State of play of sustainable companies in Europe according to the EU Taxonomy and its effect on firm value and profitability

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2 Abstract

This quantitative research study aims to evaluate the relationship between the EU Taxonomy, a classification system for sustainable activities, and its effect on firm value and profitability. Larger firms are required to disclose six EU Taxonomy KPIs and the data was made available for the first time in 2023. 817 large European firms were analysed in this study. The other 1 967 firms do not report on Taxonomy metrics. This indicates that the EU Taxonomy adoption is still in its infancy. While much research shows a positive relationship between ESG metrics and financial performance, the linear regressions in this study indicate that there is a significant ($p<0.100$) negative relationship (-0.003 to -0.002) between firm value (Tobin's Q) and all three eligibility KPIs. No significant relationships were found between a firm's profitability (ROA) and the Taxonomy KPIs.

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3 Current state of the EU Taxonomy

3.1 EU Taxonomy regulations for sustainable activities

The EU Taxonomy is a set of regulations used to classify sustainable economic activities to promote a more sustainable future. According to the European Commission there are three main users of the EU Taxonomy: "*The EU Taxonomy would provide companies, investors and policymakers with appropriate definitions for which economics activities can be considered environmentally sustainable.*".

An increasing number of firms every year are required to use the Taxonomy regulation to assess whether their economic activities are *Eligible* and *Aligned.* In short, eligibility measures whether an activity *can* be sustainable, and alignment measures if an activity *is* sustainable.

An activity is Eligible if it substantially contributes to at least one of the six following environmental objectives:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

Each objective is accompanied by a technical standard (a.k.a. delegated acts) which defines what a sustainable activity is. As of today, the technical standards for two (climate change mitigation and adaption) of the six objectives are published. Thus, companies can only report on figures related to the first two objectives. A draft from the EU commission regarding the remaining four has been published, enabling stakeholders to comment on the draft before the regulation becomes mandatory to report on. Currently, the Taxonomy Regulations does not cover all sectors in the economy and the EU commission is still continuously revising the regulation internally and by collecting feedback from stakeholders. The most recent feedback window ended on the 3rd of May 2023. Thus, the full scope of the EU Taxonomy is yet to be finalised.

For an economic activity to be considered Aligned, it must first be Eligible (i.e., substantially contributes to one of the objectives) and it must also do no significant harm to other environmental objectives as well as comply with minimum social safeguards (e.g., Guiding Principles on Business or Human Rights of the United Nations).

The economic activities are then measured across three Eligible and Aligned KPIs: Turnover, Operating expenditures, and Capital expenditures. These numbers can then be used by the three main users to raise questions on the future viability of a company's business model and to put pressure to improve sustainability performance.

For the financial year 2021, only reporting on Eligible activities was required. For the financial year 2022, Aligned activities was added to the disclosure requirements. Going forward, more firms will be covered by the regulations as seen in Figure 1.

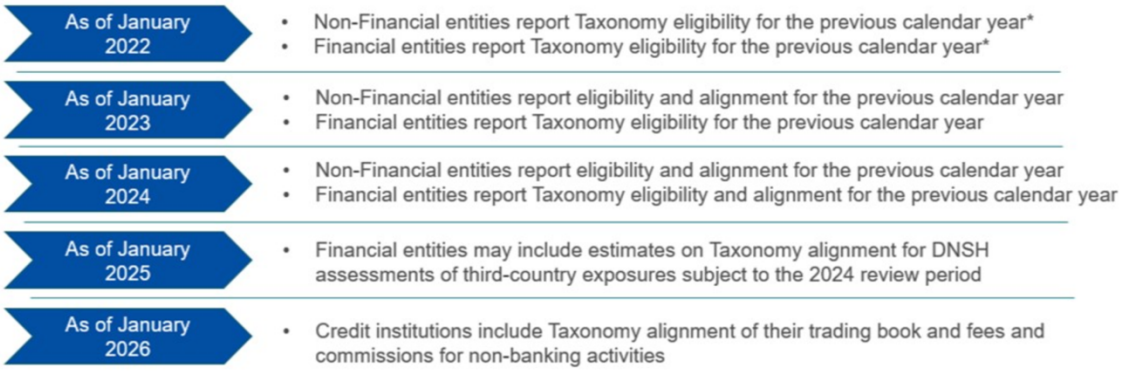

Figure 1: New EU Taxonomy regulation (source: https://ec.europa.eu/sustainable-finance-Taxonomy/home)

Clearly, the EU Taxonomy is a living legalisation and firm reporting relies heavily on their own interpretation of the current legalisation. This makes the reported numbers across years and firms less comparable. This uncertainty in the interpretation of the regulation is evidenced in annual reports and issued statements. Here are two extracts from two companies' annual reports mentioning this uncertainty:

"Based on this interpretation, the activities stated below are the ones that have been identified as relevant for Ericsson. Certain CapEx and OpEx can also be individually Eligible…. However, there remains some uncertainty around how the Taxonomy should be applied, and interpretations, as well as reporting practices, are expected to evolve over time." (Ericsson Annual Report, Financial Year 2022)

"The following disclosures are prepared in line with the Taxonomy regulation Art. 8, and the related delegated acts. The Taxonomy regulation is a living legislation, dynamic in

its development; the formulations and terms contained in these pieces of legislation are subject to uncertainty in interpretation and will require further clarification. Therefore, the following discussion relies on our own current interpretation; the principles applied for this year's reporting may not be applied in the same way in the future." (ABB Sustainability Report, Financial Year 2022)

The Finance Director at BMW, Nicolas Peter, expressed frustration about the EU Taxonomy on behalf of CFOs representing 30 industry firms saying that *"Rushing implementation, unclear definitions and divergent interpretations have resulted in reports that are not sufficiently relevant, comparable or reliable enough to be useful for investors"* (Financial Times, 2023). This further underscores that companies struggle with interpreting the new regulation. Additionally, the same group of firms mentioned that it was costly and time consuming to acquire and verify all the data that the regulation requires.

This paper aims to shed light on the current state of play of sustainable companies according to the Taxonomy. In 2023, non-financial firms are obliged to report on both eligibility and alignment KPIs for the financial year 2022. This new data will be analysed for the first time through descriptive elements and regressions to measure the impact of the EU Taxonomy KPIs on firms' valuation and financial performance.

3.2 Background and development of the Taxonomy

The first proof of rising global temperatures was presented by Guy Callendar in 1938 but his findings were largely ignored. Today, there is a scientific consensus that climate change is real (Oreskes, 2004).

The message from the scientific community is clear; we are rapidly creating a world that could be incompatible with human civilisation (New et al., 2011). A rising temperature from human influence has contributed to an increased frequency of extreme and adverse events (Fischer & Knutti, 2015; WMO, 2022): For example, in recent years, Pakistan has experienced extreme flooding events twice. In 2010 Pakistan flooded and scientists claimed that the amount of rain that caused the country to flood was an extreme low probability event, but predictable (Webster et. al., 2011). In 2022 Pakistan flooded again and the World Bank (2022) estimated that 1730 people lost their lives, 8 million people were displaced and the estimated damages and reconstruction costs amount to USD 46 billion. Additionally, the GDP output loss was estimated at around 2.2 percent for this

specific event. The 2.2 percent excludes the yearly output loss from climate change which is estimated to around 9.1 percent according to the finance minister of Pakistan (Guardian, 2022).

Climate change does not only threaten biodiversity on Earth (Murali et al., 2023), but also affect macroeconomic growth and the security of the financial system stemming from increased costs arising from banks' exposure to climate change through issued credit (Lamperti et. al., 2019). The cost of climate change induced events is substantial and the costs and risks of doing nothing far outsize the costs of immediate mitigation (Stern, 2006).

However, finding a global consensus on how to mitigate global change has been difficult. Governments, organizations, and individuals have all been asked to address climate change in various forms, but according to Finke, Gilchrist, Mouzas (2016), corporations have failed to collectively respond to climate change due to self-interest which can explained by economic interest, weak actor bonds and differing perceptions. In addition, the impact companies can have on mitigating climate change far exceeds the impact of one individual. In a calculation exercise example by Climate How Sources, if an US citizen erased their entire CO2 emissions over their entire life, they would save 1.12 seconds worth of emissions from the energy sector. Clearly, one individual company can have a bigger impact than one individual consumers. Therefore, it might make more sense that firms or governments lead the change to a more sustainable future. To address companies' inaction, Finke, Gilchrist, and Mouzas (2016) claim that an alignment of goals and interest can enable collective action.

Wright & Nyberg (2017) also argue that companies have not taken enough action to combat climate change. They claim that the lack of progress from corporations in addressing climate change is due to an organizational environment where profit maximization and business as usual is favoured. They highlight the lack of regulatory response and societal governance for the collective good to address this inertia within companies. However, opponents to firms engaging in societal issues frequently quote the shareholder theory paradigm by Milton Friedman, in which "*there is one and only one social responsibility of the business-to use its resources and engage in activities designed to increase its profits so long as it stays within the rules*". By such, regulation is not necessarily good or bad, but only dictates the environment in which firms can produce profits. A regulatory

response to climate change is therefore beneficial and expected if society wants firms to act against climate change.

A significant breakthrough in mitigation of global warming occurred in 2015 when 196 nations assembled in Paris to collectively sign and adopt the legally binding *Paris Agreement*. According to UNFCCC, the agreement's overarching goal is to keep *"the increase in the global average temperature to well below 2°C above pre-industrial levels"* and pursue efforts *"to limit the temperature increase to 1.5°C above pre-industrial levels."* Furthermore, the accord aims to acknowledge that global warming is real and to push the economies towards low-carbon activities. The agreement entered into force in 2016. In March 2023, IPCC published their *Climate Change 2023: Synthesis Report* reiterating that over the past 200 years there has been a rise of 1.1°C above pre-industrial levels of which humans are fully responsible for. The report also highlights that the 1.5°C target is still achievable, but it requires more effort. In fact, today, only 7 years after the Paris agreement entered into force, the report highlights that the goal is achievable, but it is severely threatened (UNEPCCC, 2021; WMO, 2022) and it is estimated that within the next 5 years, the annual mean temperature will temporarily be 1.5 °C above pre-industrial levels. Adverse effects from global warming are already increasingly frequent and severe, and not limiting global warming to the 1.5 °C threshold risks unleashing severe impacts (UNFCC). This adds pressure to limit global warming.

Moreover, while companies might be reluctant to collectively combat climate change, investors are more and more interested in sustainable firms. A study by Charles Schwab, reported by Morningstar (2022), highlights that 71% of individual investors believe sustainable companies make good investments and 44% consider ESG factors when making a new investment in the UK. Similar numbers were reported for the US. Younger generations found sustainability to be more important that older generations. In a report from EY (2021), it is presented that investors believe companies that report well on ESG criteria are better prepared for the long term because they are less risky and less prone to the effects of uncertainty.

Additionally, investors now, more so than before, believe that climate risk has financial implications of their portfolio firms according to Krueger, Sautner & Starks (2020). The risks can be both direct and indirect. Direct risks are the results of tangible losses and involve destruction of crops, for instance. Indirect risks can revolve around transitions of industries, reputational and regulatory advancements. Another finding from their paper is

that investors do not view climate risk as a distant future problem but rather that it is an issue today already. These risks can materially affect the returns for investors.

However, regarding shareholder returns, there is no clear the academic consensus that a sustainable portfolio yields higher returns despite investors' interest in sustainable firms. A study on the Nordic stock market by Lueg & Pesheva (2021) show a positive effect meanwhile Godinho Serra et al. (2023) argue that a sustainable portfolio does not yield more or less than a market portfolio. Kuzmina et. al. (2023) show that there is not statistical difference in the returns of ESG energy funds and non-ESG energy funds during most periods observed. Finally, Krueger, Sautner & Starks (2020)'s study shows that investors believe that equity valuations do not yet fully account for climate risks, but the overvaluations are not major. Nonetheless, the studies referenced above use different methodologies to define the ESG portfolio. looks at the ESG scores directly meanwhile Godinho Serra et al. (2023) use the ISE B3[1] index. Finally, Lueg & Pesheva (2021) also point out the difficulties in understanding Bloomberg's methodology to compute ESG scores since it is not fully transparent. ESG scores are subjective because rating agencies provide their own scores, and they are not defined in the same way across different rating agencies. In addition, ESG scores are relative to other firms in the industry and not absolute, meaning that a firm can cause significant harm but still be classified as green if its industry peers are very brown. Finally, ESG rating agencies' impartiality can also be called into question because they are paid for by the firms they rate.

Despite calls for a collective response to climate change, regulations are not harmonized and ESG scores are subject to rating agencies interpretation. Furthermore, governments have disparaging views on what is sustainable or not which makes it difficult to create policy to tackle climate challenges. To address this issue, the European Union have created the EU Taxonomy which concretely classifies what is and what is not a sustainable activity. Clear guidance on this topic can come with multiple benefits and opportunities. For instance, the subjectivity found in ESG ratings can be avoided. Furthermore, companies who are Aligned with the regulation can appear more credible towards investors due to a perceived lower risk profile and higher resilience. Compliant firms might also benefit from more and cheaper financing options.

[1] The Corporate Sustainability Index (ISE B3) is compiled as a weighted average of a theoretical portfolio of stocks pursuant to criteria set forth in this methodology. (b3.com)

With the new Taxonomy regulations, policy actions should be easier to implement (OECD 2020) and they can serve as a blueprint for other jurisdictions' sustainable economic activity standards with the overall objective to direct investments towards green activities and for the EU to become climate neutral by 2050. Lucarelli, Mazzoli, Rancan & Severini (2020) show a positive relationship between the number of scientific publications related to the EU Taxonomy and lower levels of CO_2 emissions, supporting the view that research on this area have a positive impact on combating climate change. Nonetheless, there is criticism associated with the Taxonomy. For instance, Schütze, Stede, Blauert and Erdman (2020) argue that the Taxonomy can cause entrenchment in some emission-intensive sectors, making it more difficult to transition to sustainable activities.

Relevant research on the EU Taxonomy specifically includes Dumrose, Rink & Eckert (2022) who argue that the divergence of ESG ratings from different providers can be reduced because they are significantly related. They claim that there is potential for convergence of sustainability measurements.

Academics have been analysing the relationship between ESG and profitability or firm value (ROE, ROA and Stock price) for quite some time and there is no prevailing consensus as of today. Whelan et al. (2021) have in a recent meta-study analysed over 1000 papers published between 2015 and 2022. They concluded that the authors show a positive relationship in the majority of papers (58%), 8% negative, 13% no relations and 21% showed mixed results.

Assuming that the EU Taxonomy is a more objective version of the subjective ESG criteria, one could infer that the Taxonomy should have a positive relationship with firm profitability and value as well. Supporting this hypothesis, Nipper, Ostermaier & Theis (2022) show that the mandatory EU Taxonomy KPIs have a stronger effect on the investment probability than the current sustainability ratings, meaning that investors view them as more reliable.

Because the EU Taxonomy is a new living regulation, there is currently not much research conducted on the latest required disclosure of Taxonomy KPIs on an aggregate level. This research aims to describe the status across Europe and investigate whether companies that are more Aligned with the Taxonomy are more profitable and higher valued. It is not unreasonable to assume that there is a positive correlation between the share of firms Aligned Revenues, CapEx and OpEx within the EU Taxonomy and the firm's

profitability and value, and that this relationship will grow stronger over time as more climate risks materialise.

The new EU Taxonomy does not only come with benefits but there are also risks involved. For instance, the Taxonomy does currently not cover all activities and the criteria for Eligible activities can be narrow. From a firm's perspective, a firm might not be compliant with the Taxonomy and appear as not sustainable by investors when they are de facto green. Furthermore, there is still much room for interpretation by reporting firms which removes some of the intended objectivity in the rankings. Firms can also find it difficult to properly assess their activities by for instance, not obtaining the right data from suppliers or third-party consultants hired to assess the firm's alignment with the EU Taxonomy. The auditing, enforcement and controls on firms reporting might also not be fully in place which makes it difficult to certify that a company's activities are in fact what they claim, especially as more and more firms are required to comply with the new regulations in the upcoming years. Lastly, the regulation is still being updated which both gives firms little time to act on updates but also risks efforts from certain actors to water down the regulation to make it more favourable to their own agenda. This in turn risks limiting the impact the EU Taxonomy can have on mitigating climate change.

3.3 Taxonomy KPIs from financial year 2022

3.3.1 Sample data

The data for this study was collected from Bloomberg's EQS page on May 15, 2023. All stocks with primary listing in Western and Eastern Europe except for Russia were initially selected, resulting in 17 863 firms. The listed stocks were selected because large, listed stocks with at least 500 employees are the ones required to disclose EU Taxonomy KPIs as of now. Russia was excluded because it is not affected by the Taxonomy regulations and to make the data exportable due to the data row limit of 3 000. The data in the Bloomberg database in turn comes from the latest filing of companies' annual report or sustainability reports. The data in this study stems from firms that had published their annual accounts before the data extraction date. Bloomberg updates financial data within two days of publication of a firm's results. It is unclear how long it takes for Bloomberg to update the EU Taxonomy KPIs data. However, it reasonable to expect that there is not too much delay.

Table 1 in the appendix summarises all fields that were downloaded from Bloomberg. The EU Taxonomy KPIs were exported in percentages instead of absolute numbers to investigate how sustainable a firm's activities are in relation to its potential. Due to this, the numbers in the analysis represent an average weighting without considering the absolute value of sustainable activities. This might affect the results in cases where there are a few sampled firms from a small firm with highly sustainable activities influencing the averages of a firm with not so sustainable activities. Lastly, all fields using local currencies in fields were converted to EUR in Bloomberg before exporting to enable fair comparison and analyses.

3.3.2 Data cleaning and sanity check

Before exporting the data from Bloomberg, firms with fewer than 500 employees were already dropped in Bloomberg because only the larger firms are legally obliged to report on the Taxonomy alignment KPIs. This left 2 874 firms.

Figure 2 shows the number of firms that had missing data in each field. It was noticed that a lot of the n/a fields came from the EU Taxonomy KPIs. This showed that most large, listed firms do not or are not required to disclose EU Taxonomy numbers yet and have chosen not to do so.

Ticker	0
Company name	0
No. Employees	0
Elig Capex Pct	1786
Elig Rev Pct	1751
Elig Opex Pct	1800
Alig Capex Pct	1985
Alig Rev Pct	1930
Alig Opex Pct	1968
TQ	232
ROA	180
Debt/Assets Pct	77
NACE Code	1
NACE Sect	1
NACE Nm	1
Primary Exchange	0
GICS SubInd	234
Tot Assets LF	59
Market Cap	215

Figure 2: Number of firms with missing data per field

The completeness of the data was checked and all companies that missed at least one entry across all fields were dropped to ensure that the data could be analysed. This manoeuvre excluded financial firms who are not required to report on Aligned activities yet. Replacing empty cells was considered but ultimately disregarded due to the difficulties in producing an accurate representation. For instance, to insert the average Eligible CapEx, one would have to assume that all firms are relatively similar and evaluated the same according to the Taxonomy. This is not appropriate because many industries are not yet affected by the regulation. So, by dropping firms that do not report on the Taxonomy, the data should represent the industries and firms that are more required to report at this stage. At this stage 817 firms remained. The EU KPIs, ROA and debt/assets were then re-formatted to be expressed in percentages instead of decimal form.

Action	**Firms remaining**
Eastern and Western European Listed Firms (excl. Russia)	17 863
- No. employees >= 500	2 784
- Firms with n/a in any of field	817

Table 1: Data cleaning visualisation

For the sanity check, the first ten data rows were screened. The EU Taxonomy KPIs were cross-referenced to the original annual reports published by respective firm. All but one screened record matched with the numbers found in the annual reports. The mismatch was Castellum AB which, according to Bloomberg, reported a 119.04% alignment with the Taxonomy for all Taxonomy Eligible fields. But the annual report for 2022 (Appendix: Figure 16 & Figure 17) shows that Castellum AB disclosed 100%, not 119.04%. This is also logical because a firm cannot reasonably have an alignment or eligibility of more than 100%.

To identify outliers a summary of the data was used (Figure 3).

	No. Employees	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	TQ	ROA	Debt/Assets Pct	NACE Code	Tot Assets LF
count	817.00	817.00	817.00	817.00	817.00	817.00	817.00	817.00	817.00	817.00	817.00	817.00
mean	20221.01	30.65	20.67	21.48	11.14	7.56	8.72	1.54	4.68	26.98	40.87	13428998648.78
std	53545.50	33.68	32.12	32.30	22.77	18.54	20.54	1.11	8.69	15.75	21.01	41802217760.53
min	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	-37.51	0.00	1.00	15711000.00
25%	1435.00	0.60	0.00	0.00	0.00	0.00	0.00	0.98	1.44	14.78	25.00	504288563.66
50%	3882.00	15.51	0.80	2.00	0.00	0.00	0.00	1.19	4.24	26.30	35.00	1792884992.00
75%	15040.00	55.60	30.80	31.40	8.45	4.00	4.02	1.65	7.52	36.59	58.00	7474999808.00
max	675800.00	119.04	119.04	119.04	100.00	100.00	100.00	12.73	151.47	96.07	93.00	568841011200.00

Figure 3: Descriptive statistics of Taxonomy and selected firm value KPIs before cleaning

Castellum's high value was corrected to 100%. A check for duplicate company names was made in case a firm has multiple listings within Europe. No duplicates of firms were found in the data set. This is expected because only a firm's primary exchange was considered.

One outlier with a Return on Assets (ROA) of ca. 150 has been identified as With Secure Oyj. A review of the financial accounts showcased that the remarkable ROA stems from a one-off demerger that took place in 2022 (Figure 18). For this reason, With Secure Oyj was removed from the sample by removing all firms with a ROA greater than 50 as a value higher than that would indicate some sort of one-off event which would distort the analysis. Figure 4 shows a data summary after the cleaning has been completed. 816 firms were then used to perform the later analysis.

	No. Employees	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	TQ	ROA	Debt/Assets Pct	NACE Code	Tot Assets LF
count	816.00	816.00	816.00	816.00	816.00	816.00	816.00	816.00	816.00	816.00	816.00	816.00
mean	20244.21	30.67	20.67	21.48	11.16	7.57	8.73	1.54	4.50	27.01	40.85	13445165139.77
std	53574.23	33.63	32.07	32.24	22.78	18.55	20.55	1.11	7.00	15.74	21.01	41825299766.68
min	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	-37.51	0.00	1.00	15711000.00
25%	1455.25	0.60	0.00	0.00	0.00	0.00	0.00	0.98	1.44	14.79	25.00	509395787.39
50%	3908.50	15.52	0.80	2.00	0.00	0.00	0.00	1.19	4.23	26.34	35.00	1792914183.15
75%	15081.75	55.70	30.82	31.42	8.46	4.00	4.04	1.65	7.50	36.60	58.00	7482021888.00
max	675800.00	100.00	100.00	100.00	100.00	100.00	100.00	12.73	41.63	96.07	93.00	568841011200.00

Figure 4: Descriptive statistics of Taxonomy and selected firm value KPIs after cleaning

3.3.3 Descriptive statistics: entire sample

Distribution:

The distribution of EU Taxonomy KPIs and company ratios is shown in Figure 5.

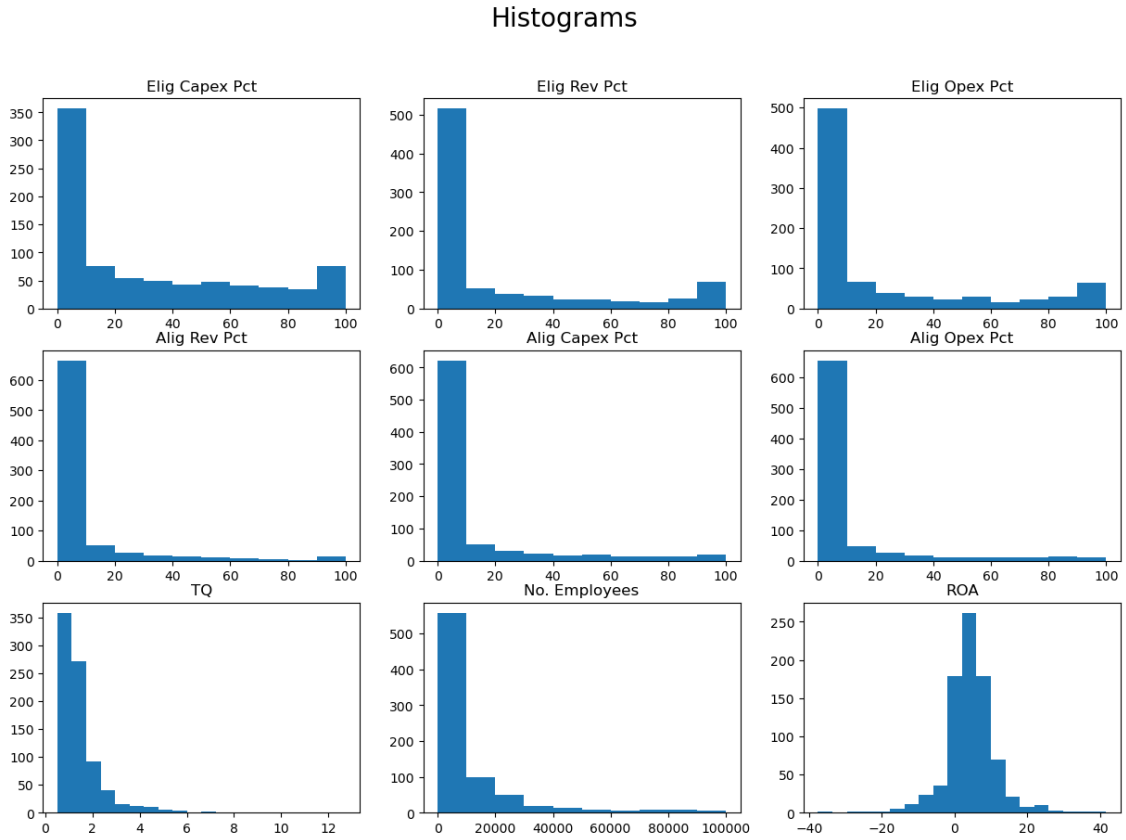

Figure 5: Distribution of Taxonomy values

For all Taxonomy KPIs, the most frequent value is zero. As explained earlier, this might be because the firm is not sustainable, or the firm cannot properly assess its sustainability through the current criteria published by the European Commission. The number of firms reporting a number close to zero for Aligned metrics is around 600 which represents a big portion of the sample. ROA appears to follow a normal distribution while about 25% of firms have a TQ lower than 1. Having more firms overvalued or close to 1 is expected because short selling constraints makes it difficult for investors to profit from an over-priced stock. Furthermore, rational investors are expected to buy a stock at a discount if the book value is greater than the market value assuming that there are no costs or delay in realising the book value while short selling is more restricted. Lastly, the book value is not necessarily the same as the market value for an asset or liability, causing a slight mismatch.

Central Tendency:

Figure 4 reports on the central tendencies.

The median values are far below the mean. For all alignment KPIs, it rests at 0. There are three reasons that can explain this. First, firms cannot classify their activities as

sustainable because they are not sustainable. Second, a firm is sustainable but because the EU Taxonomy criteria does not currently include their activities, they cannot classify as such. Three, due to the uncertainty in the interpretations of the regulations by firms, they perceive it to be safer to disclose a lower number to avoid potential claims of greenwashing per recommendation of their lawyers. This uncertainty regarding the reporting sheds light on potential data quality issues which is a common occurrence with sustainability reporting, such as ESG ratings, where the ratings are subjective.

Tobin's Q (TQ) and Return on Assets (ROA) have a mean of 1.5 and 4.5%, respectively. A TQ above 1 indicates the firms in the sample are overvalued on average in relation to their book value. The 4.5% average ROA shows that companies have a sufficient level of profitability on average.

Variability:

Figure 4 shows the standard deviation and Figure 6 shows the variance of the numerical variables. It can be observed that out of the three EU Taxonomy areas, the average for CapEx is the highest with less standard deviation in relation to the mean. This is likely due to the new investments made by firms in sustainable areas. OpEx and Revenue would be expected to take more time to catch up as they are less forward looking. This indicates that companies are on the track of becoming more sustainable according to the Taxonomy. The minimum and maximum values range between 0-100 which is expected because the numbers are reported in percentages. The variance for the Eligible KPIs is almost twice that of the alignment KPIs meaning that there is higher spread in the eligibility KPIs.

No. Employees	2870198351.17
Elig Capex Pct	1130.86
Elig Rev Pct	1028.22
Elig Opex Pct	1039.62
Alig Capex Pct	519.01
Alig Rev Pct	344.21
Alig Opex Pct	422.17
TQ	1.24
ROA	49.06
Debt/Assets Pct	247.79
NACE Code	441.58
Tot Assets LF	1749355700572502360064.00

Figure 6: Variance of each numerical variable

3.3.4 Descriptive statistics: sector

All sectors are currently not affected in the same way by the EU Taxonomy regulations. Some sectors have clearer and less strict technical screening criteria to assess the Eligible and Aligned KPIs. Therefore, it is interesting to have an overview of the current situation across sectors. Figure 7 below shows the average per EU Taxonomy KPI by sector and the number of firms in each sector:

NACE Sect	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	NRFirms
ACCOMMODATION AND FOOD SERVICE ACTIVITIES	34.10	0.00	8.50	0.20	0.00	0.10	8
ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	19.00	20.80	19.20	6.50	4.50	3.60	17
AGRICULTURE, FORESTRY AND FISHING	23.70	0.00	0.00	11.00	0.00	0.00	4
ARTS, ENTERTAINMENT AND RECREATION	8.50	7.20	5.40	0.20	0.40	0.00	12
CONSTRUCTION	50.50	64.50	34.60	17.50	17.20	15.90	33
EDUCATION	0.00	0.00	0.00	0.00	0.00	0.00	1
ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	75.20	43.00	60.00	64.50	32.70	49.90	38
FINANCIAL AND INSURANCE ACTIVITIES	24.00	11.50	16.00	4.40	2.50	4.00	31
HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	23.70	6.80	9.00	6.70	6.70	6.70	15
INFORMATION AND COMMUNICATION	26.50	17.50	13.90	6.50	4.40	5.10	114
MANUFACTURING	26.30	17.60	19.60	9.00	6.50	7.60	372
MINING AND QUARRYING	24.30	19.20	18.60	17.20	16.10	13.80	11
PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	18.50	7.60	7.50	2.50	3.40	2.70	38
REAL ESTATE ACTIVITIES	93.70	90.30	81.20	18.80	17.70	14.60	17
TRANSPORTATION AND STORAGE	44.40	41.60	36.00	16.90	14.70	10.50	32
WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	46.80	40.90	55.70	19.20	12.00	27.70	4
WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES	23.90	2.20	13.20	5.10	0.70	1.20	69

Figure 7: Average of various Taxonomy KPIs by sector

It is obvious that the manufacturing sector dominates the number of firms involved in the data set. Manufacturing makes up 372/818 = 45% of the data set and its numbers are close to that observed for the entire sample.

Electricity, gas, steam, and air conditioning supply is the sector with the highest alignment. This is likely because the generous criteria within that sector where, addition to renewable energy sources, both nuclear and gas qualify as sustainable activity if it replaces coal generation.

Real Estate shows remarkably high values in Eligible KPIs which is likely due to the regulation being favourable to their sector making it easier to fit their activities to the KPIs technical criteria.

The education sector has only one entry which is AcadeMedia AB, an education company. In their annual report for 2022 they write the following:

"The results of our analysis show that AcadeMedia's economic activities are not covered by the EU Taxonomy definitions of what should be reported."

Their interpretation states that they are not exposed to the EU Taxonomy's objectives, but they have still reported a 0% alignment. This further contributes to the question whether more companies have opted for a similar approach which questions about the quality of the data.

3.3.5 Descriptive statistics: exchange

The composition of firms on a given exchange vary depending on what a country or exchange is generally a strong performer in. For instance, Germany hosts plenty of manufacturing firms. Figure 8 shows the EU KPIs per primary exchange as well as the number of firms included in the exchange. For illustrative purposes, 13 exchanges that has fewer than 10 companies are not included in the visualisation because they are generally small exchanges. In total 42 firms are excluded here.

Primary Exchange	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	NRFirms
Athens	49.30	34.50	35.60	27.90	11.90	15.80	18
Brsaltaliana	29.30	21.10	26.20	14.60	8.90	12.40	88
Copenhagen	22.40	17.30	18.40	7.90	6.40	7.40	33
EN Amsterdam	18.30	12.70	16.30	5.50	3.70	3.40	33
EN Brussels	27.20	20.90	21.30	8.20	7.40	8.00	35
EN Lisbon	39.30	35.50	28.20	30.20	22.60	22.60	12
EN Paris	36.60	17.40	10.50	10.10	5.60	4.80	108
Helsinki	25.60	24.10	23.40	9.90	9.20	10.00	66
London	15.50	8.60	11.70	8.70	7.90	9.10	11
Oslo	31.30	28.60	32.40	18.70	16.60	16.00	21
Soc,Bol SIBE	44.20	39.50	31.60	27.70	20.90	18.50	32
Stockholm	27.30	19.30	18.00	4.60	4.00	4.00	119
Vienna	35.10	29.90	34.40	20.00	13.90	16.70	20
Warsaw	26.60	8.40	28.80	8.40	2.90	8.90	21
Xetra	34.40	20.90	24.80	10.60	7.00	9.20	152

Figure 8: Average of various Taxonomy KPIs by primary exchange

In terms of Taxonomy KPIs per exchange, only the primary exchange is considered in case a company has multiple listings. Overall, there is a big spread of the KPIs across the 15 exchanges. This is likely due to the different composition of firms on each exchange since not all industries are affected by the regulation in the same way right now.

A handful of exchanges have been selected for additional comments, namely Greece, EN Paris, Xetra, and London because of their high KPIs or their significance in the European market. It is assumed that a firm that is listed on a given exchange is also headquartered in that country.

Greece displays the highest Eligible KPIs for CapEx and OpEx, the second highest Revenue alignment as well as the highest CapEx alignment KPI, 4th highest rev alignment and 3rd highest OpEx alignment. However, there are only 18 firms included in the sample in which a couple of firms might have a big impact on the averages. Nonetheless, Greece could in some measure be considered to host the most sustainable activities together with Portugal.

Lisbon stock exchange displays the highest numbers on alignment across all exchanges. However, there are only 12 firms included.

The German exchange (Xetra) has 152 firms that have submitted Taxonomy KPIs, the highest among the sample. The German averages are similar to the entire sample, likely because they are also the biggest exchange.

Euronext Paris includes 108 firms and is also in line with the averages for the entire sample except for the OpEx related KPIs where they display the worst and third worst KPI on eligibility and alignment, respectively. Euronext Paris hosts multiple retailer and consumer goods companies, like LVMH, which are not yet subject to the regulation.

London listed companies are not required to disclose EU Taxonomy figures because of Brexit, but there are still 11 firms that have chosen to do so. Their numbers are relatively low compared to other exchanges.

3.4 Conclusion of Taxonomy's current state

The academic literature on the effect of ESG or sustainable practices on profitability and firm value is not conclusive, although much evidence indicates that better sustainability practices by firms should yield higher returns.

EU Taxonomy KPIs disclosure is still in its infancy. Out of 2874 larger firms in Europe, only 817 have fully reported on their EU Taxonomy KPIs. The available data shows that many firms disclosed zero or very small numbers. A possible explanation might be that firms find it difficult to interpret the regulation and they take a defensive stance to avoid potential greenwashing lawsuits or other legal disputes.

4 Quantitative analysis on relationship between Taxonomy KPIs and firm performance

4.1 Methodology

After an initial descriptive analysis of the EU Taxonomy KPIs, it is interesting to explore whether the Taxonomy KPIs have any impact on firms' valuation and profitability. As indicated in the literature review earlier, there have been many studies on the linear relationship between ESG rankings and firm performance. It was also indicated that the EU Taxonomy can lead to convergence of ESG ratings and that EU Taxonomy KPIs are more likely to affect the investment probability. As such, exploring the linear relationship between the EU Taxonomy KPIs and firm performance is highly relevant and can be expected to lead to similar results. Therefore, the following hypotheses have been formulated:

Thesis hypothesis 1:

EU Taxonomy KPIs have a significant impact on firm value.

Thesis hypothesis 2:

EU Taxonomy KPIs have a significant impact on profitability.

To test the hypotheses, regressions will be run on the clean data. In the next three chapters, the dependent, independent and control variables will be introduced. All computations are performed using Python. The code is attached in the appendix.

4.1.1 Dependent variables

TQ and ROA were selected as dependent variables because they can be used as proxies for valuations and profitability, respectively. TQ compares the market value to the book value of the firm. ROA indicates the how efficient a company is at employing its capital.

The formulas from the two dependent variables can be found below:

$$Tobin's\ Q = \frac{(Equity\ Market\ Value\ +\ Liabilities\ Market\ Value)}{(Equity\ Book\ Value\ +\ Liabilities\ Book\ Value)}$$

$$Return\ on\ Assets\ = \frac{Net\ Income}{Total\ Assets}$$

4.1.2 Independent variables

All six EU Taxonomy KPIs are used as independent variables. They are summarized in Table 2 below. In the following sections, the KPIs will be referred to by their abbreviations.

Eligible CapEx (EC)
Eligible Revenue (ER)
Eligible OpEx (EO)
Aligned CapEx (AC)
Aligned Revenue (AR)
Aligned OpEx (AO)

Table 2: EU Taxonomy KPIs

4.1.3 Control variables

Control variables are included to increase the validity of the study. Size and leverage have been chosen to be the control variables because they affect the financial performance of a firm and because they are common in the literature (Atan et al., 2018). A firm's size increases the CSR disclosure (Chauvey et al., 2010) and higher leveraged companies have creditors that require more ESG information (Clarkson et al., 2008). Size is estimated with the natural logarithm of total assets because it standardises the variable. This reduces the kurtosis of the variable but makes it slightly more likely to be statistically significant. Leverage is measured as the debt to assets ratio. Table 3 in the appendix summarizes all variables.

4.2 Data analysis

4.2.1 Correlation results

The correlation between variables is first examined because it gives an initial insight to whether there is a relationship between two variables. Figure 9 shows the correlation matrix results.

	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	TQ	ROA	Debt/Assets Pct	lnasset
Elig Capex Pct	1.00	0.71	0.71	0.62	0.51	0.53	-0.11	-0.01	0.09	0.22
Elig Rev Pct	0.71	1.00	0.77	0.50	0.62	0.54	-0.12	-0.05	0.10	0.13
Elig Opex Pct	0.71	0.77	1.00	0.54	0.56	0.67	-0.09	-0.01	0.13	0.17
Alig Capex Pct	0.62	0.50	0.54	1.00	0.81	0.84	-0.07	-0.03	0.09	0.19
Alig Rev Pct	0.51	0.62	0.56	0.81	1.00	0.86	-0.04	-0.06	0.08	0.06
Alig Opex Pct	0.53	0.54	0.67	0.84	0.86	1.00	-0.05	-0.05	0.06	0.14
TQ	-0.11	-0.12	-0.09	-0.07	-0.04	-0.05	1.00	0.40	-0.16	-0.11
ROA	-0.01	-0.05	-0.01	-0.03	-0.06	-0.05	0.40	1.00	-0.23	0.02
Debt/Assets Pct	0.09	0.10	0.13	0.09	0.08	0.06	-0.16	-0.23	1.00	0.13
lnasset	0.22	0.13	0.17	0.19	0.06	0.14	-0.11	0.02	0.13	1.00

Figure 9: Pearson correlation matrix of Taxonomy KPIs vs. selected value KPIs

The correlation matrix displays a high and significant (Figure 10) correlation between the EU Taxonomy KPIs. This is not unexpected because the KPIs are linked, and eligibility and alignment are assessed under the same delegated act for each objective. A correlation is considered significant if the p-value is less than 0.1.

TQ is significantly negatively correlated to all EU Taxonomy KPIs. ROA is significantly correlated to Eligible revenue, Eligible Opex and Aligned Capex. TQ and ROA are significantly correlated. Their positive correlation is not surprising because both KPIs relate to the financial performance of the firm.

	Elig Capex Pct	Elig Rev Pct	Elig Opex Pct	Alig Capex Pct	Alig Rev Pct	Alig Opex Pct	TQ	ROA	Debt/Assets Pct	lnasset
Elig Capex Pct	0.0000	0.0002	0.0002	0.0071	0.0136	0.0110	0.0407	0.1058	0.9326	0.8722
Elig Rev Pct	0.0002	0.0000	0.0000	0.0142	0.0065	0.0089	0.0480	0.0899	0.9996	0.9009
Elig Opex Pct	0.0002	0.0000	0.0000	0.0091	0.0068	0.0037	0.0444	0.0956	0.9992	0.9571
Alig Capex Pct	0.0071	0.0142	0.0091	0.0000	0.0000	0.0000	0.0761	0.0954	0.8752	0.9648
Alig Rev Pct	0.0136	0.0065	0.0068	0.0000	0.0000	0.0000	0.1185	0.1029	0.8578	0.6695
Alig Opex Pct	0.0110	0.0089	0.0037	0.0000	0.0000	0.0000	0.0981	0.1024	0.8326	0.8295
TQ	0.0407	0.0480	0.0444	0.0761	0.1185	0.0981	0.0000	0.0294	0.1253	0.2060
ROA	0.1058	0.0899	0.0956	0.0954	0.1029	0.1024	0.0294	0.0000	0.0516	0.4599
Debt/Assets Pct	0.9326	0.9996	0.9992	0.8752	0.8578	0.8326	0.1253	0.0516	0.0000	0.7487
lnasset	0.8722	0.9009	0.9571	0.9648	0.6695	0.8295	0.2060	0.4599	0.7487	0.0000

Figure 10: P-values of Pearson coefficients from Figure 9

4.2.2 Linear regressions

Before running the regressions, the independent variables are plotted against the dependent variables to investigate whether there is an obvious visual relationship. The results can be seen in Figure 11 and Figure 12.

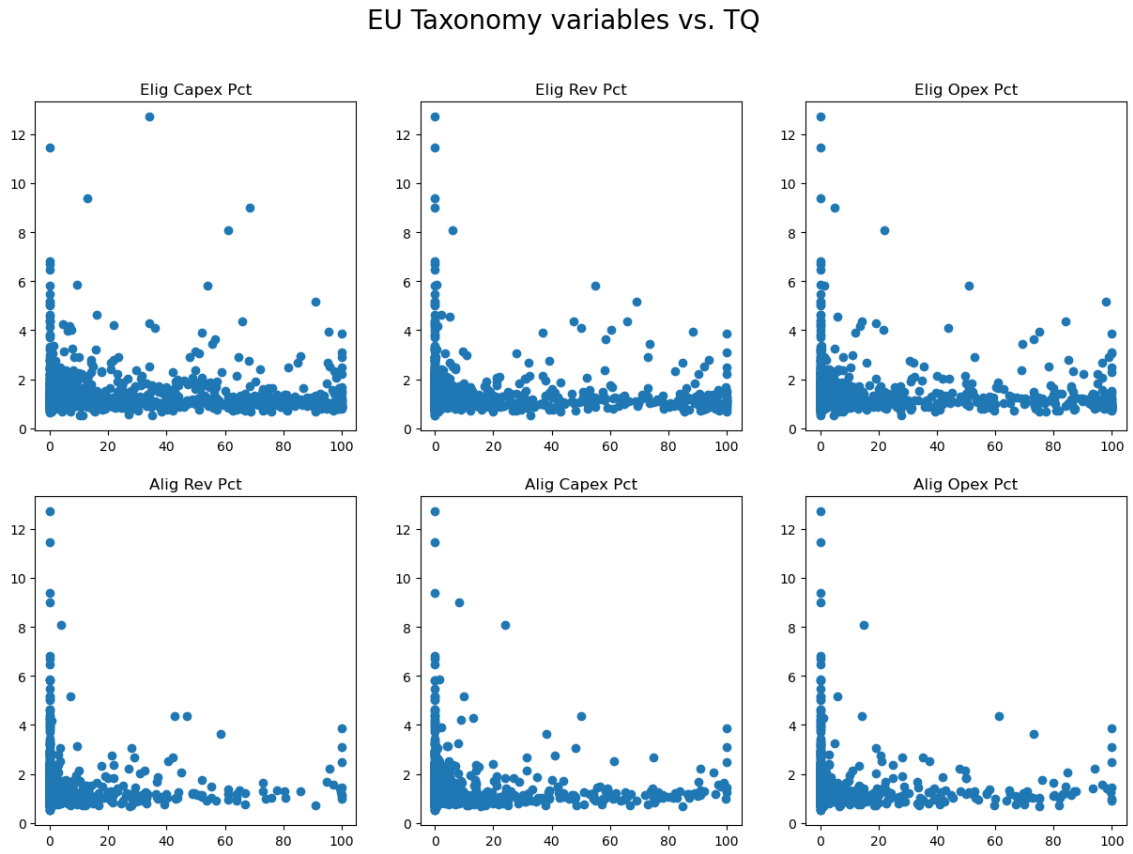

Figure 11: EU Taxonomy KPIs vs TQ

There appears to be a higher concentration of data points towards the lower end of the 0-100 range. More so for the Aligned KPIs than the Eligible KPIs. There are several outliers and the firms with the highest overvaluation (TQ) are firms with the lowest eligibility and alignment.

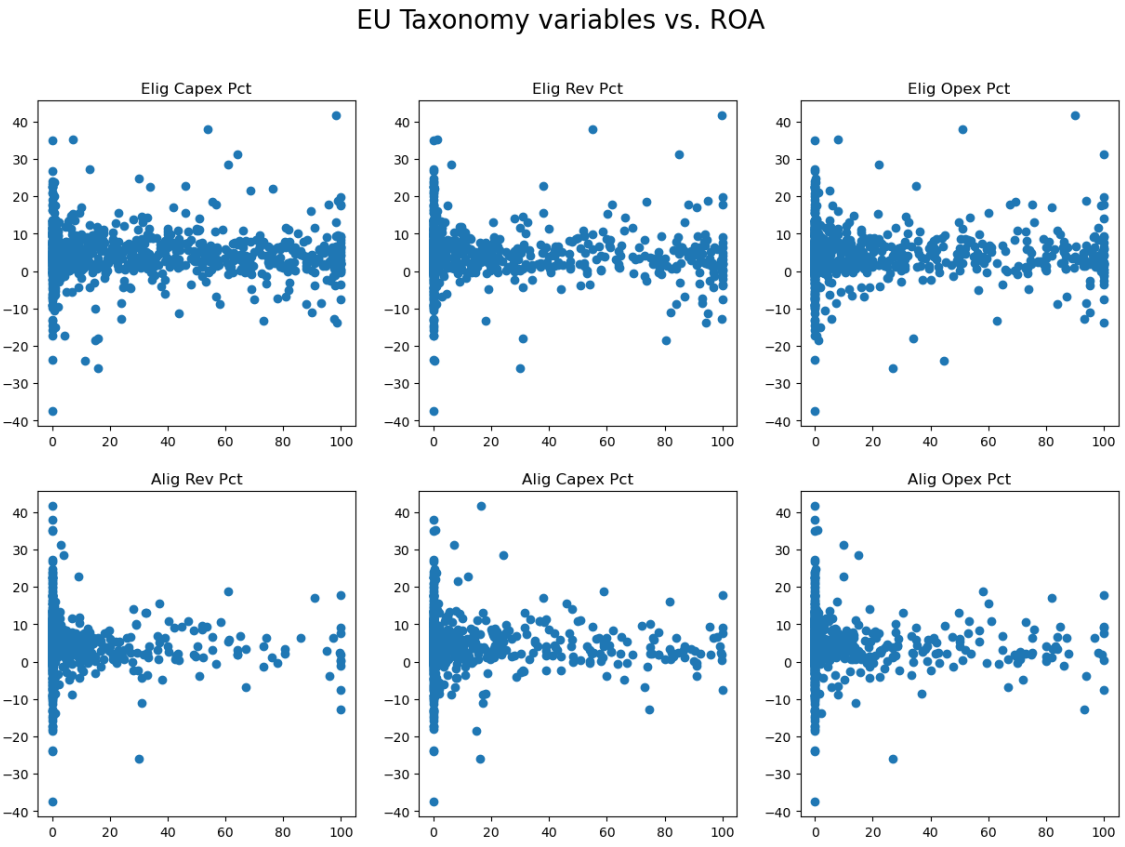

Figure 12: EU Taxonomy KPIs vs ROA

Plotting the EU KPIs vs ROA shows a higher concentration of the scores with fewer outliers than in the graphs for TQ. This might be because the TQ is a subjective measure since it compares the market value over the book value. ROA is more objective since the numbers are directly taken from the financial statements of firms.

For simplicity reasons, a linear relationship between the independent and dependent variables is assumed. Looking at the scatterplots, this seems to be more realistic for ROA than TQ.

Because the EU Taxonomy KPIs are correlated, a separate model for each KPI must be computed. This results in a total of twelve regressions:

$$TQ_i = \beta_0 + \beta_1 ER_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$TQ_i = \beta_0 + \beta_1 EO_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$TQ_i = \beta_0 + \beta_1 EC_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$TQ_i = \beta_0 + \beta_1 AR_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$TQ_i = \beta_0 + \beta_1 AO_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$TQ_i = \beta_0 + \beta_1 AC_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 ER_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 EO_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 EC_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 AR_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 AO_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

$$ROA_i = \beta_0 + \beta_1 AC_i + \beta_2 Size_i + \beta_3 Leverage_i + \varepsilon_i$$

ε_i is the error term for company i. β_0 is the intercept and β_1, β_2 and β_3 are the coefficients for each variable.

```
            feature  VIF
0  Debt/Assets Pct 4.03
1           lnasset 4.18
2   Alig Capex Pct 1.26
-----------------------
            feature  VIF
0  Debt/Assets Pct 4.03
1           lnasset 4.10
2     Alig Rev Pct 1.18
-----------------------
            feature  VIF
0  Debt/Assets Pct 4.02
1           lnasset 4.14
2    Alig Opex Pct 1.19
-----------------------
            feature  VIF
0  Debt/Assets Pct 4.02
1           lnasset 4.72
2   Elig Capex Pct 1.89
-----------------------
            feature  VIF
0  Debt/Assets Pct 4.04
1           lnasset 4.27
2     Elig Rev Pct 1.44
-----------------------
            feature  VIF
0  Debt/Assets Pct 4.06
1           lnasset 4.26
2    Elig Opex Pct 1.49
-----------------------
```

Figure 13: Multicollinearity test

To verify that there is no multicollinearity, the Variance Inflation Factor (VIF) is calculated for the planned independent variable set of all regressions. All sets in the regressions have a VIF of less than 5 as seen in Figure 13, confirming that that there is no multicollinearity.

It is now time to revisit the previously defined hypotheses and define the null hypothesis.

Thesis hypothesis 1:

EU Taxonomy KPIs have a significant impact on firm value.

The null hypothesis for the linear regressions is:

No relationship exists between EU Taxonomy KPIs and TQ where TQ as proxy for firm value

Thesis hypothesis 2:

EU Taxonomy KPIs have a significant impact on profitability.

The null hypothesis for the linear regressions is:

No relationship exists between EU Taxonomy KPIs and ROA where ROA as proxy for firm profitability

The regressions are run, and the results are presented in the following two chapters in Figure 14 and Figure 15.

4.2.2.1 Dependent variable: Tobin's Q

The coefficients are estimated using ordinary least squares method.

	Dependent variable: TQ					
	(1)	(2)	(3)	(4)	(5)	(6)
Elig Capex Pct	-0.003**					
	(0.001)					
Elig Rev Pct		-0.003***				
		(0.001)				
Elig Opex Pct			-0.002*			
			(0.001)			
Alig Capex Pct				-0.002		
				(0.002)		
Alig Rev Pct					-0.001	
					(0.002)	
Alig Opex Pct						-0.002
						(0.002)
Debt/Assets Pct	-0.010***	-0.010***	-0.010***	-0.011***	-0.011***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
lnasset	-0.041*	-0.044**	-0.045**	-0.046**	-0.050**	-0.048**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Observations	816	816	816	816	816	816
R^2	0.040	0.042	0.037	0.036	0.034	0.035
Adjusted R^2	0.036	0.038	0.034	0.032	0.031	0.031
Residual Std. Error	1.092 (df=812)	1.091 (df=812)	1.094 (df=812)	1.095 (df=812)	1.096 (df=812)	1.095 (df=812)
F Statistic	11.291*** (df=3; 812)	11.873*** (df=3; 812)	10.535*** (df=3; 812)	10.073*** (df=3; 812)	9.593*** (df=3; 812)	9.782*** (df=3; 812)
Note:						*p<0.1; **p<0.05; ***p<0.01

Figure 14: Regression coefficients of Taxonomy variables with TQ as dependent variable

Figure 14 shows that all Taxonomy KPIs have a significant slight negative impact on the firm value (TQ), but not all are significant. Eligible Revenue, Eligible CapEx and Eligible OpEx have the only significant impact on TQ with a coefficient of -0.003, -0.003 and -0.002, respectively. Thus, if a firm has a TQ of 1 and the firm increases Eligible Revenue by 1% point, leaving everything else constant, TQ will be 0.997. This is not a huge difference. The control variables are significant and have a negative impact on TQ. With a significant and negative coefficient, the null hypothesis can be rejected for the first three EU KPIs, but not for the other ones.

4.2.2.2 Dependent variable: Return on Assets

The coefficients are estimated using ordinary least squares method.

	Dependent variable: ROA					
	(1)	(2)	(3)	(4)	(5)	(6)
Elig Capex Pct	-0.001					
	(0.007)					
Elig Rev Pct		-0.008				
		(0.008)				
Elig Opex Pct			0.003			
			(0.008)			
Alig Capex Pct				-0.008		
				(0.011)		
Alig Rev Pct					-0.016	
					(0.013)	
Alig Opex Pct						-0.013
						(0.012)
Debt/Assets Pct	-0.103***	-0.102***	-0.104***	-0.103***	-0.102***	-0.103***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
lnasset	0.189	0.201	0.178	0.202	0.193	0.204
	(0.131)	(0.129)	(0.129)	(0.130)	(0.128)	(0.129)
Observations	816	816	816	816	816	816
R^2	0.054	0.055	0.054	0.054	0.055	0.055
Adjusted R^2	0.050	0.051	0.050	0.051	0.052	0.052
Residual Std. Error	6.826 (df=812)	6.822 (df=812)	6.826 (df=812)	6.824 (df=812)	6.820 (df=812)	6.821 (df=812)
F Statistic	15.358*** (df=3; 812)	15.746*** (df=3; 812)	15.395*** (df=3; 812)	15.526*** (df=3; 812)	15.870*** (df=3; 812)	15.807*** (df=3; 812)
Note:						*p<0.1; **p<0.05; ***p<0.01

Figure 15: Regression coefficients of Taxonomy variables with ROA as dependent variable

In Figure 15 the results for the regressions on ROA are presented. Every but one EU Taxonomy KPI is negatively correlated with ROA and not significant. Their coefficients range from -0.016 to 0.003. Regarding the control variables, it is observed that the leverage factor is highly significant with an impact on company value of between

-0.104 to -0.102. The second control variable, size, is not significant and shows a positive relationship with the value of the firm. Because all EU Taxonomy KPIs' coefficients are not significant, the null hypothesis cannot be rejected for any EU Taxonomy KPI's impact on profitability.

4.3 Conclusion of data review

Almost every EU Taxonomy KPI has a negative impact on TQ and ROA at different significance levels. The null hypotheses could only be rejected for EC and ER with TQ as the dependent variable. Thus, these have a slight effect on the firm value. On the other hand, the EU Taxonomy KPIs seem to have no impact on the profitability of a firm since none of the regressions resulted in significant coefficients.

5 Conclusion & outlook

This study set out to make a first analysis on the new EU Taxonomy regulations. More specifically, it summarized the current developments of the Taxonomy regulations. It became clear that the EU Taxonomy data is still in its infancy stages and more research is encouraged as the regulation and consequently reporting matures over time. This study also investigated whether the EU Taxonomy KPIs have any impact on firm value and profitability. The two initial thesis hypotheses are commented on below.

Thesis hypothesis 1:

EU Taxonomy KPIs have a significant impact on firm value.

Based on regressions where the dependent variable was TQ (firm value), there is a significant negative relationship for three of the six EU Taxonomy KPIs. This result does not support the first initial hypothesis that the EU KPIs would have a significant effect on the firm value.

Thesis hypothesis 2:

EU Taxonomy KPIs have a significant impact on profitability.

For the other dependent variable ROA (profitability), all the EU Taxonomy KPIs proved insignificant, and thus, no support can be given towards the second hypothesis that the EU Taxonomy KPIs would have a significant impact on profitability.

The result from this study is that the evidence is in general inconclusive, even negative in some cases, in generating support for or against the impact of EU Taxonomy KPIs on firm value or profitability. An open discussion for why this might be the case follows.

First, investing in sustainable activities might have a short-term negative impact on profitability due to the costs associated with going green. Consequently, an increase in profits might not appear until a later stage. This can be researched in the future when there is more data available. Then, TQ_t could be run against, for example, ER_{t-5} to investigate the relationship of investment in sustainable activities and future firm value.

Secondly, this type of analysis might have been conducted a bit early for it to be the most powerful. As mentioned before, there are many zeros in the current data and potential reasons have been listed prior. These many zeros might affect the results of the regressions. A potential solution to mitigate this issue could be to run the regression without the companies that reported only zeros.

Finally, investors might remain hesitant to incorporate EU Taxonomy KPIs in their investment theses because the Taxonomy is still a living regulation, and many changes might take place within a few years. To help investors integrate the Taxonomy in their investment process, more academic research to assess the impact of the Taxonomy would be beneficial. This can be achieved by, for example, running more studies like this one in a few years' time when there is more accurate and reliable data or a qualitative study with asset managers or other industry professionals to assess whether they find the data reliable.

6 List of figures

7 List of tables

8 Bibliography

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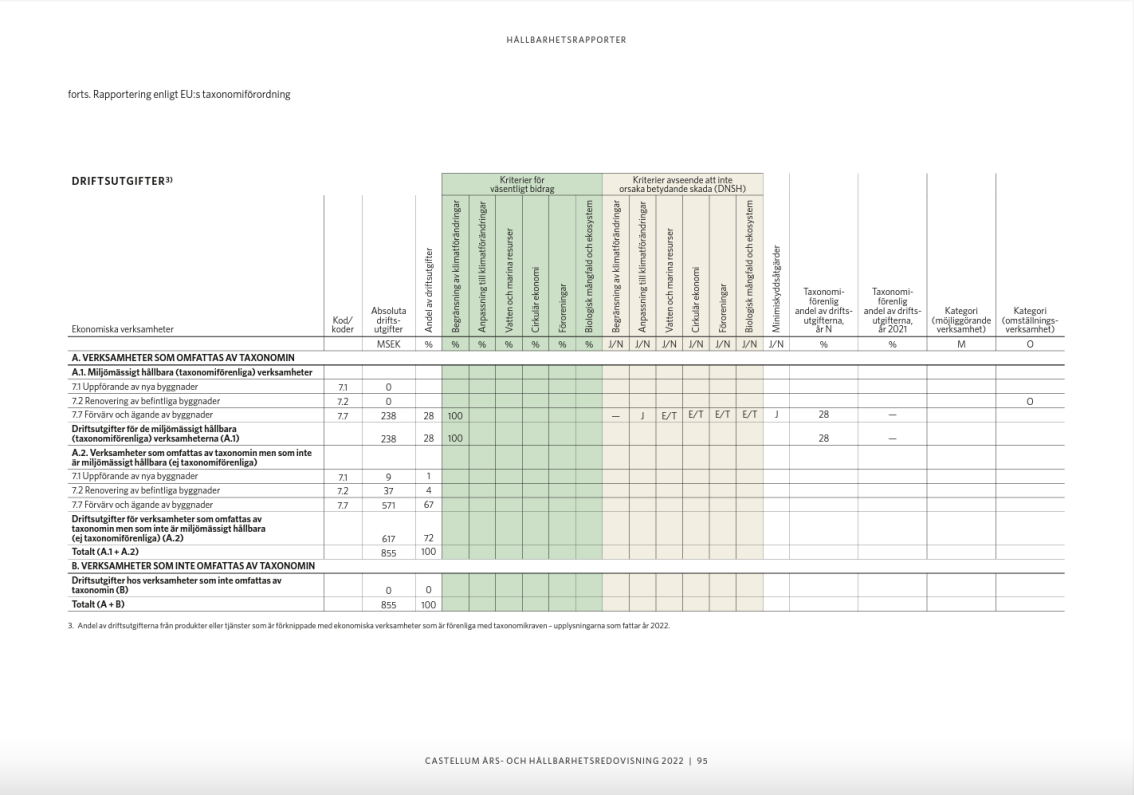
9 Appendix

Dependent Variables	**Description**
Tobin's Q (TQ)	(Equity Market Value + Liabilities Market Value) / (Equity Book Value + Liabilities Book Value)
Return on Assets (ROA)	Net Income / Total Assets
Independent Variables	
Eligible CapEx (EC)	% of CapEx Eligible according to the EU Taxonomy
Eligible Revenue (ER)	% of Revenue Eligible according to the EU Taxonomy
Eligible OpEx (EO)	% of OpEx Eligible according to the EU Taxonomy
Aligned CapEx (AC)	% of CapEx Aligned according to the EU Taxonomy
Aligned Revenue (AR)	% of Revenue Aligned according to the EU Taxonomy
Aligned OpEx (AO)	% of OpEx Aligned according to the EU Taxonomy
Control Variables	
Size (lnasset)	Logarithm of Total Assets
Leverage (Debt/Assets)	Total Debt / Total Assets
Other Fields	

Sector	Sector code
Primary Exchange	Primary exchange of listed firm
Total Assets	Total assets from balance sheet
NR Employees	Number of employees

Table 3: Summary of the variables



HÅLLBARHETSRAPPORTER

forts. Rapportering enligt EU:s taxonomiförordning

DRIFTSUTGIFTER[3)]

Ekonomiska verksamheter	Kod/ koder	Absoluta drifts-utgifter	Andel av driftsutgifter	Kriterier för väsentligt bidrag: Begränsning av klimatförändringar	Anpassning till klimatförändringar	Vatten och marina resurser	Cirkulär ekonomi	Föroreningar	Biologisk mångfald och ekosystem	Kriterier avseende att inte orsaka betydande skada (DNSH): Begränsning av klimatförändringar	Anpassning till klimatförändringar	Vatten och marina resurser	Cirkulär ekonomi	Föroreningar	Biologisk mångfald och ekosystem	Minimiskyddsåtgärder	Taxonomi-förenlig andel av drifts-utgifterna, år N	Taxonomi-förenlig andel av drifts-utgifterna, år 2021	Kategori (möjliggörande verksamhet)	Kategori (omställnings-verksamhet)
		MSEK	%	%	%	%	%	%	%	J/N	J/N	J/N	J/N	J/N	J/N	J/N	%	%	M	O
A. VERKSAMHETER SOM OMFATTAS AV TAXONOMIN																				
A.1. Miljömässigt hållbara (taxonomiförenliga) verksamheter																				
7.1 Uppförande av nya byggnader	7.1	0																		
7.2 Renovering av befintliga byggnader	7.2	0																		O
7.7 Förvärv och ägande av byggnader	7.7	238	28	100						—	J	E/T	E/T	E/T	E/T	J	28	—		
Driftsutgifter för de miljömässigt hållbara (taxonomiförenliga) verksamheterna (A.1)		238	28	100													28	—		
A.2. Verksamheter som omfattas av taxonomin men som inte är miljömässigt hållbara (ej taxonomiförenliga)																				
7.1 Uppförande av nya byggnader	7.1	9	1																	
7.2 Renovering av befintliga byggnader	7.2	37	4																	
7.7 Förvärv och ägande av byggnader	7.7	571	67																	
Driftsutgifter för verksamheter som omfattas av taxonomin men som inte är miljömässigt hållbara (ej taxonomiförenliga) (A.2)		617	72																	
Totalt (A.1 + A.2)		855	100																	
B. VERKSAMHETER SOM INTE OMFATTAS AV TAXONOMIN																				
Driftsutgifter hos verksamheter som inte omfattas av taxonomin (B)		0	0																	
Totalt (A + B)		855	100																	

3. Andel av driftsutgifterna från produkter eller tjänster som är förknippade med ekonomiska verksamheter som är förenliga med taxonomikraven – upplysningarna som fattar år 2022.

Figure 16: Appendix: Castellum AB OpEx

forts. Rapportering enligt EU:s taxonomiförordning

OMSÄTTNING[1)]

Ekonomiska verksamheter	Kod/ koder	Absolut omsättning	Andel av omsättningen	Kriterier för väsentligt bidrag: Begränsning av klimatförändringar	Anpassning till klimatförändringar	Vatten och marina resurser	Cirkulär ekonomi	Föroreningar	Biologisk mångfald och ekosystem	Kriterier avseende att inte orsaka betydande skada (DNSH): Begränsning av klimatförändringar	Anpassning till klimatförändringar	Vatten och marina resurser	Cirkulär ekonomi	Föroreningar	Biologisk mångfald och ekosystem	Minimiskyddsåtgärder	Taxonomiförenlig andel av omsättningen, år 2022	Taxonomiförenlig andel av omsättningen, år 2021	Kategori (möjliggörande verksamhet)	Kategori (omställnings-verksamhet)
		MSEK	%	%	%	%	%	%	%	J/N	J/N	J/N	J/N	J/N	J/N	J/N	%	%	M	O
A. VERKSAMHETER SOM OMFATTAS AV TAXONOMIN																				
A.1. Miljömässigt hållbara (taxonomiförenliga) verksamheter																				
7.1 Uppförande av nya byggnader	7.1	0	0	0																
7.2 Renovering av befintliga byggnader	7.2	0	0	0																O
7.7 Förvärv och ägande av byggnader	7.7	2 927	33	100						—	J	E/T	E/T	E/T	E/T	J	33	—		
De miljömässigt hållbara (taxonomiförenliga) verksamheternas omsättning (A.1)		2 927	33	100													33	—		
A.2. Verksamheter som omfattas av taxonomin men som inte är miljömässigt hållbara (ej taxonomiförenliga)																				
7.1 Uppförande av nya byggnader	7.1	137	2																	
7.2 Renovering av befintliga byggnader	7.2	358	4																	
7.7 Förvärv och ägande av byggnader	7.7	5 574	62																	
Omsättningen hos de verksamheter som omfattas av taxonomin men som inte är miljömässigt hållbara (ej taxonomiförenliga) (A.2)		6 069	67																	
Totalt (A.1 + A.2)		8 996	100																	
B. VERKSAMHETER SOM INTE OMFATTAS AV TAXONOMIN																				
Omsättningen hos verksamheter som inte omfattas av taxonomin (B)		0	0																	
Totalt (A + B)		8 996	100																	

1. Andel av omsättningen från produkter eller tjänster som är förknippade med ekonomiska verksamheter som är förenliga med taxonomikraven – upplysningar som omfattar år 2022.

Figure 17: Appendix: Castellum AB Revenue

Financial Statements WithSecure consolidated

Statement of comprehensive income January 1–December 31, 2022

The income statement is presented for continuing operations only according to IFRS 5 as Consumer security business is treated as disco

EUR 1,000	Note	Consolidated, IFRS 2022	Restated Consolidated, IFRS 2021
REVENUE	(2)	134,700	130,015
Cost of revenue		–46,972	–41,472
GROSS MARGIN		87,728	88,543
Other operating income	(3)	12,325	2,466
Sales and marketing	(4, 5, 6)	–83,118	–73,299
Research and development	(4, 5, 6)	–39,143	–32,094
Administration	(4, 5, 6)	–20,344	–15,691
EBIT		–42,552	–30,075
Financial income	(8)	1,149	1,198
Financial expenses	(8)	–2,768	–1,543
PROFIT (LOSS) BEFORE TAXES		–44,171	–30,421
Income tax	(9)	5,961	4,950
Result for the financial year, continuing operations		–38,210	–25,472
Result for the financial year, discontinued operations	(11)	468,526	38,157
RESULT FOR THE FINANCIAL YEAR, GROUP TOTAL		430,316	12,686

EUR 1,000	Note	Cor
Result of the financial year is attributable to:		
Equity holders of the parent, continuing operations		
Equity holders of the parent, discontinued operations		
Equity holders of the parent, combined operations		
Comprehensive income for the year is attributable to:		
Equity holders of the parent, continuing operations		
Equity holders of the parent, discontinued operations		
Equity holders of the parent, combined operations		
Earnings per share:	(10)	
Basic and diluted, continuing operations		
Basic and diluted, discontinued operations		

Figure 18: Appendix: With Secure Oyj Income statement 2022