Do M&A deals in green sectors result in greater synergies than those in non-green sectors for European companies?

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Abstract

Mergers and Acquisitions (M&A) deals are important in every industry and can be a game changer in every market. Green Finance is a concept that is growing, and becoming more and more important as time goes by, and it is something that every company nowadays considers. By merging these two important concepts in the world of Finance, I decided to test how the M&A value creation in green sectors differs from the value creation in non-green sectors. In this study, 865 M&A deals were considered, which were retrieved from Refinitiv Workspace.

The conclusions obtained from this study suggest that the synergies generated by the deals are not always higher when green companies are present and that it depends on the approach used. The results also show that green companies' cumulative abnormal returns (CAR) are not always positive, which impacts the synergy creation in M&A deals.

Keywords: M&A, green sectors, synergies

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Resumo

Os negócios de Fusões e Aquisições (M&A) são importantes em todas as indústrias e podem mudar por completo todos os mercados. Finanças Verdes é um conceito que está a crescer e a ficar cada vez mais importante à medida que o tempo vai passando, e é algo que todas as empresas têm em consideração nos dias de hoje. Combinando estes dois conceitos do mundo das Finanças, decidi testar como a criação de valor em negócios de M&A em setores verdes difere da criação de valor em setores não-verdes. Neste estudo, foram considerados 865 negócios de M&A, o quais foram retirados a partir do Refinitiv Workspace.

As conclusões obtidas neste estudo sugerem que as sinergias criadas nestes negócios nem sempre maiores quando as empresas presentes nos mesmos pertencem a setores verdes, e que isso depende da abordagem utilizada. Os resultados mostram também que os retornos abnormais acumulados (CAR) de empresas verdes nem sempre são positivos, o que tem impacto na criação de sinergias nos negócios de M&A.

Palavras-chave: M&A, setores verdes, sinergias

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1. Introduction

Mergers and Acquisitions (M&As) are one the most transformative activities in the corporate business world, in this type of deal, two companies combine forces to grow, innovate, or strengthen their market position. A merger happens when two companies join to form a single entity, while an acquisition involves one company taking control of another. These transactions can reshape industries, drive economic growth, and create new opportunities for innovation.

M&A deals bring a lot of benefits for both the Acquirer and the acquired company, and to assess the value creation in these deals, there is the concept of **synergies,** which are the main measure of value creation in M&A deals, and that refers to the additional value created when two companies merge (Seth, 1990), that results from the combined resources, capabilities, or cost-saving measures.

Green Finance has grown widely in the past years, in every business sector. It is something taken into account in investors' and managers' decision-making, as shown in the literature by Amel-Zadeh and Serafeim (2018), especially when considering the merger or acquisition of another company. Given this, I decided to merge these two important concepts in the world of Finance and to test my research question: **"Do M&A deals in green sectors result in greater synergies than those in non-green sectors for European companies?"**.

The results of this study will be very interesting for both companies and investors if it is proven that synergies are greater for companies in the green sectors. This could change the investment strategies and mentality of the managers and investors, making them change their focus toward "green companies", which would make the corporate world transition to an even more sustainable future.

With this test, I found that the M&A deals in green sectors do not always generate higher synergies than the deals in non-green sectors and that the creation of value is higher when a green Acquirer acquires a non-green Target. This is explained in detail in the results and conclusion's section.

In this study, I will start by introducing what conclusions and important benchmarks the previous studies concluded, about M&As, synergies creation, the topics of Green Finance, and the different ways of assessing it. Then, in the Data Analysis and Methodology section, I will explain how the final sample was built, with which filters, and why they were used, will also explain how the green sectors were defined, based on the TRBC Industry Groups' Emission

Scores, with the three different approaches used to define them, and how the synergies of each deal were calculated, following the same methodology as Faias (2017). Still in this section, I will summarize the sample's descriptive statistics, and present and explain the regressions used to test the hypothesis of the research question.

2. Literature Review

M&A deals are the total or partial acquisition of one firm's assets by another and depending on the deal orientation and objective, it can be considered as a horizontal, vertical, or conglomerate merger (Kedia et al., 2011). Jensen and Ruback (1983) comprehensively explain it and the motivations behind this type of deal, as well as the value creation through synergies, efficiency improvements, and market power gain. The authors also define this type of deal as a mechanism for reallocating corporate control to more efficient management, which will drive value creation. Later, Seth (1990) reinforces the idea that was studied before, by defining the value creation in M&A by the synergies created in the deal, that exist when the value of the merged entity is greater than the combined value of the two individual firms.

As already referred, the main measure of value creation in M&A is through the synergies generated by the combination of the two firms. Damodaran (2005) divided it into two groups: Operating Synergies and Financial Synergies. What distinguishes them is that the Operating Synergies are created through economies of scale, reduced competition, the combination of functional strengths, and the growth in existing or new markets. The Financial Synergies are valued through the lower cost of capital or higher cash flows. Despite defining what synergies are, and dividing them into different sections, the author still finds it difficult to value them, giving different approaches for each type of synergy.

However, not every acquisition creates value, only the carefully managed and selected can generate synergies. An acquisition is a valuable and difficult-to-imitate strategy, where the acquiring company needs to leverage and integrate the complementary resources, in order to achieve the objective of value creation, as Morrow et al (2017) conclude.

The Green Finance topic has grown a lot in the past few years, and it's expected that its importance will continue to grow in the future. The climate risks, especially global warming, and carbon emissions are very important issues to take into account in the days we live, and most big companies are changing their focus to a more sustainable future.

ESG information is one of the most common ways that investors and managers use to measure how a company performs in terms of Environmental, Social, and Governmental terms. In a global survey of mainstream investment organizations, conducted by Amel-Zadeh and Serafeim

(2018), the authors provided insights into why and how investors use this reported information. The results suggest that ESG information has become more important in the investment process than in the past and that most of the responding investors (82%) consider this type of information before making their investment decisions. It's also important to highlight that a higher percentage of European investors responded that they consider ESG information when compared to US investors.

In a study about the effects of ESG on M&As and market value performance, Tampakoudis and Anagnostopoulou (2019) found that there was a positive and statistically significant relationship between the change in the post-merger market value of acquirers and the change in their post-merger ESG performance. This allowed the authors to conclude that increasing the corporate ESG performance can be viewed as a strong M&A value antecedent.

After research on this topic, Zhang et al. (2024) found that "greener" firms are more focused on sustainable development, focusing on the balance of environmental protection, social responsibility, and economic benefits, aiming to generate profits while minimizing environmental impact and fostering sustainable social and economic development in the long term. While the "brown" firms prefer to follow the most traditional business model and prioritize their short-term economic gains while overlooking environmental protection and social responsibility. Pástor et al. (2020) reinforce this idea in their paper, where the authors create a framework that predicts that green firms outperform brown firms when the climate risk is elevated.

Aktas et al. (2011) proved that the better the target is regarding environmental and social performance, the higher the gain for acquirer shareholders since the acquirer's abnormal returns are positively associated with this type of performance by the targets.

Not only companies, but also investors care about climate risks, especially carbon risks, and already demand compensation for their exposure to carbon emission risks, as shown by Bolton and Kacperczyk (2021). Global warming and carbon emissions represent significant risks to investors and other stakeholders, and acquiring companies with high carbon risk might be viewed unfavorably by stakeholders, potentially reducing their support for the acquisition. This is especially true if the acquisition is perceived as a way of avoiding carbon risk compliance.

It is also important to take into consideration the Paris Agreement, which happened in late 2015, and was then signed in April 2016, where almost 200 countries participated. This agreement is a "legally binding international treaty on climate change", and its goal is to limit the rise in global average temperature to well below 2°C above pre-industrial levels. The countries that participate need to transmit the actions they take to reduce their greenhouse gas emissions, actions that, starting in 2024, these countries will transparently communicate, as well as their progress in climate change mitigation.

Since the Paris Agreement started, it has already encouraged low-carbon solutions and opened new markets, and there is an increasing number of countries, cities, and companies that are adopting these carbon-neutral targets. Today, the zero-carbon solutions represent 25% of the emissions across the economic sectors, with the expectation that by 2030 these zero-carbon solutions represent over 70% of the global emissions.

Regarding the carbon risk exposure in acquisitions, Bose et al. (2021) studied how the returns of the deals change, depending on whether the companies are high carbon emitters or not. Not surprisingly, this study reports that the lower carbon emitters experience better cumulative abnormal returns (CARs) during acquisition announcements compared to higher emitters. The authors also show that the introduction of carbon tax legislation influences acquisition behavior and that high-emission firms are now more likely to acquire foreign targets.

This study contributes to the existing literature, given that it will test if companies from green sectors generate higher cumulative abnormal returns, and consequently higher synergies, than the companies that don't belong to the green sectors.

3. Data Analysis and Methodology

3.1. Data Sample

I started by retrieving from Refinitiv Workspace all the M&A deals between 01/01/2014 and 31/12/2023 where the acquirers were European companies, considering the last 10 complete years in my analysis. I decided to use this timeframe because climate considerations have enhanced their importance in recent years, especially given the rising global warming concerns, which the Paris Agreement (2015) reinforced by stating how important it is to reduce carbon emissions.

The filters used when retrieving the deals were: deal value equal to or above €1 million (Alexandridis et al., 2010), the deal was completed, and the acquirers were European companies. With these filters applied, it gave a first sample of 33,704 deals. After cleaning the data and deleting all the deals where the acquirer did not have its primary ticker available, or its Market Value 4 weeks before the announcement, the sample had 4,583 deals.

The deals where the Target Public Status was either "Joint Venture" or "Government" were also removed, at this point, the sample had 4,527 deals. The reasoning behind the removal of these Targets is that synergies in Joint Venture transactions may be pre-existing due to prior collaboration between the two companies, and the deals involving Government Targets may often prioritize public policy objectives, like privatization or public service improvements, rather than the creation of operational or financial synergies.

Finally, after calculating the synergies created in each deal, around 80% of the sample's observations were removed, since only 865 companies had data availability regarding their returns, making the final sample ending up with 865 deals.

3.2. Green Sectors Selection

The concept of "green sectors" is very vague and there is no universal definition in the literature. So, to define them, I focused on how good the companies of each industry were in terms of low carbon emissions, since, as stated by Bose (2021), the lower carbon emitters face better cumulative abnormal returns when they acquire other companies.

To do so, I started by retrieving the Industry Scores from Refinitiv Workspace, where I got the median Emission Scores for each TRBC Industry Group (which reflects how good the

companies are in terms of low CO2 emissions - the higher the Emission Score, the better), for each of the 10 years. Then, for each year, I came up with three different approaches to define the most sustainable sectors: 1) the green sectors were the top 10% best industries in terms of Emission Scores; 2) the green sectors were the top 25% best industries in terms of Emission Scores; 3) the green sectors were the top 50% best industries in terms of Emission Scores. In this analysis, there will be different green sectors in each of the 10 years, contributing to a more in-depth and specific study. With this approach, it will be possible to understand if there are higher synergies when there is a more restricted definition of the green sectors (when only the top 10% is considered), and how it changes when the green sector selection is widened, with the top 25% and with the top 50%.

When the top 10% approach is used, the five most common green sectors are: "Chemicals", the only industry that is present in all 10 years of the analysis; "Oil & Gas", a sector that is also very present, being considered as a green sector in 8 of the 10 years; "Paper & Forest Products", that is considered as a sustainable industry in 6 years; "Coal" and "Containers & Packaging", both appearing in half of the years of the analysis.

TRBC Industry Group	# Years
Chemicals	10
Oil & Gas	8
Paper & Forest Products	6
Coal	5
Containers & Packaging	5

Table 1 - Most common Green Sectors with the Top 10% Approach

With the 25% method, we can observe the difference in the green sectors: "Chemicals" obviously still appears in all the 10 years, although, now, there are two more sectors present every year, these are "Oil & Gas" (that was already present in 8 years when the top 10% was considered), and a "new" sector, "Electric Utilities & IPPs"; "Paper & Forest Products", is now present in 9 of the 10 years (instead of the 6 years with the most strict approach); finally there are "Multiline Utilities", "Coal", and "Office Equipment", being each of them present on 8 years of the analysis.

TRBC Industry Group	# Years
Oil & Gas	10
Chemicals	10
Electric Utilities & IPPs	10
Paper & Forest Products	9
Multiline Utilities	8
Coal	8
Office Equipment	8

Table 2 - Most common Green Sectors with the Top 25% Approach

Using the wider approach, and the one that considers half of the sectors as "green" (top 50%), there are now 13 industry groups that are present in all 10 years: "Oil & Gas", "Chemicals", and "Electric Utilities & IPPs" being present is not newly given that those sectors were already "green" in all 10 years with the top 25% approach, "Paper & Forest Products", "Multiline Utilities", and "Coal" presences is also not a surprise, since they were already a very common green sector with the top 25% approach. So, the sectors that made their debut as green ones, in all 10 years, were "Freight & Logistics Services", "Food & Tobacco", "Beverages", "Personal & Household Products & Services", "Metals & Mining", "Automobiles & Auto Parts", and "Construction Materials".

It's important to note that only the sectors present in all 10 years are represented in the table and that there are a total of 45 different green industries, across the years using this wide approach.

All the green sectors for each of the three approaches are shown in the Appendix section.

TRBC Industry Group	# Years
Freight & Logistics Services	10
Oil & Gas	10
Chemicals	10
Electric Utilities & IPPs	10
Paper & Forest Products	10
Food & Tobacco	10
Beverages	10
Personal & Household Products & Services	10
Multiline Utilities	10
Metals & Mining	10
Automobiles & Auto Parts	10
Construction Materials	10
Coal	10

Table 3 - Most common Green Sectors with the Top 50% Approach

After defining the green sectors, three dummy variables were created for each of the three different approaches: Acquirer Green Sector (that equals 1 if the Acquirer sector was a green sector), Target Green Sector (that equals 1 if the Target sector was a green sector), and Both Green (that equals 1 if both the Acquirer and Target are from green sectors).

As well as in the green sectors definition, we need to look differently at the number of deals in green sectors, because of the three different approaches used.

In absolute terms, with the top 10% approach, there are 53 deals where the Acquirer was a company operating in a green sector, 54 deals where the Target company was from a green industry, and 27 deals where both companies operated in this group of sectors.

Top 10% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**202**	**Total**
Acq Green	10	5	6	4	6	4	6	2	6		5
Target Green	16	2	11	6	4	5	3	3	2		5
Both Green	4	0	6	4	3	3	3	1	1		2

Table 4 - Number of Green Deals per year with the Top 10% Approach

With the "middle" approach (top 25%), we see very different results, the number of deals where the acquiring company is from a sustainable industry and the number of deals where the acquired firm is "green", is more than two times bigger when compared to the most strict approach (110 deals for the Acquirer and 126 for the Target). The number of acquisitions where

the green Acquirer acquires another green company, is almost 3 times bigger than the previous method, with 78 deals, as represented in the table below.

Top 25% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**202**	**Total**
Acq Green	24	11	8	10	15	5	11	8	12		11
Target Green	31	10	14	15	16	7	8	9	13		12
Both Green	15	6	8	9	12	3	8	5	10		7

Table 5 - Number of Green Deals per year with the Top 25% Approach

When the wider method is applied (top 50%), we see a big increase in the number of deals for each of the three categories. There are 298 deals where the Acquirer is from a green sector, 311 deals where the Target is, and 216 where both companies operate in one of the 50% most sustainable sectors.

Top 50% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**202**	**Total**
Acq Green	80	33	32	29	25	19	19	22	23	1	29
Target Green	75	35	33	28	27	20	20	32	27	1	31
Both Green	52	25	25	19	20	14	16	16	20		21

Table 6 - Number of Green Deals per year with the Top 50% Approach

Now in terms of proportion per year, with the 10% approach, as seen below, the percentage of deals where both companies were from a green sector varies from 0% to 8.11%, having these extreme values with a year difference (2015 and 2016, respectively), and with the total percentage being equal to 3.12%. The table and graph below show that this percentage has been very inconsistent throughout the years, except for the period between 2019 and 2020, when it seems to be more constant regarding the percentage of deals where both companies were from green sectors.

Top 10% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**202**	**Total**
Number of deals	195	94	74	95	93	67	61	83	55	4	86
% Both Green	2.05%	0.00%	8.11%	4.21%	3.23%	4.48%	4.92%	1.20%	1.82%	4.17%	3.12%

Table 7 - Percentage of Deals with two Green Companies, per year, with the Top 10% Approach

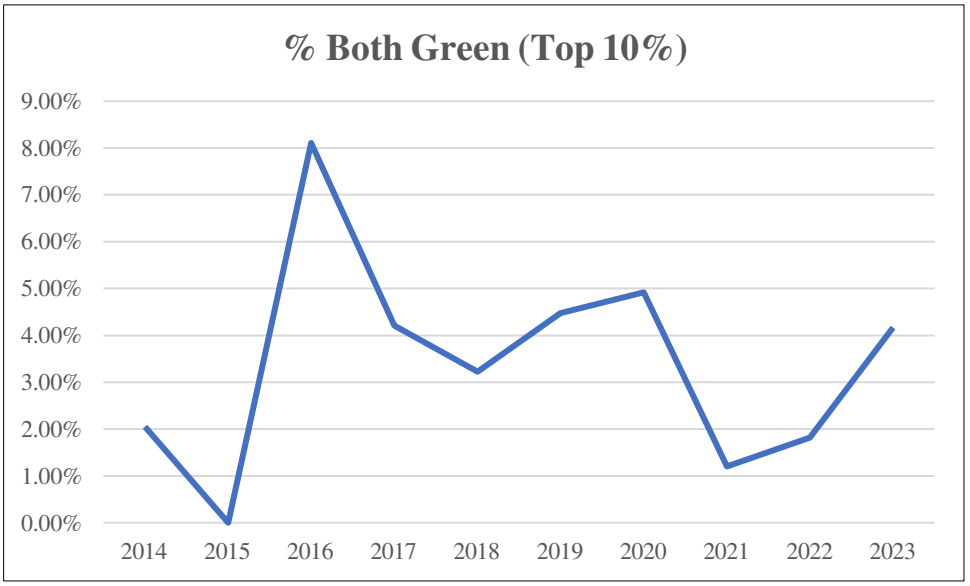

Figure 1 - Change of the Percentage of the Deals with two Green Companies, per year, with the Top 10% Approach

For the approach where the top 25% best industries in terms of Emission Score were selected as the green sectors, the variation of the percentages is now between 4.17% and 18.18%, and, as well as with the top 10% approach, these two extreme values appear to be in back-to-back years (2022 and 2023 in this case). The ratio for the whole sample is now 9.02%, almost 3 times bigger when compared to the stricter approach. From the graph, we can see that it is very inconsistent across the years, especially for the period between 2018 and 2023.

Top 25% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Number of deals	195	94	74	95	93	67	61	83	55	48	865
% Both Green	7.69%	6.38%	10.81%	9.47%	12.90%	4.48%	13.11%	6.02%	18.18%	4.17%	9.02%

Table 8 - Percentage of Deals with two Green Companies, per year, with the Top 25% Approach

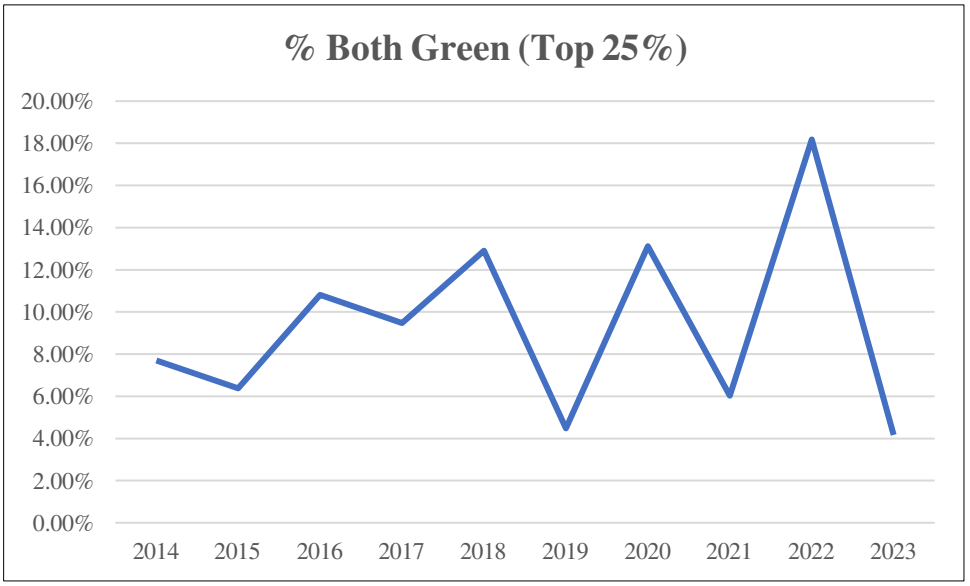

Figure 2 - Change of the Percentage of the Deals with two Green Companies, per year, with the Top 25% Approach

With the top 50% method, the range is now between 19.28% and 36.36%, in 2021 and 2022, respectively, and as happened with the two other approaches, these values are in consecutive years. This means that the year with the lowest percentage of deals where both companies were green is higher than the year with the highest percentage in the top 25% industries method. The percentage of the entire sample is also much higher when compared with the two other approaches, with a value of 24.97%. From the graph, we can understand that, with this wider approach, the percentage of deals where both companies operate in green sectors is less volatile, especially when compared with the top 25% method.

Top 50% Approach											
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**202**	**Total**
Number of deals	195	94	74	95	93	67	61	83	55	4	86
% Both Green	26.67%	26.60%	33.78%	20.00%	21.51%	20.90%	26.23%	19.28%	36.36%	18.75%	24.97%

Table 9 - Percentage of Deals with Two green Companies, per year, with the Top 50% Approach

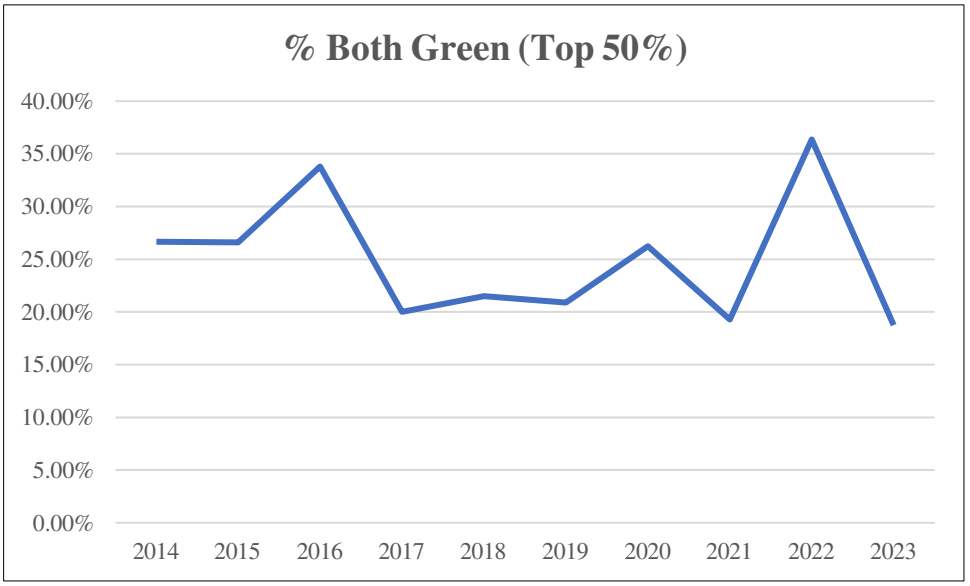

Figure 3 - Change of the Percentage of the Deals with two Green Companies, per year, with the Top 50% Approach

Finally, plotting these three approaches in the same graph allows for a better understating of how a stricter or wider way of defining the green sectors can change the percentage of deals where both companies are from a green industry in comparison with the total number of deals in a year. In the first four years of the analysis, the percentage of both firms being green in a deal is very close when the top 10% and the top 25% are being considered, and these two approaches have the percentage equal in 2019 and 2023, with values of 4.48% and 4.17%, respectively. Using the top 50%, the percentage of both green firms in a deal is very distant from the two other approaches, but from 2020 onwards it seems to follow the same variation as the top 25% approach.

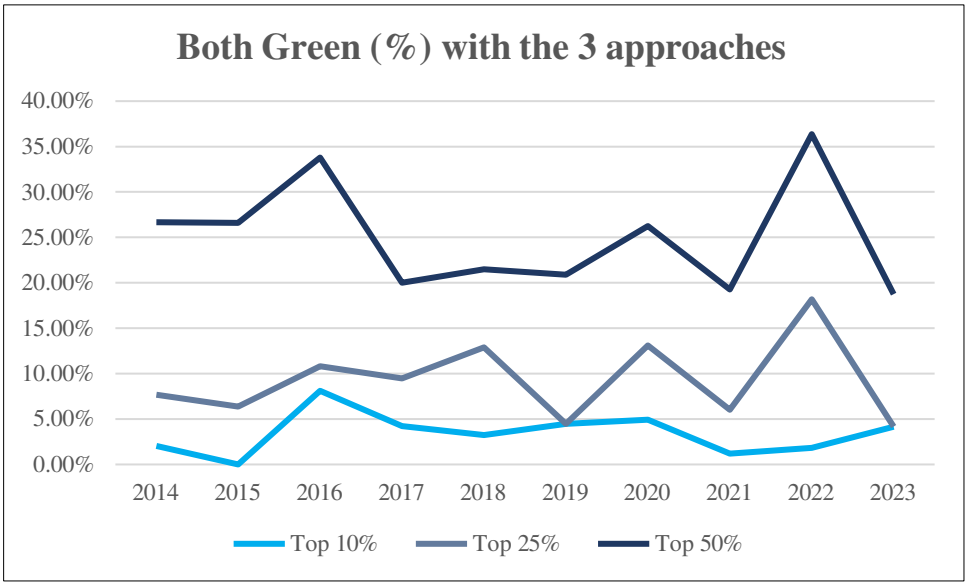

Figure 4 - Change of the Percentage of the Deals with two Green Companies, per year, with the Three Approaches

3.3. Descriptive Statistics

To summarize the descriptive statistics of the sample, I separated the data into ten groups: (1) All sample, with all the deals; (2), (3), (4) Acq Green Sector, which has the deals where the Acquirer operates in a green sector (which is divided into the three different approaches of the green sectors definition – top 10%, top 25%, and top 50%); (5), (6), (7) Target Green Sector, where only the Target is from a green industry (which, as well as the Acquirer, is also divided into the three approaches); (8), (9), (10) Both Green Sector, that englobes the deals where both companies operate in green sectors.

The descriptive statistics of the sample are summarized in the table below:

		All Sample	Acq Green Sector			Target Green Sector			Both Green Sector		
			10%	25%	50%	10%	25%	50%	10%	25%	50%
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Number of Deals	N	865	53	110	298	54	126	311	27	78	216
Deal Value	Average	667.83	807.32	594.62	721.75	862.57	663.15	692.51	892.34	618.69	792.24
	Median	94.71	171.64	74.97	94.39	164.45	85.09	75.38	476.03	101.35	115.72
	St. Deviation	2144.29	1671.52	1369.40	2166.86	2072.88	1714.06	2055.18	1287.50	1180.72	2167.67
Acquirer Market Value	Average	16688.57	27469.14	16796.24	13836.92	18199.71	13862.51	11371.19	29903.12	18055.11	14334.86
	Median	1438.36	7874.74	1520.89	1575.62	1332.50	1290.63	1262.94	4854.51	1488.75	1630.09
	St. Deviation	50563.19	35721.21	29605.36	26715.73	32044.35	26955.80	23308.95	39982.08	31850.63	26073.17
Relative Size	Average	0.96	0.57	0.59	0.83	2.49	1.48	1.17	1.02	0.79	0.67
	Median	0.06	0.04	0.06	0.07	0.06	0.07	0.07	0.04	0.06	0.07
	St. Deviation	10.27	2.40	2.38	5.43	13.85	9.26	8.18	3.33	2.81	2.95
Market-to-Book Ratio	Average	2.88	1.94	2.04	2.78	3.65	2.05	2.38	2.17	1.98	2.51
	Median	1.87	1.74	1.70	1.79	1.73	1.68	1.72	1.74	1.68	1.74
	St. Deviation	54.33	1.43	1.65	8.46	8.14	7.38	9.19	1.82	1.69	8.21
Leverage	Average	5874.66	6769.87	3944.01	3525.58	3903.13	2852.66	3503.13	6749.25	4485.47	3522.31
	Median	155.89	962.20	383.80	253.67	215.46	183.35	170.15	1710.11	490.91	285.46
	St. Deviation	24453.64	11504.30	8775.36	9279.02	7896.85	7845.18	14283.50	10199.18	9282.14	9801.16
FCF	Average	0.045	0.103	0.091	0.079	0.053	0.046	0.056	0.107	0.092	0.083
	Median	0.072	0.103	0.093	0.084	0.095	0.081	0.082	0.102	0.093	0.088
	St. Deviation	0.246	0.066	0.070	0.080	0.219	0.199	0.176	0.050	0.074	0.083

Table 10 - Descriptive Statistics of the Sample

This table can lead to several conclusions about the sample. The first one is that more than half of the deals don't have any companies from the green sectors, independently of the approach used to define those.

The average deal value is much higher when companies from the top 10% best green sectors are included in the deals, as well as the median values. Especially, when the two companies of the transaction operate in one of the green industries, in this case, the average deal value is €892.34 million and the median value is €476.03 million, which means that the Acquirers from this group of industries are willing to pay more to acquire Targets that also belong to the top 10% green sectors.

In terms of the market value of the Acquirer, the same phenomenon is observable, for the deals where companies from the top 10% were present, the values are much higher than when the other two approaches to the green sector definition are used. This is more evident in deals where the Acquirer is from a green industry, or when both companies are, where both the average and median values are much higher when compared to the rest. Is also important to note that the standard deviation of this variable is very big, meaning that there are some extreme values in the sample.

The Relative Size is the ratio of the deal value over the market value of the Acquirer, a ratio that, with high values, indicates that the Acquirer may be undervalued. The average for the whole sample is 0.96, meaning that, on average, the deal value is 96% of the Acquirer's market value. When looking at this ratio in the transactions where a green Target is acquired, the values are higher than 1 in the three approaches and have a value of 2.49 when the acquired company is from a top 10% green sector, indicating that the Acquirers of these companies are probably very undervalued and that their market value should be higher than what it is.

The Market-to-Book ratio is the ratio of the Acquirer's market value over its book value, this ratio also aims to understand if the company is undervalued, overvalued, or fairly valued, relative to its assets. The average values of the whole sample and of the different nine approaches are all higher than 2, or close to it, indicating that the market value of the Acquirer companies is, on average, two times bigger than its book value, a signal of a huge undervaluation of these companies. All the median values are higher than 1.68, which shows that half of the acquiring firms are overvalued by, at least, 68%. It is also important to note that the standard deviation for this variable has a huge value (54.33) when all the deals are considered, but when looking at the deals where green companies are present, this value drastically decreases, suggesting that the Market-to-Book ratio is especially volatile in the deals where there are no firms from green sectors.

The variable Leverage stands for the Acquirer's net debt and has a crucial value in this analysis since it reflects the financial leverage and liquidity position of the acquirer, directly impacting the deal structure, risk profile, and post-transaction financial stability. With the information available in the table, it is possible to conclude that, on average, when an Acquirer from the top 10% green industries is present in the deal, this company has a net debt value of €6,769.87 million, and when both companies are green, it has an average net debt value of €6,749.25 million. The standard deviation of this variable is much higher for the whole sample when compared to the deals where green companies are part of it, this means that as well as for the Market-to-Book ratio, in the deals without green companies, the Leverage is very volatile and may include very extreme values.

The FCF variable stands for Free Cash Flow, and in this study, it equals the ratio of the Acquirer's net cash from operations over the Acquirer's total assets, both in the year before the deal was announced. When this variable has a high value, it reflects how strong the operational performance and the efficient asset utilization of the Acquirer is. As shown in the table, the

median values of this table are higher, or equal to the average values, meaning that, at least, half of the sample is below the average value, and that there are Acquirers with very high values of net cash from operations over the total assets.

Regarding the number of deals and average deal value per year, 2014 is, at the same time, the year when more transactions happened and the year with the lowest average deal value, with 195 deals and an average value of €463.67 million. From 2015 onwards, all years have less than 100 deals, varying from 48 to 95 transactions completed yearly. The average deal value varies a lot throughout the years, having the highest value in 2021, with an average deal value of €1,016.36 million, and the lowest value in 2014, as mentioned before. Both statistics are represented in the graphs below, with the average deal value expressed in € millions.

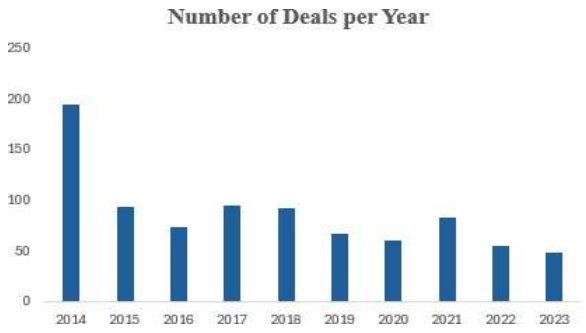

Figure 5 - Number of Deals per year

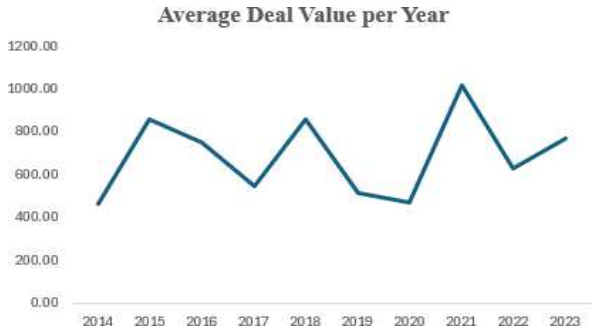

Figure 5 - Average Deal Value per year

It's also interesting to understand which countries are more represented as the Acquirer nations and which have the highest and lowest average deal values. The most represented country is the United Kingdom, with 314 deals where the Acquirer is from this country and with an average deal value of €427.11 million within these transactions. The nations with the highest average deal values are Ireland, with 43 deals and an average value of €2,520.19 million, and Switzerland, which has an Acquirer company from this country in 27 deals, with an average value of €2,260.06 million. Cyprus, the Czech Republic, Finland, the Isle of Man, and Portugal are the least present countries, with only one deal where the Acquirer is from one of these countries. This information is shown in table 11, with the average deal value expressed in € millions.

Acquirer Nation	Number of deals	Average Deal Value
Austria	4	252.19
Belgium	4	466.70
Cyprus	1	529.47
Czech Republic	1	32.19
Denmark	8	278.24
Finland	1	81.00
France	93	1168.07
Germany	61	1211.60
Greece	14	236.96
Guernsey	4	64.50
Ireland	43	2520.19
Isle of Man	1	26.20
Italy	59	167.01
Jersey	7	106.66
Luxembourg	9	788.81
Monaco	2	60.77
Netherlands	28	368.09
Norway	45	148.41
Poland	35	46.29
Portugal	1	255.90
Romania	2	1.65
Russia	4	301.36
Spain	59	516.60
Sweden	38	366.15
Switzerland	27	2260.06
United Kingdom	314	427.11

Table 11 - Number of Deals per Acquirer Nation and respective Average Deal Value

3.4. Synergies Calculation

To calculate the value of synergies generated by each deal, I followed the same methodology as Faias (2017), and several steps were needed. Starting with the calculation of the expected returns, using the market model, by the following formula:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \in_{i,t}$$

Where $r_{i,t}$ represents the return for firm *i* at time *t*, $r_{m,t}$ is the market return for time *t*, for which I considered STOXX Europe 600 returns (an index that covers 600 large, mid, and small-cap companies across different European countries), α_i is the intercept of the regression for firm *i*, and β_i is the coefficient of firm *i*, which also reflects the sensitivity of that stock to market movements.

With α_i and β_i calculated for each company, it was now possible to get the daily expected returns, by simply using the daily market returns, and the alpha and beta for each company, as represented in the formula below:

$$\overline{r_{i,t}} = \alpha_i + \beta_i r_{m,t} + \in_{i,t}$$

The next step was to compute the abnormal returns, which is the difference between the actual returns and expected returns:

$$\hat{A}R_{i,t} = r_{i,t} - \overline{r_{i,t}}$$

It was now possible to calculate the cumulative abnormal returns (CAR), in a window of 2 days prior to and 2 days after the deal was announced:

$$C\hat{A}R\ (-2,+2)_i = \sum_{t=-2}^{2} \hat{A}R_{i,t}$$

The final step was to calculate the synergies generated by each deal, using the same methodology as Faias (2017), by multiplying the Acquirer Market Value 4 Weeks Before the Announcement by the CAR (-2,+2):

$$Synergies\ Created\ (-2,+2)_i = Acquirer\ MV\ 4\ Weeks\ Before\ the\ Announcement_i * C\hat{A}R\ (-2,+2)_i$$

To give more depth to the analysis, I decided also to test the synergy creation using a different event window, to understand how a longer window impacts the cumulative abnormal returns when compared to a smaller one. To do so, I also tested the synergies created using the cumulative abnormal returns in a window between 5 days before the deal, and 5 days after the deal was announced (CAR (-5,+5)). These CAR (-5,+5) were calculated the same way as the CAR (-2,+2), with the only difference being that now the period of days is extended:

$$C\hat{A}R\ (-5,+5)_i = \sum_{t=-5}^{5} \hat{A}R_{i,t}$$

With CAR (-5,+5) calculated, the synergies created in the deal can be obtained by simply multiplying the Acquirer market value, by the respective CAR (-5,+5).

$$Synergies\ Created\ (-5,+5)_i = Acquirer\ MV\ 4\ Weeks\ Before\ the\ Announcement_i * C\hat{A}R\ (-5,+5)_i$$

To give a better understanding of the average and median values of the cumulative abnormal returns and the synergies calculation, as well as the standard deviations of these variables, the

table below summarizes these statistics for the whole sample and for the deals where companies from green sectors were present, using each of the three approaches:

		All Sample	Acq Green Sector			Target Green Sector			Both Green Sector		
			10%	25%	50%	10%	25%	50%	10%	25%	50%
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Number of Deals	N	865	53	110	298	54	126	311	27	78	216
Cumulative Abnormal Returns (-2,+2)	Average	-0.08%	1.81%	0.77%	0.41%	0.77%	0.27%	0.47%	1.14%	0.16%	0.67%
	Median	-0.11%	-0.03%	0.13%	0.13%	0.28%	0.16%	0.07%	0.15%	0.16%	0.16%
	St. Deviation	6.70%	14.35%	10.92%	7.57%	6.54%	6.11%	7.54%	6.33%	6.61%	8.47%
Synergies [with CAR (-2,+2)]	Average	-298.86	175.61	-118.36	-6.69	92.75	-173.51	-2.44	214.12	-266.02	-19.75
	Median	-0.10	-0.01	0.04	0.07	0.09	0.07	0.00	0.09	0.07	0.06
	St. Deviation	5120.38	3621.98	3051.74	2048.25	2388.66	2268.66	1814.80	3403.64	2876.89	2152.64
Cumulative Abnormal Returns (-5,+5)	Average	-0.58%	-0.75%	-0.52%	0.21%	0.84%	0.09%	0.02%	0.59%	-0.43%	0.15%
	Median	-0.45%	-1.32%	-0.35%	-0.21%	0.09%	0.01%	-0.32%	0.16%	0.08%	0.00%
	St. Deviation	9.60%	16.01%	12.51%	9.79%	10.92%	9.26%	9.96%	8.59%	9.10%	10.32%
Synergies [with CAR (-5,+5)]	Average	-524.70	-225.52	-235.11	-119.80	-108.81	-220.66	-101.34	-201.85	-349.09	-131.27
	Median	-0.58	-0.85	-0.23	-0.14	0.03	0.00	-0.19	0.01	0.01	0.01
	St. Deviation	7255.32	4301.73	3073.00	2343.04	3219.80	2263.60	2010.74	4588.59	2863.54	2361.71

Table 12 - Summarized Statistics of CARs and Synergies

The average value of the cumulative abnormal returns 2 days before and 2 days after the deal was announced is negative (-0.08%) when all the deals in the sample are considered, although, the average value of CAR (-2,+2) becomes positive when green companies are part of the deal (either the Acquirer or Target), as Bose et al. (2021) concluded in their study. However, when looking at the average values of the synergies calculated with CAR (-2,+2), we can observe that these values are, on average, negative when the top 25% green sector approach is used. The standard deviation of the synergies values is very high, independent of the approach considered, and the Acquirer market value, which is used in the synergies calculation, is what most influences this.

The average values of CAR (-5,+5) differ from the values of the prior approach. The average CAR (-5,+5) value of the whole sample is -0.58%, and contrarily to what was observed with CAR (-2,+2), now even when companies from green sectors are part of the deal, the average value of this returns can be negative. All the standard deviation values also increased, indicating that there are more extreme values for CAR (-5,+5) than for CAR (-2,+2). The synergies calculated with these cumulative abnormal returns have negative average values, even when companies from green sectors are present in the deal, which is not surprising, given the average values of CAR (-5,+5). The standard deviation values remain very high for these synergies, which is not only explained by the CARs, but, again, by the other variable used in the synergy, Acquirer market value, which is a variable with high levels of standard deviation, and this is an issue that will later be resolved in the sections of regressions testing, by calculating the

synergies using the logarithm of the Acquirer market value, this will normalize the distribution of this variable, and will lead to more concrete results and conclusions.

3.5. Regressions Testing

To test this study, I will conduct three different groups of regressions, one for each of the approaches used to define the green sectors (top 10%, top 25%, and top 50%). The dependent variable of the regressions will be the synergies created in the deal, but for the regressions study the synergies are calculated using the logarithm value of the Acquirer market value, instead of the Acquirer market value, to normalize the distribution and to have more concrete results, as mentioned in the previous section. In each regression, there will be three independent variables that are the object of the study: *Acq GS*, *Tar GS*, and *Both GS*, which are dummy variables that equal 1 if the Acquirer (*Acq GS*), Target (*Tar GS*), or both companies (*Both GS*) are from a green sector, which will be tested for each of the three green sector definition approaches.

To improve the models' accuracy and enhance their explanatory power, some control variables were used in the regressions: *MB*, which refers to the Acquirer's market-to-book ratio; *Rel Size*, which equals the relative value of the Acquirer (ratio of the deal value over the market value), both *MB* and *Rel Size* were used as independent variables by Alexandridis et al. (2017); *Leverage*, the value of the Acquirer's net debt; *On Cash*, a variable that was used in a study conducted by Travlos (1987), which equals 1 if the payment method of the transaction was entirely a cash payment; *FCF* which refers to the ratio of the Acquirer's cash flow from operations over its total assets, in the year before the deal; and *Post Covid*, which refers to a dummy variable that equals 1 if the deal was announced in 2020 or onwards. Industry fixed effects for the Acquirer (λ) and for the Target (γ) industries were also tested in these models.

Each group of regressions is tested for synergy creation using the two methods applied (CAR (-2,+2) and CAR (-5,+5)), and with and without fixed effects.

The first regression tests how the firms from the top 10% green sectors influence the synergy creation:

$$Synergies\ Created_i = \alpha_0 + \alpha_1\ Acq\ GS\ 10\%_i + \alpha_2\ Tar\ GS\ 10\%_i + \alpha_3\ Both\ GS\ 10\%_i +$$

$$+\alpha_4 MB_i + \alpha_5 Rel\ Size_i + \alpha_6 Leverage_i + \alpha_7 On\ Cash_i + \alpha_8 FCF_i + \alpha_9 Post\ Covid_i + \lambda_j + \gamma_k + \varepsilon_i$$

The second regression tests the deal value creation for the companies present in the top 25% green sectors:

$$Synergies\ Created_i = \alpha_0 + \alpha_1\ Acq\ GS\ 25\%_i + \alpha_2\ Tar\ GS\ 25\%_i + \alpha_3\ Both\ GS\ 25\%_i +$$

$$+\alpha_4 MB_i + \alpha_5 Rel\ Size_i + \alpha_6 Leverage_i + \alpha_7 On\ Cash_i + \alpha_8 FCF_i + \alpha_9 Post\ Covid_i + \lambda_j + \gamma_k + \varepsilon_i$$

The third regression is similar to the two above, with the difference that it uses the widest approach of the green sector definition (top 50%):

$$Synergies\ Created_i = \alpha_0 + \alpha_1\ Acq\ GS\ 50\%_i + \alpha_2\ Tar\ GS\ 50\%_i + \alpha_3\ Both\ GS\ 50\%_i +$$

$$+\alpha_4 MB_i + \alpha_5 Rel\ Size_i + \alpha_6 Leverage_i + \alpha_7 On\ Cash_i + \alpha_8 FCF_i + \alpha_9 Post\ Covid_i + \lambda_j + \gamma_k + \varepsilon_i$$

With this methodology, it will be possible to understand if the synergy creation in M&A deals is influenced by the fact that companies from green sectors are part of it, which of the two companies (Acquirer or Target) has more impact on it, and if with the stricter approaches of green sector definition, the synergies of the deals are higher. It will also be interesting to understand if the control variables also influence the value creation, which will influence it positively and which will influence it negatively.

4. Results

As mentioned in the methodology section, three different regression models were used to assess how companies from green sectors influence the synergies creation in M&A deals, as well as the chosen control variables. Each of these three groups is divided into four specifications, given that the synergies were calculated with two different approaches (with CAR (-2,+2) and with CAR (-5,+5)), and each of the regressions is tested with and without industry fixed effects (for both Acquirer and Target industries). The dependent variables (lnSyn22 and lnSyn55) are the synergies of the deal, which were calculated with the logarithm of the Acquirer market value, in order to have a normalized distribution and more concrete results, as mentioned before, in the methodology section. It is important to note that the coefficients and standard errors of the variables shown as "0.0000" are not exactly equal to zero, but have a value very close to this number.

The first model tests the influence that companies present in the top 10% green sectors have in the synergies creation, the results are represented in the table below.

	Top 10% Green Sector			
	lnSyn22	lnSyn22	lnSyn55	lnSyn55
	(1)	(2)	(3)	(4)
Acq GS 10%	0.280**	0.472**	0.0363	0.163
	(0.117)	(0.185)	(0.158)	(0.249)
Tar GS 10%	-0.0036	-0.0997	0.0676	-0.008
	(0.117)	(0.179)	(0.158)	(0.241)
Both GS 10%	-0.176	-0.115	-0.0348	0.0933
	(0.199)	(0.229)	(0.268)	(0.308)
MB	-0.0001	-0.0001	0.0000	0.0000
	(0.0004)	(0.0004)	(0.0005)	(0.0005)
Rel Size	-0.0002	-0.0001	-0.0001	-0.0001
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Leverage	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
On Cash	0.0325	0.0374	0.0203	0.0416
	(0.0404)	(0.0430)	(0.0545)	(0.0579)
FCF	-0.0258	-0.0058	-0.0495	0.0099
	(0.0820)	(0.0868)	(0.111)	(0.117)
Post Covid	-0.0899**	-0.0648	-0.179***	-0.133**
	(0.0445)	(0.0490)	(0.0601)	(0.0660)
Constant	-0.0198	0.0456	-0.0341	-0.0875
	(0.0314)	(0.241)	(0.0424)	(0.324)
Acquirer's Indusrty Fixed Effects	No	Yes	No	Yes
Target's Indusrty Fixed Effects	No	Yes	No	Yes
Observations	865	865	865	865
R-squared	0.013	0.139	0.013	0.142

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13 - Results obtained with the Top 10% Approach

The results of this first model suggest that when the Acquirer company is from a top 10% green sector, it always has a positive contribution to the creation of synergies, a contribution that is significant to a significance level of 5% when the synergies are calculated using the cumulative abnormal returns 2 days prior and 2 days after the deal was announced (specifications (1) and (2)).

When a target from this strict group of sectors is part of the deal, it has a negative influence on the deal value creation, except when the synergies are calculated with CAR (-5,+5) and the Acquirer's and Target industry fixed effects are not taken into consideration (specification (3)).

When a green Acquirer acquires a green Target (both from the top 10% green industries), the impact is usually negative (being only positive when the synergies are calculated with CAR (-

5,+5) and the fixed effects are considered), meaning that an Acquirer that is already from one of these green sectors, may not fully incorporate the advantages that acquiring another green company bring, creating a negative outcome after this acquisition. The coefficients of this variable, for the three first specifications, indicate that when a company from the top 10% green sectors acquires another from these sectors, the synergies decrease by between 3.48% and 17.6%

The control variables also have their importance in this study. The market-to-book ratio (*MB*) of the Acquirer has its coefficient remarkably close to zero in each of the four specifications, suggesting that, for this top 10% approach, the Acquirer being overvalued or undervalued, in relation to its book value, has a small impact on the M&A value creation. For example, if the market-to-book ratio of the Acquirer equals 2.88 (the sample's average), the value of the synergies would decrease by around 0.0288%, using the value of the coefficient of the first specification. Regarding the relative size of the Acquirer (*Rel Size*), the ratio of the deal value over the Acquirer market value has a negative, but small impact on the synergies creation, meaning that the biggest the deal value is, in comparison with the Acquirer market value, the smaller the synergies of the deal will be when the top 10% green sectors approach is considered. The *Leverage*, as shown in the table, has a positive, but very low impact (almost zero) on synergy generation, this means that if the Acquirer has a high net debt value, it will increase the value created in the deal, but not much. An interesting result is the coefficient of the dummy variable that equals 1 when the transaction payment was entirely made with cash (*On Cash*). Although not significant, the coefficient of *On Cash* suggests that the deals' synergies are higher when the Acquirer only pays cash for the acquisition of the Target, which may indicate that the Acquirer was confident about the acquisition of the Target, by paying only with cash and not with stock, per example. The ratio of the Acquirer's net cash from operations over its total assets (*FCF*) usually has a negative impact on the value creation of the deal, except for the specification where synergies are calculated with the CAR (-5,+5), and the fixed effects are being considered (specification (4)). Even though the coefficients of *FCF* are not very low (vary from -0.0258 to 0.0099), the average value of this variable for the whole sample is 0.045, meaning that this variable's contribution to the synergies creation is always small. Finally, the *Post Covid* variable has a negative and significant value for three of the four specifications, indicating that the deals that happened after the COVID-19 pandemic have significantly lower synergies than the deals that happened before 2020. Specifications (1) and (4) are significant at a significance level of 5%, and specification (3) has a significance level of 1%.

The R-squared for the specifications that do not consider the fixed effects ((1) and (3)) has a value of 1.3%, meaning that these two model variables explain 1.3% of the variation of the value of synergy created in the deals. When the industry fixed effects are added, the values of R-squared increase more than ten times, reaching the values of 13.9% and 14.2%, for the specifications (2) and (4), respectively.

Moving on to the results obtained using the top 25% green sectors approach, the table below shows how the green Acquirers and Targets, and the control variables impact the synergies creation:

	Top 25% Green Sector			
	lnSyn22	lnSyn22	lnSyn55	lnSyn55
	(5)	(6)	(7)	(8)
Acq GS 25%	0.268**	0.666***	0.145	0.394
	(0.106)	(0.190)	(0.143)	(0.257)
Tar GS 25%	0.0376	-0.287**	0.115	-0.286
	(0.0886)	(0.145)	(0.119)	(0.195)
Both GS 25%	-0.284*	-0.384**	-0.238	-0.123
	(0.152)	(0.182)	(0.204)	(0.246)
MB	-0.0001	-0.0001	0.0000	0.0000
	-0.0004	-0.0004	-0.0005	-0.0005
Rel Size	-0.0002	-0.0002	-0.0002	-0.0001
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Leverage	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
On Cash	0.0282	0.0293	0.0176	0.0372
	(0.0404)	(0.0429)	(0.0544)	(0.0579)
FCF	-0.0200	-0.0037	-0.0450	0.0124
	(0.0822)	(0.0864)	(0.111)	(0.117)
Post Covid	-0.0887**	-0.0615	-0.180***	-0.132**
	(0.0445)	(0.0487)	(0.0600)	(0.0658)
Constant	-0.0216	-0.0573	-0.0418	-0.142
	(0.0322)	(0.257)	(0.0434)	(0.348)
Acquirer's Indusrty Fixed Effects	No	Yes	No	Yes
Target's Indusrty Fixed Effects	No	Yes	No	Yes
Observations	865	865	865	865
R-squared	0.014	0.147	0.014	0.145

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14 - Results obtained with the Top 25% Approach

As well as in the stricter approach of the green sector definition, the Acquirers from a top 25% green sector, influence positively the value creation in M&A deals. This positive influence is

even significant at a significance level of 5% for specification (5) and at a significance level of 1% for specification (6), meaning that the significance of the Acquirer being from a green sector increased when the green sector definition widened from 10% to 25%. When a green Acquirer is part of an M&A deal, the synergies increase by 66.6%, with a significance level of 1%, as shown in the results obtained in specification (6), which considered the synergies calculated with CAR (-2,+2) and the fixed effects.

When the Target is from one of the top 25% green industries, it has a positive impact on the synergies creation when the fixed effects are not considered, and a negative impact when those are considered. This phenomenon may indicate that the initial positive coefficient was driven by industry-level characteristics and not by the Target firm itself, which is then corrected using the industry fixed effects. As shown in specification (6), the dummy variable that indicates if the Target of the deal is part of the top 25% green sectors, is statistically significant with a negative coefficient, for a significance level of 5%, which enforces the idea that there may be some industry characteristics that influence this variable to have a positive coefficient, given that it is not significant when the fixed effects are not applied.

When the two firms of the deal are from the top 25% green sectors, the coefficient is negative for each of the four specifications. It is important to note that when the synergies are calculated using the CAR (-2,+2) (specifications (5) and (6)), the coefficient of this dummy variable is now statistically significant at the significance level of 10% for specification (5) and at a significance level of 5% for specification (6), something that not happened when the top 10% approach was used. This means that, by extending the number of sectors that are considered green, the deals where a green Acquirer acquires a green Target significantly explain the decrease in the synergy creation.

Regarding the control variables, *MB* keeps its coefficient close to zero in the four specifications, being positive when the synergies are calculated with CAR (-2,+2) (specifications (5) and (6)), and negative when those are calculated using CAR (-5,+5) (specifications (7) and (8)), meaning that extending the period of the cumulative abnormal returns, the synergies increase for Acquirers that are undervalued (with book value lower than its market value). For the relative size of the Acquirer (*Rel Size*), the results are similar to the ones observed with the stricter approach of green sectors definition (top 10%), where, in each of the four specifications, the coefficients are negative and close to zero, indicating that the higher is the ratio of the deal value over the Acquirer's market value, the lower will be the synergies created, but not by a lot.

The coefficients of the *Leverage* variable have positive values that are close to zero in all four specifications, as well as seen in the top 10% approach. When the payment method of the deal is 100% made with cash (*On Cash*), the value of the synergies increases, not significantly, by between 1.76% and 3.72%, depending on the cumulative abnormal returns used to calculate the synergies and if the industry fixed effects are being considered or not (the values presented, are from specification (7) and specification (8), respectively). The coefficients of the *FCF* variable remain negative for three of the four specifications, being positive only in specification (8), the same observed when the top 10% green sectors were being considered. The deals made after 2020 (*Post Covid*) have the value of synergies decreased by between 6.15% and 18%, which shows the impact of the pandemic on almost every industry. This variable is significant at a significance level of 5% for specifications (5) and (8), and at a significance level of 1% for specification (7), meaning that the decrease of the synergies is significantly explained by this variable, in three of the four specifications.

Without the fixed effects applied, the R-squared of those two specifications has a value of 1.4%, for specifications (6) and (8) the R-squared equals 14.7% and 14.5%, respectively. This means that using the top 25% green sectors approach, the regression model variables explain better the variation of the synergy creation than with the top 10% approach.

The next table shows the results obtained using the widest approach of the green sector definition, where 50% of the sectors were considered “green”.

	Top 50% Green Sector			
	lnSyn22	lnSyn22	lnSyn55	lnSyn55
	(9)	(10)	(11)	(12)
Acq GS 50%	0.0149	0.105	0.0683	0.114
	(0.0703)	(0.110)	(0.0945)	(0.148)
Tar GS 50%	0.0529	0.0404	0.0829	-0.001
	(0.0661)	(0.0980)	(0.0888)	(0.131)
Both GS 50%	0.0231	-0.0224	-0.0274	-0.0337
	(0.101)	(0.117)	(0.135)	(0.158)
MB	-0.0001	-0.0001	0.0000	0.0000
	(0.0004)	(0.0004)	(0.0005)	(0.0005)
Rel Size	-0.0002	-0.0001	-0.0002	0.0000
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Leverage	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
On Cash	0.0321	0.0389	0.0191	0.0429
	(0.0404)	(0.0431)	(0.0543)	(0.0579)
FCF	-0.0245	-0.0055	-0.0630	0.0120
	(0.0824)	(0.0870)	(0.111)	(0.117)
Post Covid	-0.0859*	-0.0607	-0.182***	-0.130**
	(0.0445)	(0.0493)	(0.0598)	(0.0661)
Constant	-0.0400	-0.0488	-0.0744	-0.152
	(0.0357)	(0.250)	(0.0480)	(0.336)
Acquirer's Indusrty Fixed Effects	No	Yes	No	Yes
Target's Indusrty Fixed Effects	No	Yes	No	Yes
Observations	865	865	865	865
R-squared	0.010	0.133	0.017	0.142

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15 - Results obtained with the Top 50% Approach

When the top 50% sectors in terms of Emission Score are being considered as the green sectors, the green Acquirers keep influencing positively the synergies creation, with the difference that now the coefficients vary between 0.0149 and 0.114, much lower values when compared with the two other approaches, especially with the top 25% approach. It is also important to note that with this wider approach, this variable is not significant anymore, meaning that the green Acquirers that influence the most the value creation in M&A, are the Acquirers present in the sectors that are "greener", given that this variable was significant when the top 10% and top 25% green sectors were being considered.

The influence of the green Targets is positive for specifications (9), (10), and (11), with coefficients varying from 0.0404 to 0.0829, and for specification (12) it has a negative but very

low coefficient (-0.001). As well as in the green Acquirers' case, this variable is not significant anymore, meaning that when the green sector definition is extended from the top 25% to the top 50%, the green Targets lose their significance in terms of impacting the synergies creation.

When a green Acquirer acquires another company from the top 50% green sectors, the impact on the synergies creation is still negative, as well as in the stricter approaches, except for the specification where the synergies are computed with CAR (-2,+2) and the fixed effects are not applied (specification (9)). As the green Acquirer and green Target variables, the variable of both firms being from green sectors is not significant with the top 50% approach.

Moving on to the control variables, the market-to-book ratio of the Acquirer (*MB*) still has a negative and close to zero coefficient for the first two specifications of the model (specifications (9) and (10)), and a positive and close to zero value for the two latter specifications ((11) and (12)). The Acquirer's relative size (*Rel Size*) keeps the same logic seen when the top 10% and top 25% approaches were being considered to define the green sectors, where the coefficients of this variable are negative, but very close to zero, and given that the value of this ratio is usually between 0 and 1 (the average of the whole sample is 0.96), the impact of this variable on the synergy creation is not very relevant. The coefficient of *Leverage* remains positive and remarkably close to zero, for each of the four specifications, meaning that this variable increases relevantly the value of the synergies created, only when the Acquirers have high levels of net debt. The coefficients of the variable *On Cash* have increased when compared to the ones observed with the top 25% approach, keeping not statistically significant. Now these coefficients vary between 0.0191 to 0.0429, which means that when the payment method of the deal is entirely made by cash, the value of synergies increase between 1.91% to 4.29%, depending on the cumulative abnormal returns used to calculate the synergies, and if the industry fixed effects are being considered or not. As observed with the two first methods of the green sector definition (top 10% and top 25%), the coefficients of the variable *FCF* remain negative, for the three first specifications ((9), (10), and (11)), only being positive in specification (12). Finally, the *Post Covid* variable shows that the deals announced in 2020 or afterward, have lower synergies than the deals made before this year. The decrease in the value of synergies varies from 6.07% to 18.2%, depending on the approach used. It is important to note that this variable is significant in three of the four specifications of this model: at a significance level of 10% in specification (9), at a significance level of 5% in specification (12), and at a significance level of 1% in specification (11). Is also important to say that it is the only significant variable in this regression model, where the top 50% green sectors were considered,

meaning that it doesn't matter how the green sectors were defined, the deals that happened in 2020 or after always generate lower synergies.

The R-squared values from this model are equal to 1% and 1.7% when the fixed effects are not applied, for specifications (9) and (11), respectively and equal to 13.3% and 14.2% for the specifications that consider the fixed effects – (10) and (12), respectively.

5. Conclusions

There are several and different conclusions that can be taken from this study. One of them is that, when the Acquirer company is from a green sector, it always creates value for synergies, which can still be negative, but it is less likely to happen when a green Acquirer is present in the deal. This is especially true when the Acquirer is from one of the top 25% green sectors (which englobes the top 10% and top 25% approaches), given that the coefficient of this variable in the regression testing, significantly explains the value creation of the deal (for the synergies calculated with CAR (-2,+2)) when the top 10% and the 25% best sectors in terms of Emissions Score were considered as the green sectors.

Looking at the Targets' results, the conclusions are a bit different. As the green sectors approach changes, the coefficients of the variable that tests the influence the green Targets have in the deal value creation also change. Given this, the focus and the conclusion about this variable needs to be about the only significant value obtained, which was when the top 25% green sectors approach was being used, the synergies were calculated with the cumulative abnormal returns 2 days prior and 2 days after the deal, and the industry fixed effects were being considered. The coefficient of this variable in the described regression is negative and statistically significant at a significance level of 5%, so the conclusion that is possible to take is that when a green company from one of the top 25% green sectors is acquired, the combined value of the two companies after the acquisition is lower than before the acquisition was made.

In the cases where a green Acquirer acquires another green firm, the impact is usually negative, and it is even significantly negative when the synergies are calculated with CAR (-2,+2) and the top 25% best sectors in terms of Emissions Score are considered as the green sectors. This may suggest that when a green company is acquired by another, the acquiring firm is not fully incorporating the benefits of the Target, or some conflicts in the integration of the new company.

Another conclusion taken from the results of this study is that the COVID-19 pandemic really influenced negatively the synergies created in the deals, given that the dummy variable *Post Covid*, equals 1 when the deal is done in 2020 or after, has a significant value, in all the three green sector definition approaches used.

Regarding the three different approaches used to define the green sectors, the conclusion that can be taken is that the top 25% approach may be the most representative since is the only

approach where all the three independent variables of the study have a significant value explaining the value creation in M&A.

Finally, the answer to the research question of this study - **"Do M&A deals in green sectors result in greater synergies than those in non-green sectors for European companies?"** – is that it depends. It first depends on how the green sectors are defined, but let's focus on the top 25% approach, which is the one that gave the most significant results. The synergies are positively influenced when the Acquirer of the deal is green, but they are negatively influenced when the Target is green, or when both companies are. These results are also partially aligned with the conclusions from Bose et al. (2021) study, which concluded that low-carbon emitters obtain higher cumulative abnormal returns than high-carbon emitters companies. This led to the conclusion that the M&A deals in green sectors are, in fact, greater than those in non-green sectors, but only in the cases where the green Acquirer is acquiring a non-green company.

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Appendix – Green Sectors

Top 10 % Approach	
TRBC Industry Group	**# Years**
Chemicals	10
Oil & Gas	8
Paper & Forest Products	6
Coal	5
Containers & Packaging	5
Diversified Industrial Goods Wholesale	4
Electric Utilities & IPPs	3
Office Equipment	3
Natural Gas Utilities	2
Oil & Gas Related Equipment and Services	2
Freight & Logistics Services	2
Multiline Utilities	2
Communications & Networking	2
Passenger Transportation Services	1
Water & Related Utilities	1
Residential & Commercial REITs	1
Integrated Hardware & Software	1
Beverages	1
Personal & Household Products & Services	1
Construction Materials	1
Schools, Colleges & Universities	1

Table 16 - All Green Sectors with the Top 10% Approach

Top 25 % Approach	
TRBC Industry Group	**# Years**
Oil & Gas	10
Chemicals	10
Electric Utilities & IPPs	10
Paper & Forest Products	9
Multiline Utilities	8
Coal	8
Office Equipment	8
Beverages	7
Construction Materials	7
Containers & Packaging	7
Freight & Logistics Services	6
Consumer Goods Conglomerates	5
Automobiles & Auto Parts	5
Natural Gas Utilities	4
Water & Related Utilities	4
Personal & Household Products & Services	4
Communications & Networking	4
Diversified Industrial Goods Wholesale	4
Schools, Colleges & Universities	4
Oil & Gas Related Equipment and Services	3
Transport Infrastructure	3
Integrated Hardware & Software	3
Metals & Mining	3
Passenger Transportation Services	2
Residential & Commercial REITs	2
Food & Tobacco	2
Aerospace & Defense	2
Semiconductors & Semiconductor Equipment	2
Textiles & Apparel	1
Food & Drug Retailing	1
Renewable Energy	1
Uranium	1

Table 17 - All Green Sectors with the Top 25% Approach

Top 50 % Approach	
TRBC Industry Group	**# Years**
Freight & Logistics Services	10
Oil & Gas	10
Chemicals	10
Electric Utilities & IPPs	10
Paper & Forest Products	10
Food & Tobacco	10
Beverages	10
Personal & Household Products & Services	10
Multiline Utilities	10
Metals & Mining	10
Automobiles & Auto Parts	10
Construction Materials	10
Coal	10
Natural Gas Utilities	9
Food & Drug Retailing	9
Containers & Packaging	9
Construction & Engineering	9
Oil & Gas Related Equipment and Services	8
Consumer Goods Conglomerates	8
Textiles & Apparel	8
Office Equipment	8
Telecommunications Services	8
Diversified Industrial Goods Wholesale	8
Water & Related Utilities	7
Transport Infrastructure	7
Computers, Phones & Household Electronics	7
Semiconductors & Semiconductor Equipment	7
Passenger Transportation Services	6
Professional & Commercial Services	6
Communications & Networking	6
Integrated Hardware & Software	5
Machinery, Tools, Heavy Vehicles, Trains & Ships	5
Homebuilding & Construction Supplies	5
Aerospace & Defense	4
Renewable Energy	4
Schools, Colleges & Universities	4
Residential & Commercial REITs	3
Hotels & Entertainment Services	3
Electronic Equipment & Parts	3
Diversified Retail	2
Insurance	2
Household Goods	1
Real Estate Operations	1
Uranium	1
Banking Services	1

Table 18 - All Green Sectors with the Top 50% Approach