GREEN BONDS: THE MOST INNOVATIVE FINANCIAL INSTRUMENTS ON THE STOCK EXCHANGE

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Abstract: *In the last decades, the market economy adopted new developments in terms of sustainable growth. A significant number of states realized the need to develop a sustainable environment in which the climate is valued and protected. The word 'green' has become increasingly used in the field of sustainable investments. Some of the most innovative and profitable tools are green bonds. Since their inception, accredited institutions and governments have developed various practices and principles, which they constantly improve to adapt to the market. Moreover, given that the interest of multinational companies has gradually increased, the stock exchange has become increasingly interested in these green bonds. Thus, in the research carried out, a clear delimitation of the concept of green bond was made, in the context in which, according to the researches, the area of coverage is much bigger from year to year. In fact, the purpose of the paper is also to present the development framework of these financing instruments, the principles and concepts underlying the impact that green bonds have on the capitalist economy, but also their development stage. An extremely important aspect that we have surprised is the stages of issuing bonds from asset management, to reporting and auditing them. In order to highlight the steps made by the green bonds as best as possible and to present the role played in the stock market, we have used qualitative research methods of indicators that highlight the performance of debt instruments, calculating market changes and its trend using the standard deviation. Meanwhile, in order to create an overall picture, the market leaders of the green bonds along with the value of investments in the environmental economy were presented detailed. In this way, it was pointed out that most of the amounts are allocated to mitigation and only a quarter to the adaptation of the bonds. In other words, although some of the newest specialized financing instruments are considered on the market, they have become some of the most popular and innovative financing mechanisms in the world.*

Keywords: *Green Bonds; Green Finance; Financial Instruments; Green debt securities; Green Bonds Principles; Green Investment.*

JEL Classification: *Q56; G12.*

1. Introduction

Recently, environmental finance has been attracting more attention in frameworks for developing green program. At this point investors, governments and multinational companies become more and more interested in this kind of projects. This has recently taken form in an increasing number of enterprises issuing green bonds. These are considered financial instruments for funding ecological projects. In comparison with normal bonds, green bonds have particular characteristics, and

their released follows a special path (Zhiyong Li, Ying Tang, Jingya Wu, Junfeng Zhang & Qi Lv, 2019). Investing in the business environment can have an important impact in renewable development, As Taher Nahed&Hajjar Bandar (2014) stated this concept is part of the banking sphere, as such investments could generate profits with a substantial net value. Investments in the environment could therefore serve as a multiplier for the creation of remarkable sources of liquidity and may also induce policy changes.
As far as financial products are concerned, they are considered an essential tool to allow investors to allocate funding for green projects. Green bonds are one of the most affordable methods for low carbon emissions. In fact, these are currently available as financial instruments that resonate with investor preferences for the sustainability and refreshment of projects (Sarah La Monaca, Katherine Spector and James Kobus, 2020).

2. Literature review

First, we will briefly detail what a bond is and how this financing instrument works. A green bond is a specialized financial instrument, defined by a "use of income criteria" that require those that are collected from their issuance to contribute to the mitigation/adaptation of climate change. Also, it is important for the conservation of natural resources if the prevention of the pollution and the control of it is done. This theme is set within the literature covering energy finance, including climate finance and environmental finance (Broadstock & Cheng, 2019). Zhang (2018) considers that much more investigations are needed to support the rapid growth of green bonds.
In the last decades, the word "green" has been frequently associated in wide economics with ecological growth, which in turn leads to sustainable economic development. At the same time, the notion alludes to saving or conserving natural resources, so that natural assets are also sustainable (OECD, 2011). Compared to the bond history we can say that the term green bonds are relative, especially since nowadays there are cases in which it is interpreted differently. But despite the differences between the aspects of green bond concepts, it is generally agreed that green bonds are the instrument of debt that raises funds for causes, in one way or another, connected to the green economy. On the other hand, there is clear evidence that the green economy has a strong bond to the sustainable part of the economy. Moreover, we can import to the green economy the characteristics of what we call a sustainable economy (Draksaite, Kazlauskiene, & Melnyk, 2018).
On the one hand, a green bond can be seen as a guarantee of debt issued by a multilateral institution, government entity or corporation to raise capital from investors for a project that contributes to a low-carbon economy, but especially with climate resistance (Georg Inderst et.al, 2012). In other words, a green bond is the convergence of its two component parts: a climate change ("green") and a debt instrument (a "bond") (Park, 2018). To be classified as a green bond, the use of collateral must first be used in at least one of five eligible environmental categories: alternative energy, efficient energy, prevention and control of the pollution, sustainable water and green building. The World Bank also provides a definition for

highlighting the green bond program support for the transition to developing and expanding support of low carbon countries. (Anderson, 2016)

3. The history and the principles of Green Bonds

The first issuer of green bonds was International Bank for Reconstruction and Development in 2007. (OECD, 2011) This was the first to issue awareness-raising bonds by combining innovative features focused on protection of the climate. As this was the first issue of its kind, it is a debt instrument that had rather simple features. In fact, this was considered a bond, with a relatively short maturity of 5 years, some of the price risks being associated with having bonds with a maturity higher than those that offer zero coupons. Green bond issues have been sustained by a vast range of institutions that are providing financial support, including multinational companies and financial institution which are accredited to give a second opinion of the reports (Anderson, 2016).
As (Bagnoli & Watss, 2020) stated in 2013 the first corporate green bond was made public. In that year, one of the biggest companies in the car industry announced the largest green bond for financing leases and loans for low fuel, (Moodie, 2016). Later, in 2016 was issued one of the largest corporate green bonds and the largest obligation to finance sustainability initiatives (Wolf, 2017).
The country that surprised the market in 2016 was Poland. This was the first with a EUR 750 million sovereign credit issue (external debt). Subsequently, in 2017, France came on the market with the largest issue of approximately 7 billion euros (Soe, Xie, Luke, & Horan, 2019).
In 2019, the five largest individual green bonds issued were from the Netherlands State Treasury Agency (climate bonds) with a total amount of EUR 5.99 billion, KfW of 3 billion, Industrial Bank Co., Ltd. with 2, $ 91 billion, France with 2.47 billion euros and Noor Energy with 2.69 billion dollars. The sectors targeted by green bonds were clean energy, which dominated the general use of revenues at 31.5%, followed by buildings with low carbon emissions at 29.3%, transportation with low carbon emissions 20.2%, water 9, 3%, with the use of land and waste at 3.5%, the rest being divided into other categories. (Whiley & Fatin, 2020)
The main difficulty faced by the issuers of green bonds is regarded to the issuer's promise that the funds raised will effectively fund socially responsible activities. (JP Morgan, 2014). Similarly, a constant "verification". to help investors trust that they are investing in green bonds is provided by the Climate Bond Initiative and other organizations are developing (Bagnoli & Watss, 2020).
In 2014, the International Capital Market Association published the Principles of Green Bonds (GBP) (International Capital Market Association (ICMA), 2017). Thus, the first voluntary guidelines for green bonds that are largely accepted by stakeholders are drawn by GBP (Zhiyong Li, 2019). With the expansion of the market, the need to clarify some concepts and processes associated with green bonds has intensified. Thus, the conventions accepted in 2014 were revised and published in a second edition in March 2015. In other words, to encourage the development of the green bond market there is an essential need of transparency, along with the disclosure and the integrity. The important fundamentals to

development GBP are related to the administration and the broadcasting of bond receipts. When it comes to launching the green bonds, issuers need a clear vision of the fundamental material of the basic components. Investors in green bonds can subscribe to several eligible projects, among which the most important categories are: renewable energy, energy efficiency, sustainable waste management, sustainable land use, biodiversity conservation, clean transport, the management of sustainable water and adaptation to climate variation (The World Bank, 2015).
The key binding principles around which green bonds are built include firstly the description of the use of revenues to finance assets and projects with a positive impact on the environment, secondly the requirement of a process needs to be clearly delimited for project selection. (EU Technical Expert Group on Sustainable Finance, 2020). Finally, it is mandatory to declare the use of receipts with, if possible, information on the environmental impact of the projects. GBP includes four basic components. These include to explain how the revenue is invested, which is the sequence of the project selection, followed by evaluation. Nevertheless, it is mandatory to present the distribution of the revenues and the reporting steps(ICMA, 2018).

4. Research and Methodology

The research was conducted starting from the central objective, namely the analysis of green bonds on the stock market. In this sense, we followed how they have evolved recently, which are the European countries that have companies or institutions that issue green bonds as well as the calculation of the standard deviation. In our research, the database used was provided by the Luxembourg Green Exchange regarding the S&P Green Bond Index. It calls itself the first platform in the world that is committed 100% to financial instruments meant to help the world to become sustainable (Luxembourg Stock Exchange, 2020). Moreover, 32 countries are listed globally, holding 690 listed securities with a total of approximately 247.83 bn euros.
In Figure 1 we captured the distribution of green bonds worldwide. Thus, the states with the most listed securities are the USA with a total of 268 bonds, of which Citigroup Inc. holds 1, International Bank for Reconstruction and Development 244, and International Finance Corporation 23.
This is followed by Luxembourg with 100 listed securities, some of which belong to Banque Europenne D'Investissement (37), Candriam SRI (33), NEF (8), etc. and the Netherlands with 55 of which 11 return to BNG Bank NV, 6 to Iberdrola International B.V. and 3 at ENEL Finance International B.V.
In terms of their value, the IBRD holds 70.88 bn. Euro, European Investment Bank 22.98 bn. Euro, and the Dutch Waterschapsbank N.V. 10.92 bn. euro.

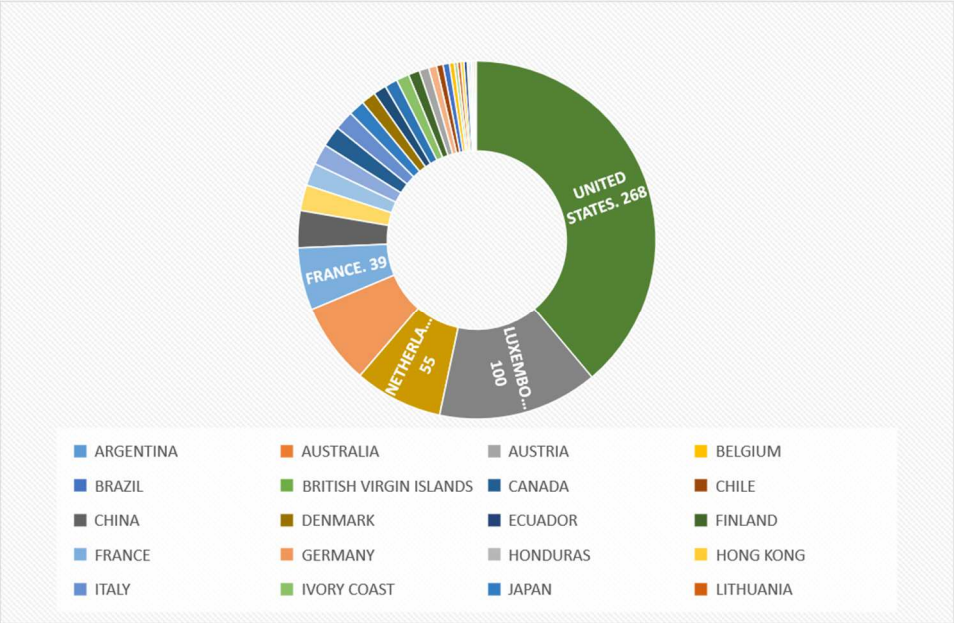

Figure 1: The distribution of green bonds by country
Source: own edited based on data provided by: https://www.bourse.lu/home

In the first table, we selected the most important companies on the Luxembourg stock market for European countries. When it the database was accessed the biggest issued amount was 1.000.000.000 euros. Several companies reached out this summ, among which E.ON SE (Germany), ENEL Finance Internatioan N.V. (Netherlands) and Sparebank 1 Boligkreditt N.V. (Norway). Although, there is a semnificant amount of money, the number of bonds listed differs. Meanwhile, E.ON SE has just 12 green bonds, ENEL Finance Internatioan N.V has 5 bonds and Sparebank 1 Boligkreditt N.V is the lider with 18 bonds. If we are looking deeper, even if E.ON at this issued amount has a 0.375% coupon, on the stock market it has also coupons with 1.625% for an issued amount of 750.000.000 eur. Meanwhile Enel has coupons with a percentage of 1,5% and Sparebank 1 Boligkreditt coupons worth aroun 0,5%.
In addition, I selected from Luxemburg Stock Exchange, all the listed countries and companies the ones with the greatest profits, highest coupons and a wide range of listed bonds. From the entities with a high number of green bonds held in the top of the ranking we note Commerzbank AG (Germany) - 834 green bonds, Natixis Structured Issuance S.A. (Luxembourg) 683 green bonds and Natixis (France) 404 green bonds. With regard to bond coupons, the highest percentage is held by Neo Industrial PLC (Finland) 6%, followed by Suzano Austria GMBH (Austria) 5.75% and Greenalia S.A. (Spain) 5.5
First of all, looking at the the value of emissions. at the time of accessing the platform (02.04.2020) they had the following characteristics:

Table 1: Top listed green bonds on stock market

Issuer	Country	Issued amount (EUR)	Bond	Coupon	Listing date	Final maturity
E.On Se	Germany	1000000000	12	0,375 %	16/01/ 2020	29/09/2027
Enel Finance International N.V.	Netherlands	1000000000	5	1,5 %	21/01/ 2019	21/07/2025
Sparebank 1 Boligkreditt As	Norway	1000000000	18	0,5 %	30/01/ 2018	30/01/2025
Innogy Finance B.V.	Netherlands	850000000	18	1,25 %	19/10/ 2017	19/10/2027
Iberdrola International B.V.	Netherlands	850000000	16	3,25 %	12/2/ 2019	Perpetual
Naturgy Finance B.V.	Netherlands	800000000	15	0,875 %	15/11/ 2017	15/05/2025
Assicurazioni Generali S.P.A.	Italy	750000000	12	2.124%	1/10/ 2019	1/10/2030
Caisse Francaise De Financement Local	France	750000000	135	0,1 %	13/11/ 2019	13/11/2029
Iberdrola Finanzas, S.A.U.	Spain	750000000	19	1,25 %	28/06/ 2018	28/10/2026

Source: own edited based on data provided by:https://www.bourse.lu/home

In the first phase we will focus on the Green Bond Index, provided by S&P which is designed to track the global market for green bonds. This is one of the first indices that maintain strict standards to include only bonds whose revenues are used to finance ecological projects. In our research we considered the market value weight index, which aimed to quantify the performance of green bonds at global level. The green bonds were issued by any country, without exclusions, with the requirement that the current currency is indexed. The maturity of the bonds must at least one month old from the date of rebalancing, without it developing in the index. Bonds such as fixed and zero, fixed to float, floaters or step-up coupons were accepted. The minimum requirement realized in the methodology provided for Euro issuers is that Sovereign has to be 750 million euros, the investment level will be 250 million euros, and High Yield will be 250 million euros. Table 2 provides a background of the performance of the index with a total yield of 158.81 and a YTD drop of -1.14%. In terms of annual returns, they have a positive trend of 2.41% for 1 year, 1.79% for 3 years, 1.23% for 5 years and 4.11% for 10 years (S&P Dow Jones Indices, 2020). To measure the volatility of the green bond market we calculated the standard deviation. The database used was the one provided by (S&P Dow Jones Indices, 2020) and was accessed on April 13, 2020. The research has a starting date of

15/04/2019 until 13/04/2020. Thus, we measured how the value of bonds is dispersed on a large scale by the average value.

Table 2: The appearance of the index level

INDEX LEVEL	**RETURNS**			**ANNUALIZED RETURNS**			
Total Returns	1 MO	3 MOS	YTD	1YR	3YRS	5 YRS	10YRS
158.81	-4.39%	-1.14%	-1.14%	2.41%	1.79%	1.23%	4.11%
Benchmark Total Returns	-4.49%	-3.36%	-3.36%	0.07%	2.69%	1.68%	1.96%
137.43							

Source: own edited based on data provided by: https://us.spindices.com/indices/fixed-income/sp-green-bond-index

In our case the standard deviation is 3.82%, with a daily variation of 0.00058% and an annual variation of 3.82%. The calculation was made based on the following formula: SD= $\sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}}$
However, the lowest registration was on 15/04/2019 with 154.02 (eur), and the highest on 25/02/2020 with 166.91 (eur).

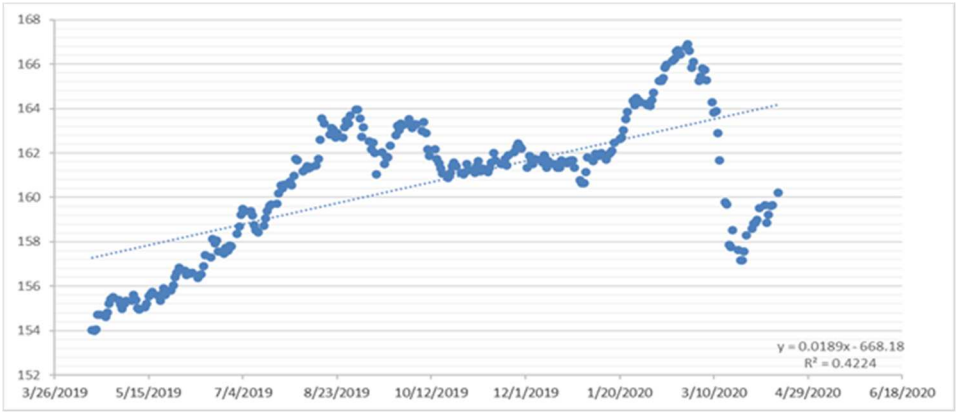

Figure 2: The trendline of Green Bond Index
Source: own representation

Also in April 2020 an upward trend, with strong fluctuations, can be noticed.
From another point of view, green bonds is the observation of the sectors where they are invested. According to data provided by (WORLD BANK, 2019) in 2019, and shown in Table 3, Renewable Energy and Energy Efficiency accounted for 36% of the total eligible projects, 30% were allocated to Clean Transportation, 17% to Agriculture, Land Use, Forests and Ecological Resources, 8% belonged to Water and Wastewater, another 8% go to Infrastructure Resistance, Environmental

Building and others and last but not least 1% remained solid waste management. The net committed amount of cancellations for eligible projects for which loans are paid reaches a total of $ 12.8 billion for mitigation, representing 75% of the total and $ 4.3 billion for adaptation for the remaining 25%. Last but not least, the revenue from green bonds allocated to support the financing the funding of suitable projects, without compensation of loans that are not adapted for past obligations and have not been replaced with new green bonds, is $ 10.5 billion.

Table 3: Distribution of green bonds impact

Amounts in Eq. US$ billion	**Committed**			**Allocated& Outstanding**
	Mitigation	**Adaptation**	**Total**	
Renewable Energy & Energy Efficiency	6.1	0.1	6.2	4.4
Clean Transportation	5.0	0.2	5.1	3.1
Water & Wastewater	0.1	1.3	1.3	0.8
Solid Waste Management	0.1	0.0	0.1	0.1
Agriculture, Land Use, Forests & Ecological Resources	0.5	2.4	2.9	1.3
Resilient Infrastructure, Built Environment & Other	1.0	0.4	1.4	0.8
TOTAL	**12.8 (75%)**	**4.3 (25%)**	**17.2**	**10.5**

Source: own edited based on data provided by: (WORLD BANK, 2019)

5. Conclusion

Following my investigation, we concluded that Green bonds have become indeed the most well seen and innovative financial instruments. We can see a marked increase of them since 2007 when they were first listed, but also an improvement of everything that means procedural and legal framework. Starting from picking the environmental programs in which companies to invest, to their issuance, certification and audit, we can observe a series of policies aimed at increasing transparency.
The results of my research show that the number of green bonds has become increasingly popular both among multinational companies and governments. The percentage of coupons is quite consistent, especially since the duration between the listing date of the green bonds and the final development is significant. However, in the last period, the slope of green bonds has experienced a slight instability due to an increased volatility, but with an upward direction. It is worth noting, however, that the yield is a positive one, and the economic forecasts are quite favourable The purpose and impact of green bonds has been concentrated in the area of Clean Transport, Agriculture, Renewable Energy and Efficienc, Land Use, Forests and Ecological Resources of Water and Wastewater, Infrastructure Resistance, Environment Building and, last but not least, Solid Waste Management. In conclusion, we can say that green bonds are the newest and most innovative green financing instruments.

Bibliography

1. Anderson, J. (2016). Environmental Finance. In *Handbook of Environmental and Sustainable Finance* (pp. 307-333). Elsevier. Retrieved from https://linkinghub.elsevier.com/retrieve/pii/B9780128036150000157
2. Bagnoli, M., & Watss, S. (2020, January). On the corporate use of green bonds. *Journal of Economics & Management Strategy, 29*(1), 187-209. doi:10.1111/jems.12331
3. Broadstock, D. C., & Cheng, L. T. (2019). Time-varying relation between black and green bond price benchmarks: Macroeconomic determinants for the first decade. *Finance Research Letters 29*, 17-12. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S154461231930042X
4. Draksaite, A., Kazlauskiene, V., & Melnyk, L. (2018). The Perspective of the Green Bonds as Novel Debt Instruments in Sustainable Economy. In *Consumer Behavior, Organizational Strategy and Financial Economics* (Vol. 9, pp. 221-230). Cham: Springer International Publishing. doi: 10.1007/978-3-319-76288-3_16
5. EU Technical Expert Group on Sustainable Finance. (2020). *Usabiliti Guide: EU Green Bond Standard.* Retrieved from https://ec.europa.eu/info/publications/sustainable-finance-teg-green-bond-standard_en
6. Georg Inderst et.al. (2012). Defining and Measuring Green Investments: Implications for Institutional Investors Asset Allocations. *(Paper No. 24)*, 28. (OECD Working Papers on Fin., Ins. & Priv. Pensions. Retrieved from https://www.oecd.org/finance/WP_24_Defining_and_Measuring_Green_Investments.pdf
7. ICMA. (2018). The Green Bond Principles (GBP). Retrieved from https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/
8. ICMA. (2020, April). Retrieved from https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/
9. International Capital Market Association. (2017). The green bond principles 2017.https://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-social-and-sustainability-bonds/green-bond-principles-gbp/
10. JP Morgan. (2014, January 13). Green bond principles created to help issuers and investors deploy capital for green projects. Retrieved from https://www.jpmorgan.com/country/US/en/detail/1389155300983
11. Kochetygova, J., & Juahari, A. (2014). Climate Change, Green Bonds and Index Investing: The New Frontier. *The New Frontier*, 1-14. Retrieved from https://us.spindices.com/documents/research/research-climate-change-green-bonds-and-index-investing-the-new-frontier.pdf
12. *Luxembourg Stock Exchange*.(2020,April 5). https://www.bourse.lu/green
13. Moodie, A. (2016, March 20). Can Apple's $ 1.5bn green bond inspire more environmental investments? The Guardian. Retrieved from https://www.theguardian.com/sustainable-business/2016/mar/20/apple-green-bond-environment-energy-toyota-climate-change

14. OECD. (2011). *Towards green growth. OECD green growth studies.* Paris. Retrieved from https://www.oecd.org/greengrowth/48012345.pdf
15. Park, S. (2018). Investors as Regulators: Green Bonds and the Governance Challenges of the Sustainable Finance Revolution. *Stanford Journal of International Law, Vol. 54, No. 1, 2018*, 1-48. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3142887
16. *S&P Dow Jones Indices.* (2020, April 15). Retrieved from https://us.spindices.com/indices/fixed-income/sp-green-bond-index
17. Sarah La Monaca, Katherine Spector and James Kobus. (2020). FINANCING THE GREEN TRANSITION. *Journal of International Affairs Editorial Board, 73*(1), -32. Retrieved from https://www.jstor.org/stable/10.2307/26872776
18. Soe, A., Xie, H., Luke, B., & Horan, K. (2019, Nocember). A Look Inside Green Bonds: Combining Sustainability With Core Fixed Income. 1-19. Retrieved from https://us.spindices.com/documents/research/research-a-look-inside-green-bonds.pdf
19. Taher Nahed, Hajjar Bandar. (2014). Environmental Investments. In *Energy and Environment in Saudi Arabia: Concerns & Opportunities* (pp. 53-93). Retrieved from http://link.springer.com/10.1007/978-3-319-02982-5_3
20. The World Bank. (2015). What are Green Bonds? Retrieved from http://treasury.worldbank.org/greenbonds
21. Whiley, A., & Fatin, L. (2020, January 16). Green Bonds Reach Record $255bn for CY 2019 - New Milestone $350-400bn Climate Bonds initial forecast for 2020 $1trillion in annual green investment in sight for early 2020s. (C. B. Initiative, Ed.) https://www.climatebonds.net/resources/press-releases/2020/01/green-bonds-reach-record-255bn-cy-2019-new-milestone-350-400bn
22. Wolf, D. (2017, April 7). Bond of the year: Social and sustainability—Starbucks. Environmental Finance. Retrieved from https://www.environmental-finance.com/content/awards/green-bond-awards-2017/winners/bond-of-the-year-social-and-sustainability-starbucks.html
23. WORLD BANK. (2019). *Green Bond Impact Report 2019.* Retrieved from http://pubdocs.worldbank.org/en/790081576615720375/IBRD-Green-Bond-Impact-Report-FY-2019.pdf
24. Zhang, D. (2018). Energy finance: background, concept, and recent developments.*Finance Trade*, 1687-1692. Retrieved from https://www.researchgate.net/publication/325354745_Energy_Finance_Background_Concept_and_Recent_Developments
25. Zhiyong Li, Y. T. (2019, January 21). The Interest Costs of Green Bonds:Credit Ratings Corporate Social Responsibility, and Certification. 1-14. Retrieved from https://doi.org/10.1080/1540496X.2018.1548350