Corporate Alignment with the EU Taxonomy for Sustainable Activities:
First Evidence from Financial Accounting Data

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Abstract

We perform the first analysis of corporate disclosures of the percentage of revenues, capital and operating expenditures aligned with the EU's taxonomy on sustainable activities. Overwhelmingly, disclosed activities relate to climate change mitigation rather than adaptation. We document low absolute levels of alignment with the taxonomy and significant variation across competing companies. Companies with higher alignment exhibit little difference in past sales growth, current profitability margins, or valuation ratios compared to their peers. Moreover, our data suggests that the existing information set available, through business segment disclosures, environmental ratings, and carbon emissions data, is insufficient to assess alignment with the taxonomy. For the first time in history, investors can analyze a company's alignment with climate change mitigation activities using standardized and audited financial accounting data.

Keywords: Climate Investments, Corporate Disclosure, Sustainability, ESG.

Introduction

What is sustainable? This question is of paramount importance given the trillions of assets invested according to different sustainability criteria. While until now we have had no standard for answering this question, the European Union's (EU) Taxonomy[2] for sustainable activities aims to provide a comprehensive classification system for environmentally sustainable economic activities. This research paper examines the disclosures of European companies that are part of the Stoxx 600 index in relation to the EU Taxonomy.

The EU Taxonomy went into effect in July 2020, following the adoption of the Taxonomy Regulation (Regulation (EU) 2020/852). It can be a critical piece of legislation for investors, as it

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[2] https://joint-research-centre.ec.europa.eu/scientific-activities-z/sustainable-finance/eu-taxonomy_en
https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

establishes a common language and framework for identifying environmentally sustainable investments. The taxonomy provides clear criteria for determining whether an economic activity can be considered environmentally sustainable based on six environmental objectives, including climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems. Fiscal year 2022 disclosures, the first year that the regulation went into effect, relate only to the first two objectives.

Companies subject to the Non-Financial Reporting Directive (NFRD) are required to report on their alignment with the EU Taxonomy. This includes large, publicly listed companies with more than 500 employees. Activities that contribute to one of the six goals are deemed "eligible." To be considered "aligned," a company must not only contribute to one or more of the above objectives, satisfying specific technical criteria, but do so while also meeting a "do no significant harm" standard: while supporting sustainable goals, aligned activities must not otherwise impinge upon any other sustainable goals. These companies must disclose data related to the taxonomy, including information on the proportion of their revenues, capital expenditures, and operating expenditures that are aligned with the taxonomy's criteria. These disclosures could be helpful for investors, policymakers, and other stakeholders to assess the progress of companies towards sustainable activities and specifically, the transition to a low carbon economy.

We undertake a comprehensive analysis of the newly reported corporate disclosures related to the EU Taxonomy, focusing on the alignment of revenues, capital expenditures (Capex), and operating expenditures (Opex) with the taxonomy's criteria. Leveraging this unique dataset for the first year of reporting, we aim to answer several pertinent research questions that can shed light on the current state of corporate sustainable activities in the context of the EU Taxonomy.

We start by documenting several empirical patterns. To be aligned, a sustainable activity first needs to be eligible, by contributing substantively to one of the six sustainability objectives. We find that the largest percentage of eligible revenues are in the Real Estate, Utilities, and Industrials sectors. However, significant within-sector and across-industry variation exists. For example, while the Consumer Discretionary sector has a relatively low percentage of eligible revenues overall, the Automobiles industry ranks as one of the highest industries in terms of eligible revenues. This reflects the ongoing transformation due to electric vehicles. Other

industries with high eligible revenues include Diversified REITs, Building Products, Construction Materials, Marine Transportation, Transportation Infrastructure, Utilities, and Insurance.

An activity is aligned if it is eligible and satisfies a host of technical criteria. We find that aligned revenues are much lower than eligible revenues, consistent with the technical criteria representing a bar that most companies are not currently meeting. This trend is evident in the Automobiles industry, which has a high percentage of eligible revenues but very low aligned revenues. In contrast, Transportation Infrastructure exhibits an almost equal percentage of aligned and eligible revenues, suggesting that all eligible revenues are aligned in this industry. Building Products and Electrical Equipment industries also demonstrate higher aligned revenues, while Utilities and Real Estate exhibit the highest alignment at the sector level. Moreover, significantly higher variation exists within sectors and across companies for aligned rather than eligible revenues, suggesting firm-specific strategies are an important driver of alignment.

Our data is cross-sectional in nature, given the first year of available data required by the regulation has been for the 2022 fiscal year end. The absence of a panel dataset and exogenous shocks to a firm's aligned investments and revenues does not allow us to make any causal claims about the relation between them or with other variables of interest. However, we uncover several empirical patterns that are of interest to investors and managers. For example, modeling the relation between aligned capital and operating investments and aligned revenues we find that a 1% increase in aligned operating expenditures is associated with a 0.82% increase in aligned revenues with an additional 0.39% contribution from capital expenditures.

Moreover, given the significant variation in alignment metrics across competing companies within industries, we analyze the relationship between alignment metrics, business fundamentals, and corporate valuation ratios. There are three plausible scenarios for how these might relate. First, some firms may choose not to align because alignment leads to suboptimal financial outcomes, while other firms value the environmental benefits of the alignment. For example, eligible products that meet the technical criteria might face lower demand by customers due to higher prices, or they might require higher production costs leading to lower margins. Second, some firms may choose to align because alignment leads to better financial outcomes by tapping unmet customer demand for new products, while other firms are slower to align as they are reluctant to make the necessary investments, or they do not have the capabilities to adapt. Third, neither strategy may dominate so far. Firms with higher alignment may sell products and

services to satisfy emerging customer demands while optimizing their investment profile, while at the same time firms with lower alignment satisfy existing customer needs. Consistent with this third scenario, we find little difference in sales growth, profitability ratios, or corporate valuation ratios across firms with high or low alignment within the same industry. However, we document that companies with higher enabling revenues and capital investments exhibit lower profitability (i.e., ROA) and (1-year sales growth).

Then, we analyze the ability of models that rely on business segment data and a classification of business segments to sustainable activities to predict eligibility of revenues and the correlation between alignment metrics and other environmental data. We find that models significantly overestimate the percentage of revenues that would be eligible as a sustainable activity. This is particularly true in the Information Technology, Communication Services, Industrials, and Utilities sectors. This discrepancy reflects the challenges associated with accurately estimating these figures from corporate business segment disclosures. Moreover, the alignment metrics are only moderately correlated with environmental data and ratings. Strikingly, we find that many firms in industries with high exposure to carbon emissions have close to perfect environmental ratings while having close to zero Taxonomy-related revenues or expenditures. We conclude that the disclosure regulation has provided investors with novel data and a differentiated assessment of firm strategies.

The analyses conducted in this paper are valuable for investors for several reasons. First, by examining the alignment of revenues, capital expenditures, and operating expenditures with the taxonomy across sectors, industries, and firm characteristics, investors can gain a deeper understanding of the extent to which large European companies are embracing sustainable practices. This can help investors identify investment opportunities in firms that are more likely to benefit from the transition to a low-carbon economy and avoid those that may face increasing regulatory risks and stranded assets.

Second, by documenting the intra-industry variation in alignment with the taxonomy, this research can provide insights into the differences in the adoption of sustainable practices within industries. This information can be used by investors to better assess the relative performance of firms within an industry and make more informed investment decisions based on environmental considerations.

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Lastly, by investigating the relationship between alignment with the taxonomy and commercial environmental ratings, this research can help investors evaluate the consistency between the EU's classification system and other widely used environmental ratings. This information can support investors in their due diligence process and portfolio construction by identifying potential discrepancies and complementarities between different sustainability frameworks.

Sample

Fiscal year 2022 is the first year that companies are obliged to report the amount of revenues, capital expenditures, and operating expenditures aligned with the EU taxonomy for sustainable activities. Moreover, companies need to report the amount of revenues that are eligible for evaluation of alignment with the taxonomy. Finally, companies have the option to also report revenues, capital expenditures, and operating expenditures in enabling or transitional activities.

We collect these data from Bloomberg for all companies that have reported as of the end of June 2023. We focus on companies in the Eurostoxx 600, as these companies represent the largest European companies and as a result, we expect that the quality of the disclosures will be robust given that these companies have the accounting resources, internal control systems, and regulatory, as well as market scrutiny, to produce reliable financial data. After removing firms that have no data on Bloomberg as of the end of June as well as all financial sector firms,[3] our sample includes 327 firms with reported eligible revenue data and 303 with reported aligned revenue data.

Descriptive Statistics

Eligible Activities

To be eligible as a sustainable activity, an economic activity should substantially contribute to at least one of the six environmental objectives of the Taxonomy. However, only activities that contribute to the first two environmental objectives – climate change mitigation and adaptation – have been formally adopted for 2022 fiscal year disclosures. In analyzing the disclosures, we find that almost all reported activities relate to mitigation rather than adaptation, so all the results speak to climate change mitigation.

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[3] Financial firms have distinct reporting requirements, such as the green asset ratio, instead of revenues, capital expenditures and operating expenditures, introducing incomparability in the metrics of analysis.

In our sample, a similar percentage of revenues and operating expenditures are eligible (~23%) while a much higher percentage of capital expenditures is eligible (~35%). This is the case across all sectors. Given that capital expenditures are towards longer-lived assets that are depreciated over long lifetimes, we interpret these results as evidence that companies are making longer-term investments in eligible activities, more so than activities that generate near-term revenues or that are supported by operating expenditures.

We find that eligible activities are the highest in the Real Estate and Utility sectors, followed by Materials and Industrials (Table 1 Panel A). Figure 1 shows graphically averages for the key three metrics. However, this sectoral decomposition obscures meaningful variation across industries within sectors. For example, despite a low level of eligible activities in Consumer Discretionary, the Automobile industry is the second highest industry in eligible revenues and the highest in expenditures (Panel B).

Aligned Activities

An eligible activity becomes taxonomy-aligned when it a) substantially contributes to one of the six economic activities in line with the Technical Screening Criteria (TSC), and b) does-no-significant-harm (DNSH) in relation to the other environmental objectives, and c) complies with minimum social safeguards (MSS) as described in the Taxonomy Regulation. For example, the manufacturing of energy efficiency equipment for buildings is an eligible activity. However, for the activity to be aligned, there are specific thresholds to be met: for windows, doors, roofing, and external wall systems, a U-value[4] less than or equal to 1.0, 1.2, 0.3, and 0.5 W/m^2K, respectively. Therefore, the percentage of revenues and expenditures aligned will be lower than those eligible.

The EU established a Technical Expert Group (TEG) on sustainable finance, consisting of experts from civil society, academia, business, and the finance sector, as well as additional observers from EU and international public bodies, tasked with developing recommendations for the technical screening criteria. The criteria are intended to be science-based, reflecting the best available evidence on what constitutes a substantial contribution to climate change mitigation or adaptation, while avoiding significant harm to other environmental objectives. The TEG's proposals underwent public consultation and were subject to scrutiny from various stakeholders to ensure broad consensus and applicability.

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[4] A U-value measures insulation performance, specifically it is the rate of heat transfer through a structure, scaled by the difference in temperature between either side of the structure.

Table 2, Panel A and Figure 2 show how much lower those are. On average, across all firms, the percentage of revenues aligned declines to ~8% from ~23% eligible. Similarly, the percentage of capital expenditures declines to ~15% from ~35% eligible. Moreover, all sectors experience very substantial declines. For example, Real Estate revenues decline by ~66%, from 90% eligible to 24% aligned. This represents the fact that many buildings do not meet the TSC on energy efficiency.

Figure 3, Panel A, shows clearly that aligned revenues are dramatically lower than eligible revenues across almost all industries. The further away is an industry from the 45-degree line, the further is an industry from translating eligible revenues to aligned. The few exceptions relate to companies in utility, energy equipment and services, and transportation infrastructure industries. Panel B presents a view of the gap between eligible and aligned revenues on average for each industry. Industries that score high on the chart, such as automobiles, real estate, construction, and mining, have significantly more room to expand their aligned revenues.

Figure 4 shows that the coefficient of variation increases substantively for aligned versus eligible activities, as most industries fall below the 45-degree line. This reflects the fact that eligibility is driven more by industrial membership, but firm-level factors significantly influence whether activities are aligned or not. For example, in the real estate sector, leasing and development of buildings are eligible activities. However, the energy efficiency of buildings reflects Real Estate Development and Management firm strategies regarding insulation, glass materials used, heating and cooling equipment efficiency, energy generation, and building automation processes.

Table 2 Panel B shows the top industries in terms of alignment. As expected, Electric Utilities and Multi-Utilities score high given the industry's focus on electricity generation from renewable energy and energy storage. However, other industries—such as Transportation Infrastructure and Building Products—are less intuitive, and therefore we analyze company disclosures for examples of aligned activities. In the case of Transportation Infrastructure, aligned activities include electric rail infrastructure; for Building Products, examples include wall or roof insulation products.

Additionally, we find that aligned capital expenditures exceed aligned revenues. This finding suggests that some Capex is either not revenue-generating but rather cost or risk mitigating (for example, investing to insulate buildings or to retrofit processes and energy efficiency

equipment in factories), or that Capex is leading revenues, with companies investing to generate revenues that have yet to materialize (for example, investing in manufacturing plants to produce batteries for electric vehicles). Capex alignment is particularly high in the Utilities, Real Estate, Energy, Consumer Discretionary, Materials, and Industrials sectors. Unlike aligned Capex, aligned operating expenditures (Opex) are at a similar level as aligned revenues.

Finally, we find that climate change adaptation revenue is scarce, with only a few companies in the Industrials, Communication Services, and Consumer Discretionary sectors generating revenue from related services. Similarly, most investments are directed towards climate mitigation rather than climate adaptation. Of those firms with some adaptation-related capital expenditures, most are in the Real Estate sector.

Enabling and Transitional Activities

The Taxonomy allows a firm to report two additional types of activities: transitional and enabling activities. Transitional activities support the transition to a low carbon economy but do not qualify as aligned. For example, the manufacturing of soda ash is a transitional activity if the greenhouse gas emissions (GHG) during production are less than 0.789 per tonne of product. Similarly, the manufacturing of carbon black, aluminum, steel, and cement classify as transitional activities if they are produced with less GHG per tonne of product than the threshold set by the Taxonomy. Enabling activities facilitate the aligned activities. For example, the construction and operation of facilities that store electricity, such as pumped hydropower storage, are considered enabling activities.

Table 3, Panel A, shows that enabling activities primarily exist in Utilities and sporadically in other sectors, such as Materials. Within industries, we observe enabling activities in perhaps unexpected industries. For example, in Semiconductors, companies report enabling activities through the design and manufacturing of energy efficient equipment. Moreover, transitional activities are reported in Utilities, Real Estate and Materials (Table 4, Panel A). For example, in the case of Steel companies, using scrap-based steel with electric arc furnaces is a transitional activity. For Construction Materials firms, producing clay blocks is considered transitional.

In terms of expenditures, enabling Capex is mostly observed in the Utilities, Automobiles, Building Products, Construction Materials, and Paper and Forest Products industries. Transitional Capex is concentrated in Real Estate, Utilities, and Materials sectors. Moreover, we find that

enabling Opex is higher than transitional Opex, with significant enabling Opex observed in the Construction Materials, Utilities, and Automobiles industries.

The Aligned Revenue-Investment Relation

We expect a positive correlation between aligned revenues and investments. Firms that invest to build manufacturing plants and hire people to produce products that are aligned with the EU taxonomy should exhibit higher revenues from aligned activities. For example, an automobile company that invests to build a manufacturing plant that produces electric vehicles and to hire electrical engineers for battery optimization and integration in the vehicles should exhibit higher revenues from the sales of electric vehicles.

However, there are two reasons why we expect the revenue and investment relation to be attenuated in our empirical model. First, not all aligned expenditures are revenue generating. Some expenditures are not going to generate revenues but rather they are directed towards reducing the carbon emissions of a firm. For example, powering the paint shop in an automobile manufacturing plant with electricity from renewable energy instead of natural gas. Second, some expenditures might not produce revenues yet. Following the same example, the automobile manufacturer might not be selling any vehicles yet, with the expenditures leading to futures sales. Therefore, the observed empirical relation between aligned revenues and expenditures is likely to be smaller than the relation if one was able to identify revenue-targeting investments and measure revenues generated over a multiyear period. Table 5 shows the estimated coefficients on a model that has as a dependent variable aligned revenues and as key independent variables aligned expenditures. We log transform all variables so the coefficients can be interpreted as measures of elasticity. We control for industry fixed effects to allow estimates to be derived only from within industry variation. We find that for every 1% increase in capital and operating expenditures, revenues increase by 0.888%.

However, combining capital and operating expenditures obscures the strength of the relation with revenues across the two types of expenditures. Estimating separately the relation with capital and operating expenditures we find a larger coefficient on the latter. A 1% increase in operating expenditures is associated with a 0.822% increase in revenues while a 1% increase in capital expenditures contributes another 0.387%. The higher association with operating expenditures is sensible given that capital expenditures can be recognized as an asset because they

will lead to future economic benefits, consistent with the definition of an asset in financial accounting standards.

Estimating sector-specific models for the three sectors with the highest number of observations, we find that the estimated coefficients on expenditures vary significantly across sectors. For example, in both materials and consumer discretionary, a 1% increase in operating expenditures is associated with a 1.3% increase in revenues. Capital expenditures do not exhibit a significant association with revenues. In contrast, in industrials capital expenditures exhibit a significant association with revenues. A 1% increase in capital expenditures is associated with a 0.647% increase in revenues. A 1% increase in operating expenditures is associated with a 0.533% increase in revenues.

Fundamental Analysis

Given the significant variation in firm alignment with the taxonomy, we explore whether companies with higher alignment exhibit different business fundamentals. To keep the analysis tractable, we focus on two fundamental aspects of the business: growth and profit. We use 1, 3 and 5-year revenue growth as our growth metrics. We use operating profit margin and return on assets (ROA) as our profit metrics.

If sustainable products experience higher growth or they command premium prices for equal production costs, then we expect companies with higher alignment to exhibit stronger fundamentals. In contrast, if demand for sustainable products is weak, or if their production requires higher costs, then we expect companies with higher alignment to exhibit weaker fundamentals.

In some industries, the percentage of activities classified as sustainable is very small for all companies. In those industries, it would be rather impossible for such a small part of a firm's activities to generate differential sales growth or operating profitability. Therefore, to increase the power of our test, we focus on a subset of industries where there is at least one firm with 10% or greater aligned revenues. This cuts our sample by a little more than half.

Table 6 shows that the alignment metrics are not significantly associated with past sales growth after controls for GICS industry fixed effects and starting period level of sales. We control for the latter given that it might be easier to grow more from smaller levels of sales. Moreover, the association with profitability margins is insignificant. This suggests that firms that are selling

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products and services aligned with sustainable activities have not been growing at lower or higher rates nor that their cost and pricing structures have been generating lower profitability ratios.

For enabling and transitional metrics, we find a negative and significant correlation with both past 1-year sales growth and ROA. In unreported results, we separately analyze enabling and transitional metrics and find that the negative association is driven by enabling activities. Firms with more enabling activities, primarily coming from utilities (electric, gas, and multi), machinery, automobiles, semiconductors, chemicals, and electrical equipment industries, are growing at a slower rate and earning a lower rate of return on their assets. While such activities are important in that they enable the implementation of climate solutions that can reduce carbon emissions they do not reduce carbon emissions directly. Companies that engage in more enabling activities do not seem to be adequately compensated so far for the investments they make in terms of profitability or sales growth. In contrast, transitional activities are associated with superior sales growth in some of the unreported models.

Corporate Valuation Multiples

Following the fundamental analysis, we analyze if firms with greater alignment with sustainable activities are trading at higher or lower valuation multiples. For example, if investors expect that alignment with sustainable activities might make a firm less risky or that it exposes a firm to future superior business growth, these firms might trade at higher multiples. In contrast, if investors expect that these activities will not experience growth and that these firms are investing resources that will not be monetized later, they might assign lower valuation multiples to those firms.

For this analysis, we focus on two widely used valuation ratios: the price-to-book equity value ratio (PTB) and the price-to-earnings ratio (PE). We control for GICS industry fixed effects, logarithm of market capitalization, past 3-year sales growth, and in the case of PTB also for ROA.

Table 7 shows that firms with higher alignment exhibit no difference in valuation multiples. Across all specifications, none of the estimated coefficients on the Taxonomy variables is significant. This is the case for both PTB and PE.

Are Taxonomy Data Predicted by Existing Data?

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In this section, we explore whether the new disclosures are predicted by three data types. First, data from models that rely on business segment disclosures and their classifications as sustainable or not. Second, environmental ratings provided by commercial entities. Third, carbon emission metrics reported by companies. If existing data are sufficient to characterize the activities of a company and their positioning relative to competitors, then the disclosure requirements could be obsolete.

Model Prediction Errors: Estimated vs Reported Data

Bloomberg provides estimates of the percentage of revenues for a company that might qualify as eligible activities. This is calculated as the sum of each company's total revenue percentage within an eligible BICS (Bloomberg Industry Classification) code. If business segment disclosures and their assessment as sustainable activities or not are accurate, then we would expect very small difference between predicted and reported percentage of eligible revenues.

Figure 5 shows that this is far from being the case. On average, prediction errors are large with models overestimating eligible revenues across all industries. The degree of overestimation is most dramatic in Information Technology, Communication Services, Industrials, and Utilities. Large, but smaller, prediction errors exist in Materials, Energy, and Consumer Discretionary. The models perform much better in Healthcare, Consumer Staples, and Real Estate. In the case of Healthcare and Consumer Staples, this is because a very small percentage of revenues is typically eligible, while the opposite is true for Real Estate.

In summary, we observe that business segment disclosures and their classification to sustainable activities would lead to large overestimation of eligible activities.

Correlation with Environmental Data

Table 8 shows the correlation between the Taxonomy financial data and nonfinancial data. Specifically, we consider carbon emissions from MSCI and environmental ratings from MSCI and Refinitiv, two widely used rating providers. We divide all carbon emission data by firm revenues to create intensity measures that are comparable across companies of different size.

We expect that these nonfinancial data will be only moderately correlated with the Taxonomy financial data, but we are interested in understanding the magnitude of those correlations. We expect a relatively low correlation because it is unlikely that these data are sufficient proxies for a company's revenues from sustainable activities or how much they allocate in capital or operating expenditures. For example, a company might have very low carbon

emissions in its supply chain, operations, or from the after-sale use of the product, but still generate a low amount of revenues from sustainable activities. Similarly, a company might have a very strong environmental rating because it has a low exposure to environmental risks and a strong management of them, but little in revenues or expenditures to sustainable activities.

Nevertheless, there are reasons to expect a moderate correlation. For example, environmental ratings will consider firm investments in sustainable activities, or the amount of revenues generated from them. In the absence of disclosure, of course, qualitative judgments need to be made about the magnitude of those. Similarly, a firm that might have lower emissions from product use and end of life management might be more likely to have higher revenues from sustainable activities as products with these characteristics will be more likely to qualify.

Table 8 shows correlations both across industries and within industry (after industry demeaning all the data). Overall, the correlations are moderate and smaller within, rather than across, industries. For environmental ratings, the correlation is in the 0.15 range, and it declines to less than 0.1 for the industry adjusted metrics. The correlation with carbon emission metrics is somewhat higher but still moderate. Scope 1 exhibits a stronger correlation than scope 2 and 3. The highest correlations are between scope 1 emissions intensity and operating expenditures in aligned, enabling and transitional activities when we do not industry adjust the metrics.

In Figure 6 we perform a more targeted analysis to understand the disclosure regulation's objective to "prevent greenwashing and to help investors identify economic activities in line with our environmental and climate objectives."[5] Specifically, we visualize the correlation between environmental ratings and Taxonomy data for firms in industries where climate change is the biggest driver of the rating.[6] This includes industries, such as mining and metals, oil and gas, construction materials, chemicals, and marine transportation. We exclude the rest of the firms, as companies might be receiving high environmental ratings because of low exposure to climate risks rather than strong management of them (which would give rise to high expenditure).

Several key insights emerge from this analysis. First, there is almost a complete absence of companies that score below 50% on the scale of the ratings, even though many of those firms have close to zero Taxonomy aligned, enabling and transitional revenues or expenditures. This is

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[5] EU Commission.
[6] Specifically, using MSCI carbon exposure data item we keep a subsample of firms that belong in a GICS industry with at least 50% carbon exposure.

consistent with most firms taking the necessary actions in adopting and disclosing policies, targets, and other commitments to gain a minimum level of score by rating providers and that those frameworks allow a firm to reach half of the total possible score without satisfying any of the technical and other criteria in the Taxonomy. Second, most firms plot in the area of "greenwashing risk," the upper left-hand quadrant in the figure. These firms receive high ratings but have close to zero revenues or expenditure. Strikingly, some firms receive close to perfect score while having close to zero aligned revenues or expenditures. Third, a small number of firms plot in the upper right-hand quadrant, having high ratings and higher levels of Taxonomy data, with more firms included in this category when we use expenditures rather than revenues as the Taxonomy metric. This reflects that ratings are more likely to be measures of climate risk management rather than provision of climate solutions products and services that allow customers to reduce carbon emissions.

In summary, we find only moderate correlation between Taxonomy financial data and existing environmental data. Combining these results with the results from the prediction models, we infer that the disclosure requirements are needed to characterize a company's revenues and investments in sustainable activities.

Discussion

We have analyzed data from more than 300 large European companies on their first year of mandatory corporate disclosure of financial accounting data that characterize whether their activities are sustainable or not based on technical criteria. We reach several conclusions based on the analysis of this dataset.

First, our data suggests that because of the technical criteria set forward by the EU Taxonomy, only a small percentage of business activities align with the taxonomy as shown in Table 2. This is consistent with the EU taxonomy setting a 'high bar' for what constitutes a sustainable activity. However, we expect that over time, the percentage of activities will increase, as companies are transitioning their investments and products towards activities that align with the taxonomy. In other words, we expect that the gap we document in Figure 3 to shrink over time.

Second, we observe significant differences in the percentage of activities that are aligned with the taxonomy across competitors, suggesting that some firms are much faster and willing than others to align their activities. However, we find little evidence in Tables 6 and 7 that efforts to

attain alignment can observably translate into benefits in operating performance or market valuation multiples at the time of the analysis nor that firms that chose to align more with the taxonomy have put themselves at a competitive disadvantage so far. Perhaps in the future, as product and capital markets reward alignment with sustainable activities, companies with higher alignment will grow their revenues faster, enjoy higher profitability margins, and trade at higher valuation multiples. An indication that this might be the case would be the estimated coefficients on investments in Table 5 to increase over time, suggesting that aligned investments translate at a higher rate to revenues.

Third, we find little evidence that existing data are correlated with alignment metrics. Analyzing correlations with carbon emission metrics and environmental ratings reveals very weak relationships. We infer that carbon emission metrics serve a distinct purpose compared to alignment metrics. Carbon emission metrics provide a measure of the total carbon emissions produced in the value chain of a company. This in turn provides a measure of the contribution of the operations of a company, its supply chain, and the use of its products to the challenge of climate change, while at the same time gauging a degree of exposure to risks arising from the transition to a low carbon economy as a result of regulatory (i.e., carbon taxes or cap and trade systems) or market changes (i.e., shift to lower carbon products by customers). In contrast, alignment metrics represent the extent to which an organization's products and services can be classified as sustainable and its investments are directed towards sustainable activities. Regarding the low correlation with environmental ratings, we expect that the increase in available data of EU taxonomy aligned activities will likely increase that correlation as rating agencies will integrate such data into their own rating processes. In other words, we expect over time the dots in the scatter plots in Figure 6 to populate the non-red area.

Figure 1: Eligible Revenues and Expenditures by Sector

Eligible Percent (Average)
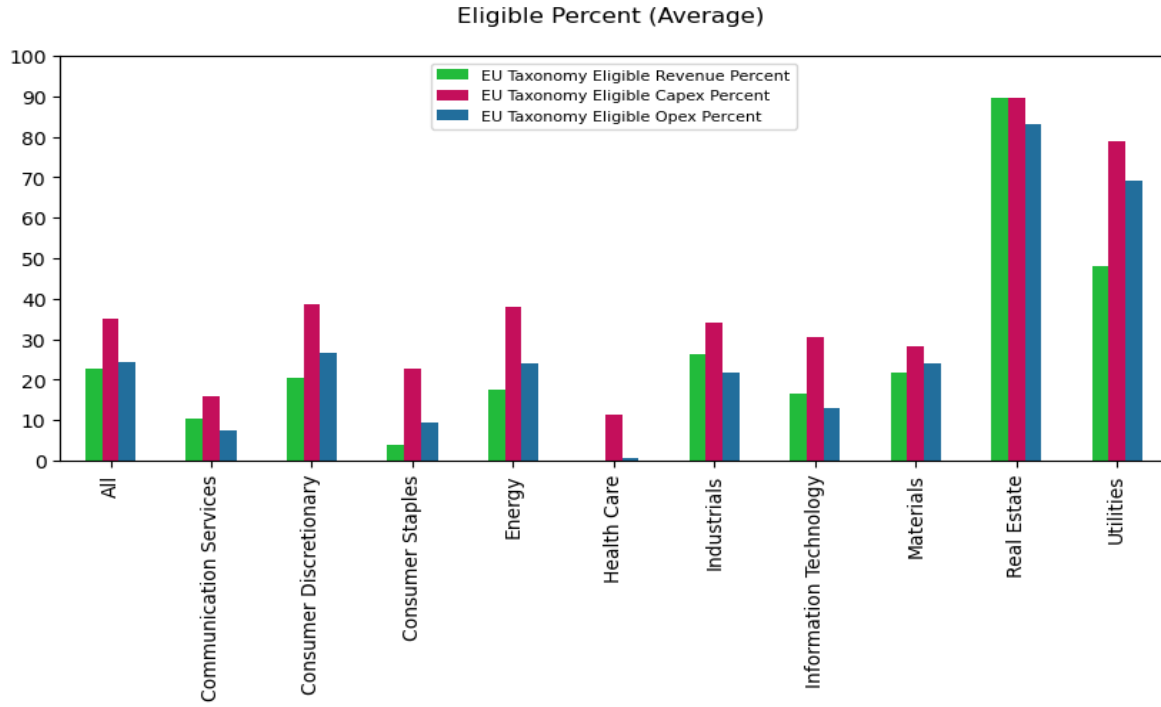
Figure 2: Aligned Revenues and Expenditures by Sector

Aligned Percent (Average)
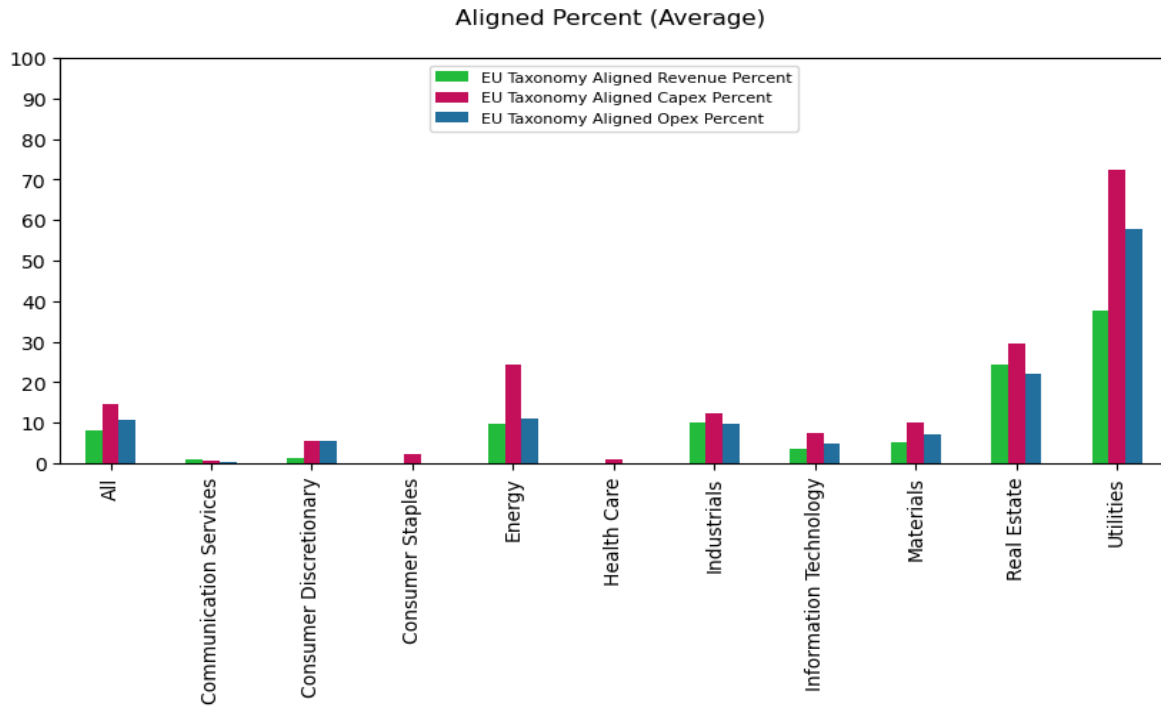
Figure 3: Eligible vs Aligned Revenues across Industries

Panel A: Industry-level Eligible-to-Aligned Scatter Plot
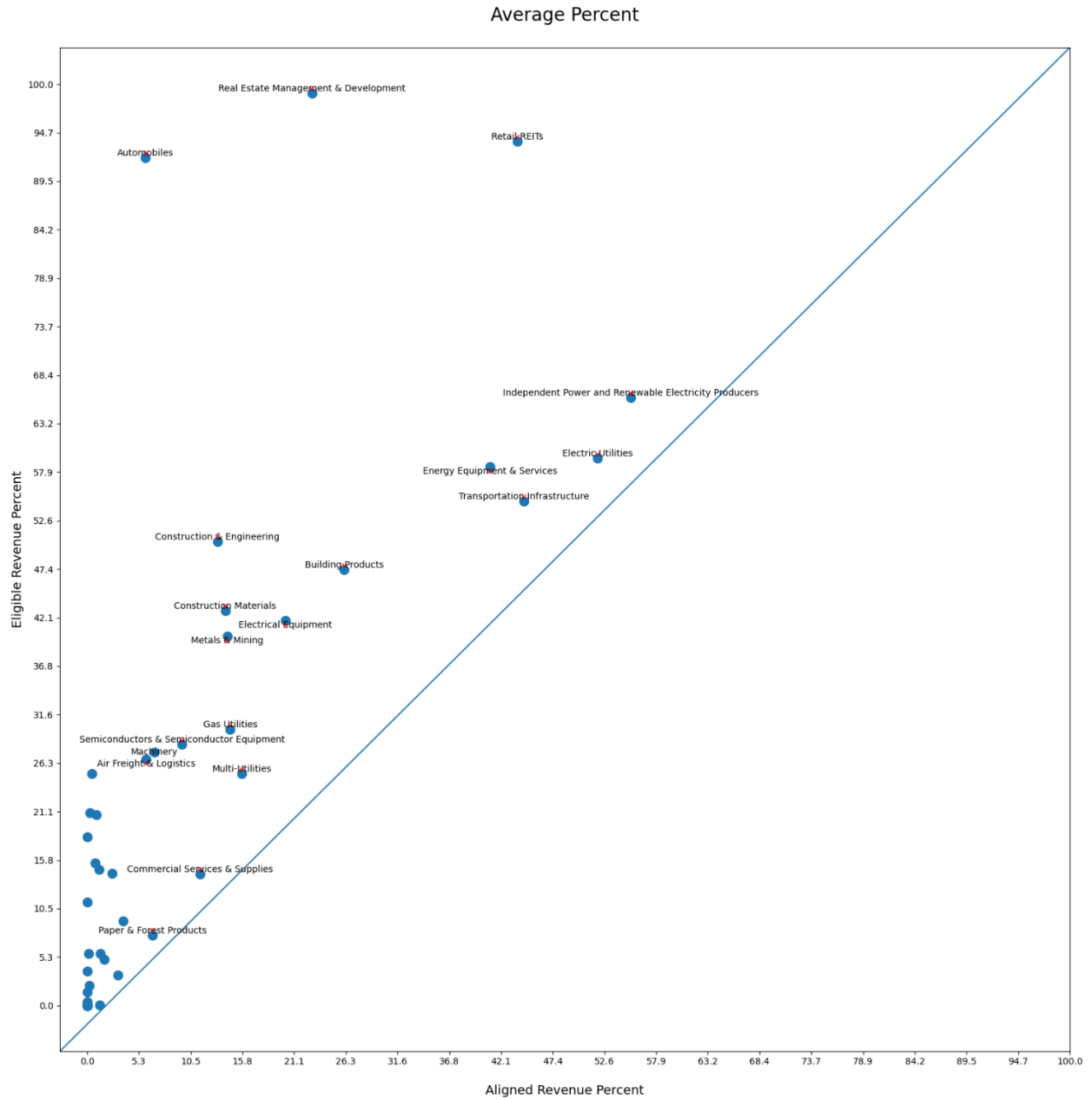
Panel B: Industry-level Eligible-to-Aligned Gap Bar Chart

Aligned vs Eligible Revenue Percent
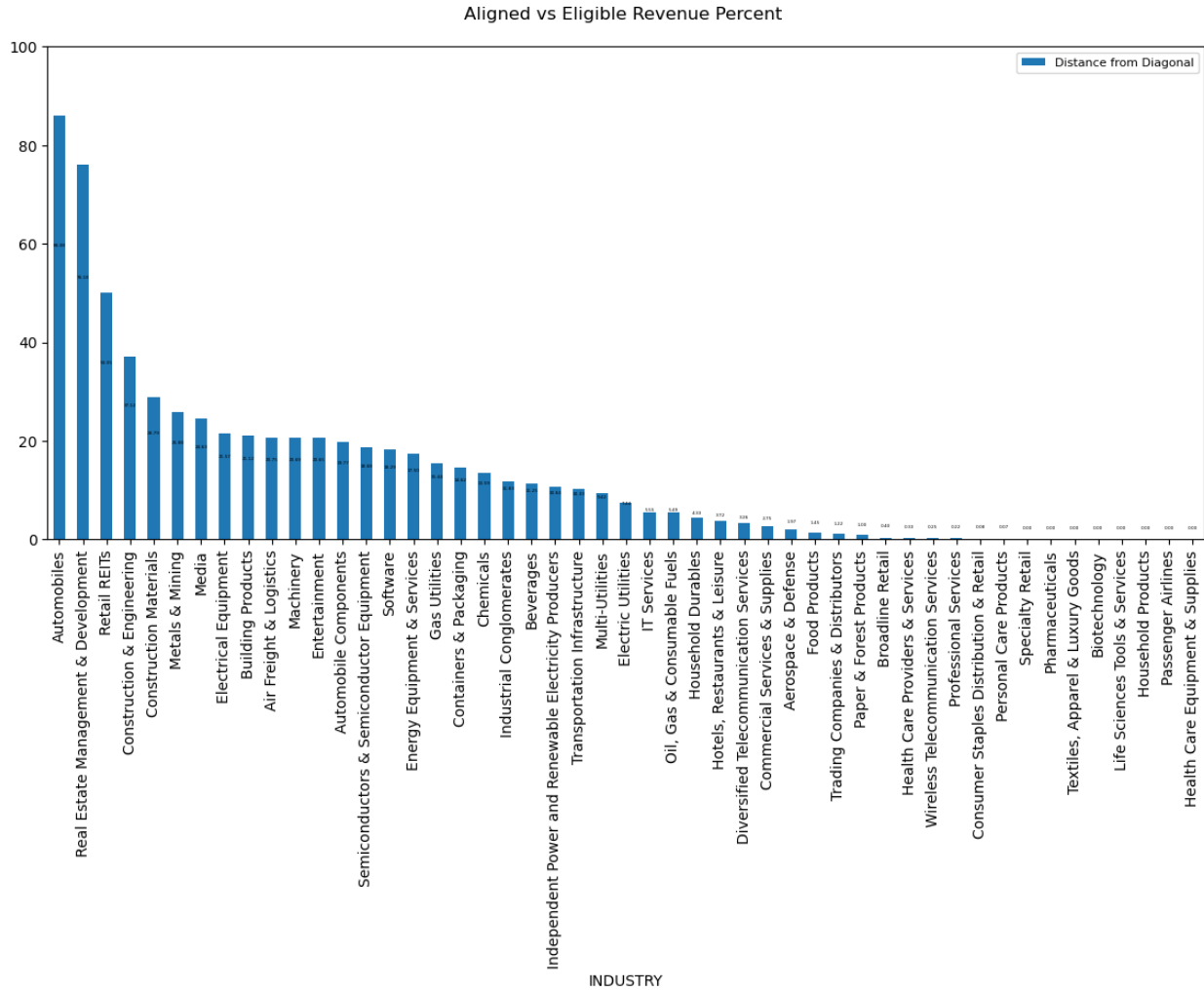
Figure 4: Aligned vs Eligible – Coefficient of Variation across Industries

Coefficient Of Variation
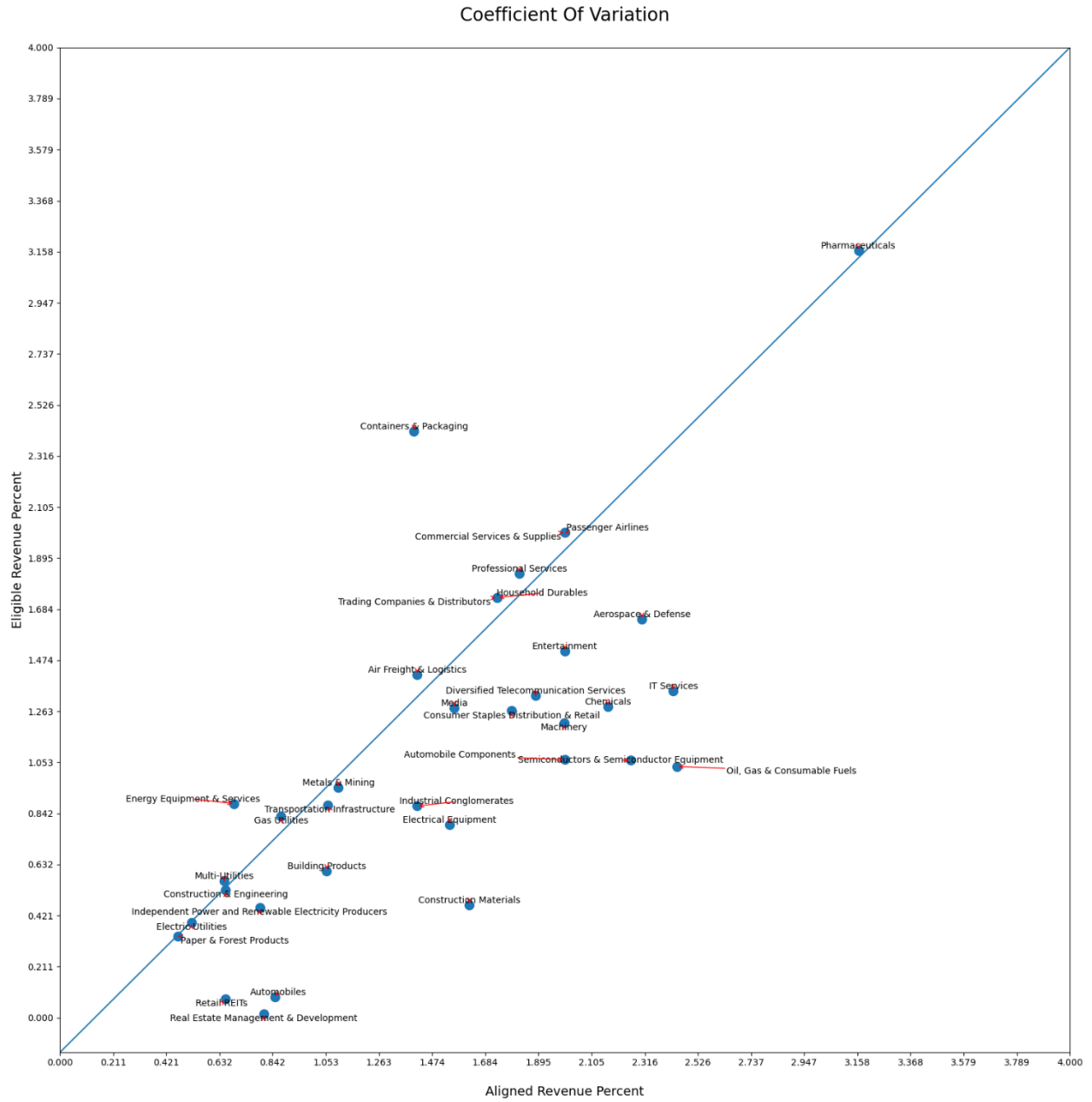
Figure 5: Difference between Estimated and Actual Reported Eligible Revenues
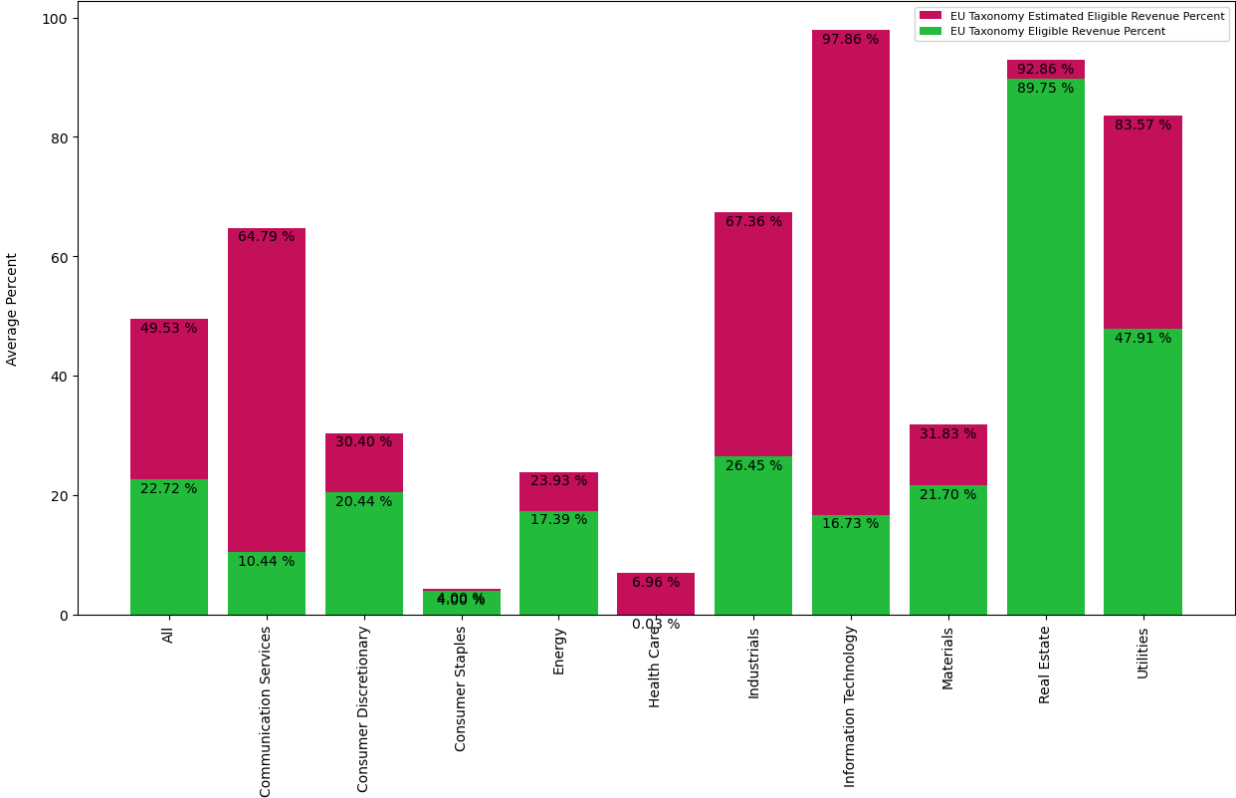
Figure 6: Views of Greenwashing Risk
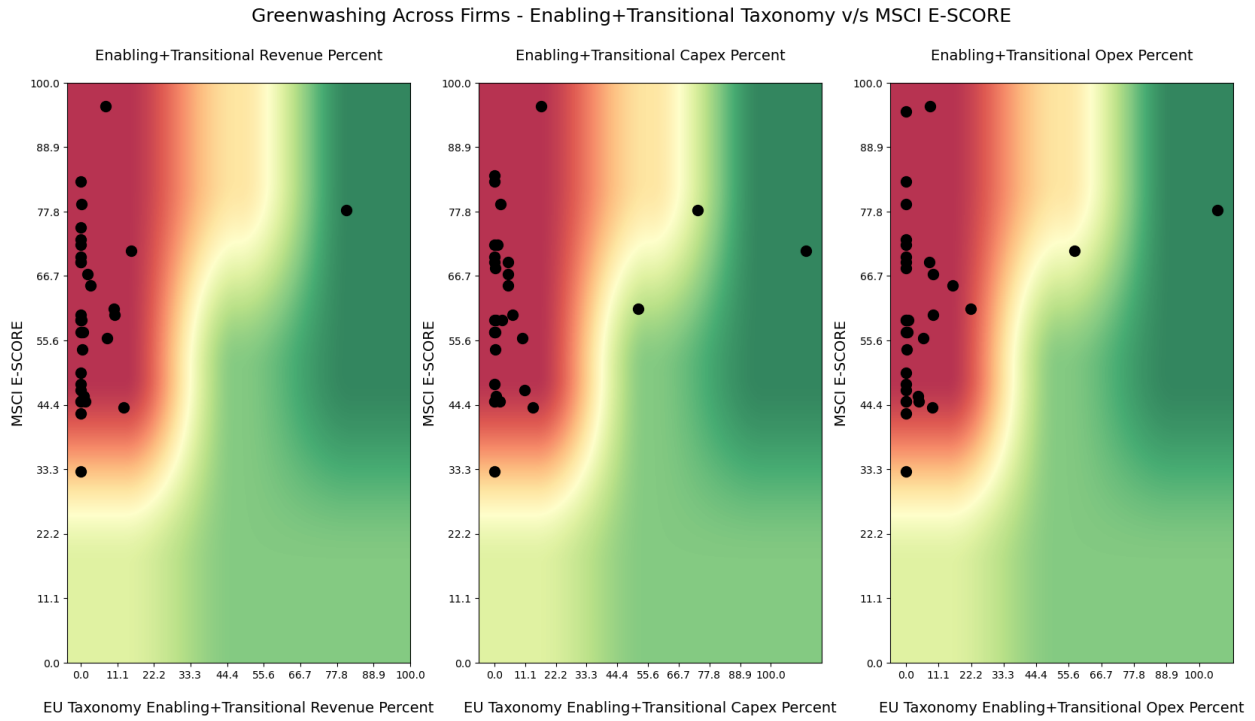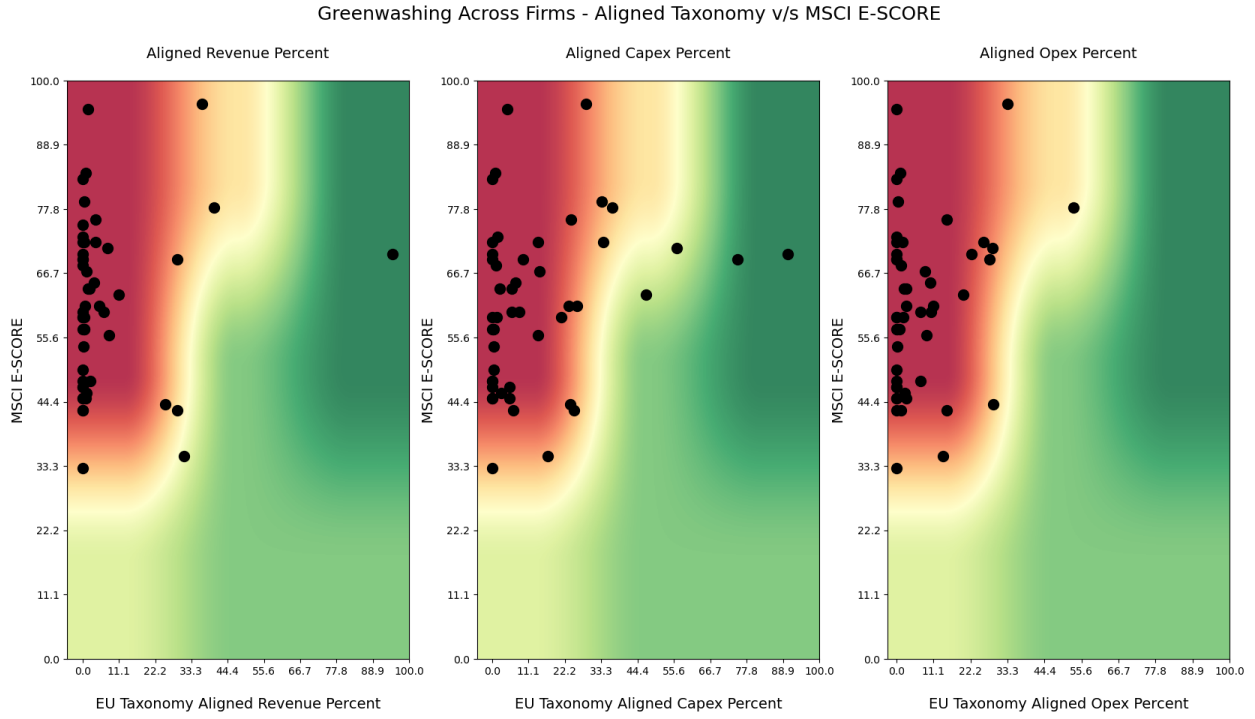
Greenwashing Across Firms - Aligned Taxonomy v/s MSCI E-SCORE

Aligned Revenue Percent | Aligned Capex Percent | Aligned Opex Percent

Greenwashing Across Firms - Enabling+Transitional Taxonomy v/s MSCI E-SCORE

Enabling+Transitional Revenue Percent | Enabling+Transitional Capex Percent | Enabling+Transitional Opex Percent

Greenwashing Across Firms - Aligned Taxonomy v/s Refinitiv E-Score

Aligned Revenue Percent / Aligned Capex Percent / Aligned Opex Percent

Greenwashing Across Firms - Enabling+Transitional Taxonomy v/s Refinitiv E-Score

Enabling+Transitional Revenue Percent / Enabling+Transitional Capex Percent / Enabling+Transitional Opex Percent

Note: Only Industries with significant exposure to Carbon Emissions (equal or greater than 50%) as determined by the MSCI IVA ratings are included.

Table 1 Panel A: Eligible Revenues and Expenditures by Sector

Sector	Revenues (%)			Capital Expenditures (%)			Operating Expenditures (%)		
	N	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.
All	327	22.65	32.61	323	35.05	33.94	321	24.32	34.12
Communication Services	23	10.44	19.55	23	15.95	24.92	22	7.48	13.53
Consumer Discretionary	43	20.44	35.99	43	38.72	37.36	43	26.78	38.20
Consumer Staples	27	3.79	17.30	27	22.64	24.09	27	9.37	25.07
Energy	12	17.39	26.17	12	37.90	29.72	12	23.90	24.84
Health Care	34	0.03	0.17	34	11.38	14.58	34	0.78	3.28
Industrials	81	26.45	31.91	79	34.16	30.51	79	21.92	31.17
Information Technology	25	16.73	24.32	24	30.47	29.72	24	13.07	20.75
Materials	42	21.70	28.20	42	28.29	27.67	41	24.05	28.90
Real Estate	14	89.75	26.53	13	89.51	27.75	14	83.27	35.96
Utilities	26	47.91	27.17	26	79.06	19.62	25	69.08	24.49

Table 1 Panel B: Top 10 Industries for Eligible Revenues or Expenditures

	Revenues (%)				Capital Expenditures (%)				Operating Expenditures (%)			
	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.
1	Real Estate Management & Development	10	99.04	1.47	Automobiles	8	97.54	5.17	Automobiles	8	98.05	4.89
2	Automobiles	8	92.01	7.76	Real Estate Management & Development	9	96.35	8.21	Real Estate Management & Development	10	96.90	8.28
3	Independent Power and Renewable Electricity Pr...	3	65.97	29.92	Independent Power and Renewable Electricity Pr...	3	95.28	6.33	Electric Utilities	12	81.62	14.00
4	Electric Utilities	13	59.38	23.26	Electric Utilities	13	87.64	11.29	Independent Power and Renewable Electricity Pr...	3	72.02	35.97
5	Transportation Infrastructure	3	54.76	48.03	Gas Utilities	5	66.45	12.65	Multi-Utilities	5	55.36	14.11
6	Construction & Engineering	8	50.38	26.49	Multi-Utilities	5	59.61	27.09	Gas Utilities	5	50.93	32.97
7	Building Products	5	47.28	28.60	Electrical Equipment	9	59.00	29.36	Construction Materials	3	49.43	24.78
8	Construction Materials	4	42.83	19.90	IT Services	6	55.88	13.87	Building Products	5	44.98	34.41
9	Electrical Equipment	9	41.76	33.25	Transportation Infrastructure	3	55.44	44.20	Metals & Mining	8	44.20	39.79
10	Metals & Mining	8	40.11	38.03	Construction Materials	4	49.55	26.84	Electrical Equipment	9	41.73	29.43

Table 2 Panel A: Aligned Revenues and Expenditures by Sector

Sector	Revenues (%)			Capital Expenditures (%)			Operating Expenditures (%)		
	N	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.
All	303	8.19	18.13	285	14.59	25.12	295	10.69	21.64
Communication Services	21	1.02	2.44	20	0.65	1.27	20	0.44	1.81
Consumer Discretionary	40	1.38	3.26	40	5.63	10.40	40	5.43	12.44
Consumer Staples	26	0.01	0.02	24	2.42	4.82	26	0.03	0.12
Energy	12	9.90	18.70	12	24.21	23.02	12	11.07	17.18
Health Care	34	0.00	0.01	28	0.87	2.59	32	0.03	0.18
Industrials	78	10.04	19.35	72	12.27	20.04	75	9.74	18.53
Information Technology	19	3.59	13.45	17	7.51	13.48	17	4.89	17.74
Materials	35	5.09	10.16	34	10.15	15.09	35	7.00	11.79
Real Estate	13	24.22	20.23	13	29.56	26.23	13	22.21	21.12
Utilities	25	37.62	29.85	25	72.30	25.95	25	57.77	28.69

Table 2 Panel B: Top 10 Industries for Aligned Revenues or Expenditures

	Revenues (%)				Capital Expenditures (%)				Operating Expenditures (%)			
	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.
1	Independent Power and Renewable Electricity Pr...	3	55.33	43.76	Independent Power and Renewable Electricity Pr...	3	93.56	9.17	Electric Utilities	12	71.50	18.69
2	Electric Utilities	12	51.94	27.02	Electric Utilities	12	84.37	15.11	Independent Power and Renewable Electricity Pr...	3	67.08	42.24
3	Transportation Infrastructure	3	44.43	47.14	Multi-Utilities	5	51.73	26.22	Multi-Utilities	5	44.86	16.17
4	Building Products	5	26.16	27.63	Gas Utilities	5	51.17	28.64	Gas Utilities	5	32.15	34.11
5	Real Estate Management & Development	9	22.86	18.44	Transportation Infrastructure	3	41.29	44.21	Building Products	5	31.88	36.56
6	Electrical Equipment	8	20.19	31.16	Electrical Equipment	8	29.53	28.74	Automobiles	8	24.99	17.49
7	Multi-Utilities	5	15.72	10.23	Building Products	5	28.64	27.83	Electrical Equipment	8	24.68	31.73
8	Gas Utilities	5	14.55	12.74	Paper & Forest Products	4	28.25	17.17	Real Estate Management & Development	9	22.00	16.50
9	Metals & Mining	6	14.23	15.69	Construction Materials	3	20.33	18.03	Construction Materials	3	19.03	29.60
10	Construction Materials	3	14.03	22.75	Real Estate Management & Development	9	19.88	15.42	Transportation Infrastructure	3	18.60	17.02

Table 3 Panel A: Enabling Revenues and Expenditures by Sector

	Revenues (%)			Capital Expenditures (%)			Operating Expenditures (%)		
	N	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.
All	256	4.40	13.49	225	6.89	16.91	246	6.27	16.88
Communication Services	20	0.71	1.87	19	0.50	0.94	20	0.44	1.81
Consumer Discretionary	39	1.31	3.26	32	4.60	10.94	35	5.27	13.03
Consumer Staples	25	0.00	0.01	21	0.35	0.63	24	0.00	0.02
Energy	8	0.37	0.46	7	1.27	0.94	7	1.60	2.00
Health Care	34	0.00	0.01	26	0.62	2.56	32	0.03	0.18
Industrials	65	7.13	15.32	60	7.97	15.97	66	6.88	15.52
Information Technology	18	3.68	13.35	11	4.50	11.52	16	5.15	18.11
Materials	24	2.91	8.31	22	6.41	14.50	23	4.68	12.31
Real Estate	2	0.01	0.02	6	2.10	1.60	2	0.00	0.00
Utilities	21	21.89	29.48	21	32.36	33.45	21	33.02	33.00

Table 3 Panel B: Top 10 Industries for Enabling Revenues or Expenditures

	Revenues (%)				Capital Expenditures (%)				Operating Expenditures (%)			
	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.
1	Electric Utilities	11	35.43	35.76	Electric Utilities	11	48.75	34.72	Electric Utilities	11	45.81	34.25
2	Electrical Equipment	8	20.19	31.16	Electrical Equipment	8	29.03	28.94	Automobiles	7	25.66	18.78
3	Construction & Engineering	5	11.70	10.33	Multi-Utilities	4	21.99	32.82	Electrical Equipment	8	24.68	31.73
4	Commercial Services & Supplies	4	10.00	20.00	Automobiles	7	19.89	16.19	Multi-Utilities	4	23.91	29.49
5	Semiconductors & Semiconductor Equipment	7	9.36	21.06	Building Products	3	12.40	19.77	Gas Utilities	4	22.09	31.58
6	Gas Utilities	4	9.21	8.64	Gas Utilities	4	7.49	10.60	Semiconductors & Semiconductor Equipment	7	11.77	26.99
7	Multi-Utilities	4	7.54	3.78	Semiconductors & Semiconductor Equipment	7	7.07	14.14	Machinery	22	7.66	14.12
8	Machinery	22	6.85	13.75	Machinery	20	6.94	13.06	Building Products	3	5.80	9.87
9	Building Products	3	6.60	8.96	Chemicals	12	5.21	16.18	Aerospace & Defense	6	4.27	10.16
10	Automobiles	8	5.90	5.01	Construction & Engineering	6	4.63	3.84	Construction & Engineering	7	3.11	6.14

Table 4 Panel A: Transitional Revenues and Expenditures by Sector

	Revenues (%)			Capital Expenditures (%)			Operating Expenditures (%)		
	N	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.
All	200	0.82	4.07	168	2.31	9.25	197	0.71	3.86
Communication Services	14	0.09	0.27	15	0.18	0.67	18	0.00	0.01
Consumer Discretionary	34	0.01	0.04	27	0.50	1.64	30	0.17	0.93
Consumer Staples	24	0.00	0.00	18	0.42	1.42	23	0.00	0.00
Energy	4	0.01	0.01	6	1.72	2.50	4	0.23	0.45
Health Care	33	0.00	0.00	23	0.05	0.13	30	0.00	0.00
Industrials	42	0.47	1.73	36	1.27	3.98	45	0.28	1.13
Information Technology	14	0.00	0.00	10	0.30	0.95	14	0.00	0.00
Materials	24	3.46	8.78	18	5.44	8.64	22	2.84	6.23
Real Estate	3	7.20	12.47	6	15.20	28.32	3	0.00	0.00
Utilities	8	4.87	9.13	9	12.86	26.75	8	7.31	14.69

Table 4 Panel B: Top 10 Industries for Transitional Revenues or Expenditures

	Revenues (%)				Capital Expenditures (%)				Operating Expenditures (%)			
	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.	Industry	N	Mean	St. Dev.
1	Metals & Mining	6	12.80	14.56	Metals & Mining	5	11.56	10.94	Electric Utilities	4	14.28	19.34
2	Electric Utilities	4	9.50	11.70	Electric Utilities	4	8.45	11.97	Metals & Mining	6	8.55	10.17
3	Commercial Services & Supplies	4	1.25	2.50	Real Estate Management & Development	3	3.64	5.21	Chemicals	11	0.66	1.51
4	Machinery	15	0.69	2.58	Consumer Staples Distribution & Retail	4	1.78	2.86	Machinery	17	0.54	1.74
5	Construction & Engineering	3	0.68	0.72	Oil, Gas & Consumable Fuels	6	1.72	2.50	Textiles, Apparel & Luxury Goods	10	0.51	1.61
6	Chemicals	13	0.35	1.10	Chemicals	10	1.61	3.29	Passenger Airlines	3	0.43	0.74
7	Multi-Utilities	4	0.24	0.32	Machinery	14	1.53	4.83	Multi-Utilities	4	0.34	0.52
8	Diversified Telecom Services	6	0.18	0.40	Textiles, Apparel & Luxury Goods	8	1.44	2.83	Oil, Gas & Consumable Fuels	4	0.23	0.45
9	Professional Services	4	0.10	0.20	Automobiles	3	0.67	1.15	Diversified Telecom Services	9	0.00	0.01
10	Automobiles	4	0.06	0.11	Diversified Telecommunication Services	7	0.38	0.98	Aerospace & Defense	4	0.00	0.00

Table 5: Aligned Investments and Revenues

	Aligned Revenue Amount				
	All Sectors		Consumer Discretionary	Materials	Industrials
Aligned Capex + Opex	0.888**	-	-	-	-
Aligned Capex	-	0.387**	0.008	0.115	0.647**
Aligned Opex	-	0.822**	1.330**	1.322**	0.533**
Industry effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.802	0.849	0.860	0.908	0.754
N	277	277	40	33	71

Both dependent and independent variables are measured as the logarithm of one plus total amount in euros reported by companies. * $p<.05$, ** $p<.01$

Table 6 Panel A: Alignment Metrics and Operating Performance

Alignment Metric	Operating Profit Margin						Return On Assets					
Aligned Revenues	0.073*						-0.025					
Aligned Capex		-0.064						-0.028				
Aligned Opex			0.031						-0.024			
Enabling + Transitional Revenues				0.038						-0.055*		
Enabling + Transitional Capex					0.004						-0.046*	
Enabling + Transitional Opex						0.021						-0.046*
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.49	0.474	0.475	0.381	0.481	0.364	0.446	0.546	0.442	0.454	0.497	0.48
N	128	122	127	105	100	105	128	122	127	105	100	105

Independent variables are measured as the % of revenues, capital expenditures or operating expenditures reported by companies.

* $p<.05$, ** $p<.01$

Table 6 Panel B: Alignment Metrics and Revenue Growth

Alignment Metric	5 Yr. Revenue Growth						3 Yr. Revenue Growth						1 Yr. Revenue Growth					
Aligned Revenues	0.004						-0.055						-0.061					
Aligned Capex		0.02						0.023						0.039				
Aligned Opex			0.034						-0.005						-0.053			
Enabling + Transitional Revenues				-0.006						-0.062						-0.204*		
Enabling + Transitional Capex					0.007						-0.021						-0.200*	
Enabling + Transitional Opex						0.016						-0.007						-0.181*
Log(Starting Period Sales)	-1.257*	-1.091	-1.212*	-1.722*	-1.672*	-1.617*	-0.728	-0.31	-0.553	-1.518	-1.267	-1.216	3.133*	3.590**	3.263*	1.141	1.85	1.477
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.253	0.233	0.257	0.251	0.242	0.25	0.355	0.334	0.343	0.384	0.373	0.384	0.457	0.452	0.454	0.462	0.455	0.482
N	126	120	125	103	98	103	128	122	127	105	100	105	128	122	127	105	100	105

Independent variables are measured as the % of revenues, capital expenditures or operating expenditures reported by companies.

* $p<.05$, **$p<.01$

Table 7: Alignment Metrics and Valuation

	Log (1+Price to earnings ratio)						Log (1+Price to book ratio)					
Aligned Revenues	0.002						0.001					
Aligned Capex		0.000						0.001				
Aligned Opex			-0.001						0.001			
Enabling + Transitional Revenues				0.000						0.000		
Enabling + Transitional Capex					-0.001						0.000	
Enabling + Transitional Opex						-0.001						0.000
ROA	-	-	-	-	-	-	0.076*	0.073*	0.077**	0.076**	0.073**	0.077**
3-yr Revenue Growth	-0.001	-0.004	-0.002	-0.002	-0.004	-0.002	-0.003	-0.004	-0.004	-0.004	-0.004	-0.004
Ln(MarketCap)	-0.024	0.035	0.017	0.022	0.031	0.017	0.044	0.048	0.041	0.043	0.044	0.040
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.255	0.313	0.300	0.296	0.315	0.301	0.541	0.543	0.546	0.541	0.541	0.546
N	119	115	120	121	115	120	121	115	120	121	115	120

Independent variables are measured as the % of revenues, capital expenditures or operating expenditures reported by companies.

* $p<.05$, **$p<.01$

Table 8: Alignment Metrics and Environmental Data

	Metric	1	2	3	4	5	6	7	8	9	10	11	12
1	Aligned Revenues	1.0**	0.56**	0.57**	0.4**	0.79**	0.42**	0.04	0.06	0.05	0.13	-0.12	-0.11
2	Enabling + Transitional Revenues	0.63**	1.0**	0.36**	0.77**	0.42**	0.73**	0.16**	0.06	0.09	0.07	0.03	0.04
3	Aligned Capex	0.78**	0.55**	1.0**	0.51**	0.65**	0.48**	0.02	0.03	-0.15	-0.03	-0.05	-0.08
4	Enabling+ Transitional Capex	0.56**	0.84**	0.64**	1.0**	0.5**	0.84**	0.18**	0.08	0.01	0.08	0.07	0.08
5	Aligned Opex	0.87**	0.59**	0.85**	0.66**	1.0**	0.63**	0.04	0.14	-0.09	0.01	-0.06	-0.08
6	Enabling + Transitional Opex	0.53**	0.81**	0.59**	0.88**	0.71**	1.0**	0.18**	0.08	0.050	0.050	0.050	0.060
7	Refinitiv E Rating	0.08	0.19**	0.12	0.21**	0.12	0.21**	1.0**	0.31**	0.01	0.04	0.12	0.13
8	MSCI E Rating	0.13	0.07	0.17*	0.07	0.14	0.05	0.2**	1.0**	-0.25**	-0.12	-0.04	-0.11
9	Scope 1 Intensity	0.16	0.21*	0.13	0.19*	0.14	0.18*	0.11	-0.15	1.0**	0.08	0.08	0.24**
10	Scope 2 Intensity	0.28**	0.2*	0.19	0.23**	0.21*	0.16	0.11	-0.08	0.41**	1.0**	0.06	0.13
11	Scope 3 Intensity	0.00	0.11	0.05	0.13	0.07	0.15	0.17	-0.16	0.15	0.08	1.0**	0.97**
12	Scope 1+2+3 Intensity	0.04	0.15	0.09	0.19*	0.11	0.19*	0.19*	-0.18*	0.39**	0.24**	0.95**	1.0**

* p<.05, **p<.01

Note: Industry Adjusted above diagonal, No Adjustment below diagonal

Disclosures