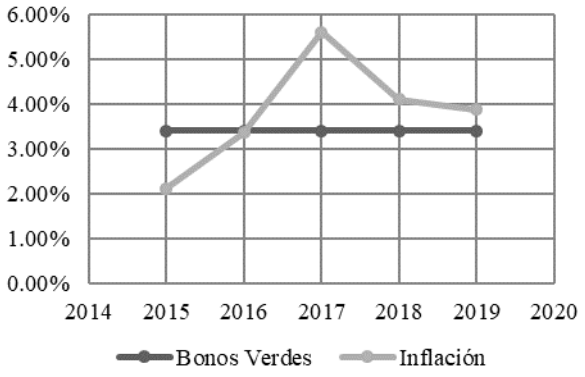


Graphic 6 Annual inflation
Source: own elaboration with data obtained from INEGI (2016)

Comparing both Graphics we can see that Graphic 6 shows in red color the expected inflation for the period 2016 to 2019 values more representative of a real behavior. The values in blue, would be the result of a simple smoothing. The tables of analysis of comparative behavior presented below have been adjusted to the validity of the instruments studied. The GBs were issued with a term of five years and the analyzes presented have been calculated for a period equal to the term of the bonds. The inflation considered to compare yields have been calculated for the same time span, Table 3.

Year	Green Bond	Inflation
2015	3.41%	2.13%
2016	3.41%	3.36%
2017	3.41%	5.60%
2018	3.41%	4.11%
2019	3.41%	3.88%

Table 3 Annualized Green Bond Performance Vs Inflation.
Source: own elaboration with data of INEGI (2016) and BM (2016)



Graphic 7 Comparative of the performance of Green Bonds Inflation Vs Inflation
Source: own elaboration with the data of Table 3

Graphic 7 represents the update of the relationship between GBs performance and inflation.

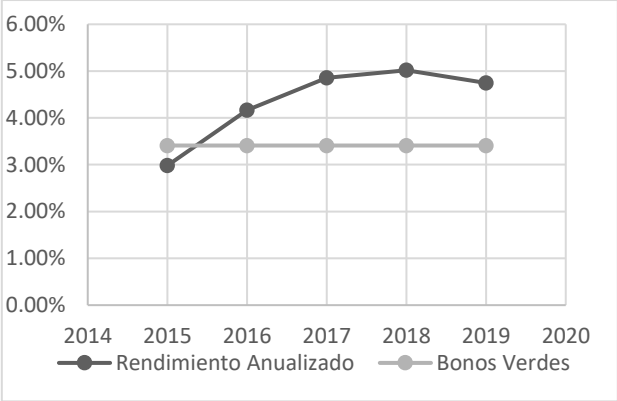
International pressures on the economy change the relationship between the two indicators, showing that after the second year the expected yields were no longer an additional attraction.

Comparison of CETES versus Green Bonds

Table 4 shows the performance of the GBs as constants, since in their emission a fixed rate of yield was established.

Year	Expected Inflation	Green Bonds	Performance
2015	2.983%	3.410%	
2016	4.166%	3.410%	2.178%
2017	6.08635%	3.410%	- 2.198%
2018	6.24781%	3.410%	- 2.805%
2019	5.97988%	3.410%	- 3.667%

Table 4 Annualized CETES Performance Vs Green Bonds
Source: own elaboration with data of INEGI (2017) and BM (2016)



Graphic 8 Comparison of the annualized performance of CETES Vs Green Bonds.
Source: own elaboration with the data of Table 4

To make comparisons of both yields, the reinvestment of CETES should be considered in order to equate the terms of the investment between the two instruments. It can be seen that, depending on the reinvestment, the acquisition of CETES, Graphic 8.

Performance Green Bonds

The consistency of this analysis is calculated using the Sharpe ratio, which shows the performance of debt instruments.

To calculate the performance the following mathematical expressions have been used:

$$PR_C = R_C - R_F \quad (1)$$

Where:

- PR_C = Portfolio risk premium.
- R_C= Profitability of the portfolio at the time of its offer in the primary market.
- R_F = Risk-free return = weighted rate.

The following expression is the most widely used performance of debt instruments and is known as Sharpe's (2010) ratio, where σc is the standard deviation of portfolio performance and Sc's performance[1].

$$Sc = \frac{Rc-Rf}{\sigma c} = \frac{PRc}{\sigma c} \quad (2)$$

The Sharpe ratio, as already mentioned, is an indicator that provides us with information on the profitability of debt instruments per unit of risk.

Conclusions and final reflections

The present article had the following research objective: To compare the performance and performance of Mexican GBs listed on the BMV with CETES.

For this reason three types of analysis were made. First, a comparison of the predicted inflation versus the performance of GBs was made. Second, we compared the performance of CETES over a five-year horizon versus the performance of GBs. And finally, the performance of the GBs was determined by comparing the results obtained from the annualized performance using the Sharpe ratio.

Solving the hypothesis of this research work, we understand that GBs are not more attractive to investors than CETES over a five-year horizon. The financial attractiveness of the GBs in Mexico is that the profits they generate are deductible for investors; that is, the buyer has an additional profit when deducting taxes from what he gets. The sustainable attractiveness of investment in GBs is based on the funding of green projects.

As well as developed in this article the green market is in development phase. So increasing the diversity of investors, with high probability would increase the variety of bonds that are offered; bonds with different issuers that have a greater risk, but with higher yields, bonds in currencies of different countries and bonds related to green projects. The greater the variety, the greater the possibilities of GBs that would increase private capital raising to support investments for climate change projects.

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[1]It is convenient to clarify that performance and performance are usually interpreted as yields. The difference is the correction applied when considering the standard deviation.

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