

# The Green Transition: Evidence from Corporate Green Revenues

Finance Working Paper N° 1032/2025 January 2025 Johannes Klausmann University of Virginia

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#### Abstract

We introduce a novel measure of revenues from green products and services for publicly listed firms worldwide that is not spanned by prior sustainability metrics used in the literature. We show that green revenues grew at an accelerated pace after the Paris Agreement. This growth has been driven by innovative US companies converting green patents into green revenues, as well as by firms with higher sustainability-focused institutional ownership before the Paris Agreement. Furthermore, we examine the stock returns of firms with green revenues and find modest evidence of a green alpha in the post-Paris period, primarily concentrated in US stocks.

Keywords: green revenues, sustainability, climate change, climate finance, green impact, ESG JEL

JEL Classifications: G15, G18, G23, G30, Q55

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# The Green Transition: Evidence from Corporate Green Revenues<sup>\*</sup>

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## 1 Introduction

The detrimental effects of climate change and environmental degradation pose a global challenge. Pressure has been put on companies worldwide to transition to "green" business models that are low carbon, resource efficient, and environmentally sustainable. The unexpected success of the 2015 Paris Agreement elevated the salience of environmental issues. However, there has been insufficient progress in the energy transition to achieve the emission reduction goals outlined in the agreement, and challenges persist in implementing a global carbon pricing scheme and other first-best policies to address wider environmental externalities (Tirole, 2008). To accelerate the "greening" of their economies, several jurisdictions have tried to introduce science-based green classification systems to define which economic activities are considered environmentally sustainable. The most prominent of these is the recent EU Taxonomy on Sustainable Finance (EUTSF), which addresses both climate change and other environmental goals such as biodiversity, environmental resource management, and pollution prevention.<sup>1</sup>

In this paper, we investigate the extent to which publicly listed firms around the world are generating "green revenues", that is, revenues coming from the sale of environmentally friendly products and services. We first start by showing that green revenues accelerated with the heightened emphasis on environmental issues spurred by the Paris Agreement and the prospect of follow-on regulation such as the EUTSF. This aligns with the recent model proposed by Inderst and Opp (2025), which suggests that a taxonomy of sustainable activities can facilitate the green transition, particularly in the presence of policy failures that hinder the implementation of first-best tools, such as carbon taxes. In addition, the model shows that taxonomies can address concerns related to greenwashing. Second, we ask what are the technological and market drivers behind the extent to which firms sell products and services that contribute positively to the environment. Third, we examine the financial consequences of green revenues and whether the transition to green business models comes at a cost to shareholder value.

 $<sup>^{1}</sup>$ Regulation (EU) 2020/852 - see https://ec.europa.eu/sustainable-finance-taxonomy/ established in the context of the European Green Deal.

To address these questions, we use data from the FTSE Russell Green Revenues Classification System (GRCS), which, to our knowledge, is the first to provide comprehensive information on the extent to which firms generate revenues from green products and services. The GRCS assesses the impact of firms' economic activities not only on climate change mitigation and adaptation but also on other environmental concerns, such as water and resource use or pollution. The FTSE Russell classification provides a rules-based framework for identifying and measuring revenue from environmentally beneficial products and services in defined sectors for transparent market tracking. The data covers more than 16,000 publicly listed firms in 48 developed and emerging markets between 2008 and 2023. The GRCS classification precedes, but is similar in structure to the more recently introduced EUTSF.

The majority of firms have both green and non-green revenues. For example, Toyota generated about 30% of its revenues from green sources at the end of our sample period, mainly from its line of hybrid vehicles. However, some pure-play firms such as Tesla receive all (100%) of their revenues from green sources in the same year (93% from electric vehicles and 7% from solar panels and power storage). The example of Tesla illustrates how green revenues data differ from ESG ratings, as Tesla scores low on some ESG metrics that primarily assess the sustainability of a firm's operations or its conduct, rather than the environmental impact of its products.<sup>2</sup> The weak association between ESG ratings and green revenues measure used in our study provides new information and has a low correlation with both environmental scores issued by ESG rating agencies and firm-level Scope 1 and 2 carbon emissions that have been the focus of previous literature (e.g. Bolton and Kacperczyk (2021); Pastor et al. (2022)).<sup>3</sup>

We start by sizing up the "green economy". Although the majority of public com-

 $<sup>^2</sup>$  Wall Street Journal, "Is Tesla or Exxon More Sustainable? It Depends Whom You Ask" (Sept. 17, 2018).

<sup>&</sup>lt;sup>3</sup>Sustainability assessments by ESG rating agencies (Pastor et al., 2022) have received criticism from both academics (Berg et al., 2022b) and policy makers (https://bit.ly/49J9bfU). The focus has also often been on Scope 1 carbon emissions arising from business operations (Bolton and Kacperczyk, 2021, 2023; Aswani et al., 2024), which usually does not capture the environmental impact of the firms' products and services.

panies around the world still primarily engage in non-green business activities, we show that there is an accelerated shift to green in the period after the Paris Agreement. The global percentage of green revenues was basically flat at approximately 4% from 2008 until 2015 but then grew to approximately 6% by 2023. Although the share of green revenues might seem modest at first sight, there are actually more than 3,000 companies generating green revenues (a fifth of all global public firms in the sample). Translating the share of green revenues into US dollar revenues, we find that the aggregate corporate green revenues at the end of the sample totaled approximately USD \$4 trillion. This positions the green economy at about the same size as the oil and gas sector, to which it is often compared.<sup>4</sup> Green economic activities are diversified across several industries with manufacturing being the largest (e.g., electric vehicles, rail transportation, or renewable energy equipment), followed by utilities (e.g., renewable energy generation), and also technology firms exhibit relatively high green revenue shares (e.g., IT processes such as cloud computing). Although the US, China, and Japan have the largest aggregate dollar green revenues, the highest green revenue exposure is observed in Europe, where the green share exceeded 10% of total company revenues in markets such as France. This suggests that European companies are aligning faster with their countries' net-zero targets and broader sustainability goals.

In the second part of the paper, we examine possible channels that facilitate the generation of green revenues at the corporate level. For this purpose, we follow Seltzer et al. (2022), among others, and use the unexpected passage of the Paris Agreement as a regime shift to the global commitment to address environmental challenges. Before the treaty, media outlets and policy-makers expressed skepticism about the conference's outcome, given the unsuccessful track record of previous climate negotiations. The Paris Agreement not only made climate change more salient, but also raised expectations that more stringent environmental regulations could be imposed in the future. We validate this approach by documenting a ramp up of green revenues in European companies with the post-Paris rollout of the "European Green Deal" and the announcement of the EUTSF.

<sup>&</sup>lt;sup>4</sup>IBISWorld, "Global Oil and Gas Exploration - Production Market Size 2005–2028".

Furthermore, countries with more stringent environmental regulation, as measured by the Environmental Performance Index (EPI), also generate on average more green revenues after the Paris Agreement.

We then turn to the drivers of the corporate green transition. In the absence of first-best environmental policies, Acemoglu et al. (2016); Aghion et al. (2016) and others have shown the importance of corporate innovation to help the transition from dirty to clean technologies. Therefore, as a first channel, we examine the role of technological innovation, which we capture by firms patenting green inventions pre-Paris and then successfully taking these solutions to market generating more green revenues in the period after the Paris Agreement. We estimate that firms with at least one green patent pre-Paris experienced an average increase of 2.3 percentage points in green revenue shares after the Paris Agreement came into effect, compared to firms that did not have a single green patent pre-Paris. The effect is economically meaningful and represents about onesixth of a standard deviation in green revenues. This relation seems specific to green patents as we do not find an association between green revenues and non-green patents. Exploring regional variation, we find that the conversion of green patents into marketable environmental solutions is stronger for US companies, where there was actually less of a regulatory push.<sup>5</sup> In fact, when limiting the sample to European firms, we observe a statistically significant relation between green patents and green revenues, but do not find any strengthening of this relation post Paris. We perform a number of robustness checks on the measure of "greenness" and alternative regression specifications.

A second channel we explore is the external support provided by investors in assuming the equity risk of the green transition and driving real change. Again, in the absence of first-best environmental policies, models such as Oehmke and Opp (2024) highlight the importance of sustainability-conscious investors in addressing environmental challenges. These ESG-focused investors can collectively take the role of a large socially responsible fund that reduces negative externalities arising from dirty production and relaxes financ-

<sup>&</sup>lt;sup>5</sup>Our study does not measure the impact of the subsequent government support programs such as the landmark 2022 US Inflation Reduction Act which may produce effects only after the end of our sample period.

ing restrictions for green investments. We focus on institutional ownership that might be more aligned with the environmental goals outlined in the Paris Agreement based on previous research on ESG-oriented investment (Dimson et al., 2015; Dyck et al., 2019; Krueger et al., 2020; Dimson et al., 2021; Pastor et al., 2024). We first examine whether firms with higher institutional ownership prior to the passage of the Agreement have higher green revenues post-Paris. Our focus on the predetermined level of institutional ownership pre Paris is intended to rule out that results are driven by institutional investors' portfolio adjustments as a reaction to the Paris Agreement. We estimate that a one standard deviation higher level of pre-Paris institutional ownership is associated with an about 0.3 percentage points higher green revenue share post Paris. Next, we focus on the particular role of sustainability-conscious investors, which we measure by the extent to which a firm is held by signatories of the most prominent ESG investor coalitions such as the Principles for Responsible Investment (PRI) (Gibson Brandon et al., 2022) and the CDP (Atta-Darkua et al., 2023). We find evidence that a stronger presence of these sustainability-focused institutions is associated with more green revenues post Paris. In a last test, we look at the investment horizon of institutional investors using average portfolio churn measures at the firm level (see Gaspar et al. (2005); Starks et al. (2024)). We find that companies owned by more long-term institutions pre Paris generated higher green revenues post Paris. This evidence suggests that there might be a trade-off between short-term (financial) goals of companies and possibly costly longer-term societal objectives of the green transition.<sup>6</sup>

In the final part of the paper, we examine the financial returns of the corporate shift to green business activities thus far. Successfully commercializing green products and services does not necessarily imply higher profits or a good return on the invested capital required to carry out the transition. Green business activities could be profit-enhancing if these create new market opportunities for firms or if a markup on green products can be passed on to customers with green preferences. This would be consistent with

<sup>&</sup>lt;sup>6</sup>Our findings speak more broadly to the larger debate around the impact of engagement and exit strategies by institutional investors (Berk and Van Binsbergen, 2021; Edmans et al., 2022; Heath et al., 2023; Hartzmark and Shue, 2022; Becht et al., 2023; Atta-Darkua et al., 2023).

our evidence above that institutional ownership plays a role in the promotion of green revenues for financial "value"-oriented reasons (see Starks (2023)). However, investors could be motivated by their "values", that is non-pecuniary preferences such as reducing their portfolio environmental impact. Therefore, it could also be the case that green revenues entail lower profit margins or higher capital investments, resulting in net costs associated with shifting to green solutions, at least in the short term. This presents a potential trade-off between positive environmental impact and stock performance.

To better understand the financial consequences of shifting green, we analyze the stock market performance of firms with green revenues. When we form portfolios of firms with green revenues, these appear to exhibit higher returns than the overall market, consistent with some of the outperformance of the FTSE Russell green revenues index series.<sup>7</sup> However, our tests show no overall "green alpha" once we account for exposures to common sources of return co-variation such as market beta, size, value, momentum, profitability, or investment factors. Nonetheless, there is some evidence of alpha for portfolios of firms with high shares of green revenues adjusting for systematic asset pricing factors. This result is concentrated in the post-Paris sub-period-when attention to environmental issues is heightened-and mostly concentrated in US stocks, with green patents and high levels of institutional ownership pre Paris. We conclude that the market favorably received the green transition from US companies that had the internal resources and external support to develop green business models. In additional tests, we examine possible explanations for the outperformance of portfolios consisting of stocks with high green revenues. Our analysis suggests that the outperformance is likely driven by a combination of discount rate effects—manifested as a lower cost of capital for green firms— and unexpected shifts in climate-related concerns rather than by underreaction to earnings news.

Our paper contributes to the finance literature that examines the implications of climate change and environmental concerns. Previous studies have examined carbon emissions (Bolton and Kacperczyk, 2021, 2023; Ilhan et al., 2021; Aswani et al., 2024), industrial pollution (Hsu et al., 2023), or measures of environmental performance from

<sup>&</sup>lt;sup>7</sup>LSEG FTSE Russell (July 2024), "Investing in the Green Economy 2024".

ESG ratings (Pastor et al., 2022; Karolyi et al., 2023; Alves et al., 2023; Eskildsen et al., 2024; Berg et al., 2022a). Most of these studies either use the "E" component of ESG ratings or carbon footprints based on Scope 1 and 2 emissions, which mostly reflect the sustainability of the operations or the conduct of firms. In contrast, the green revenues measure captures the extent to which a firm's output contributes to addressing environmental conservation and how a firm can benefit commercially from a shift to a greener economy.

A second stream of literature to which our paper contributes is studies on green patents and R&D (Cohen et al., 2023; Hege et al., 2022; Bolton et al., 2022). In our study, we take the extra step to examine whether green innovation translates into actual market adoption of those technologies and whether firms achieve higher commercial revenues as a result. Interestingly, we find that incumbent energy companies, despite having green patents (Cohen et al., 2023), do not seem to generate more green revenues, which indicates a disconnect in the green transition of this important sector. The green shift appears to be driven by companies outside the traditional energy sector.

A third research stream related to our paper is that on the existence of a green alpha in stock returns. Our tests suggest that the outperformance is concentrated in a subset of US firms. Additional tests show no average earnings surprises for firms with green revenues, suggesting that the observed alpha might come from a discount rate, rather than an excess cash flow effect. These findings are related to the literature that examines whether investors are willing to pay more for holding green securities.<sup>8</sup>

Finally, we also provide novel evidence on the impact of public policies that establish taxonomies for firms' sustainable activities in order to direct private capital to support the green transition. More recently, several papers have looked at EU policy frameworks, for instance Hoepner et al. (2023), Sautner et al. (2022), Bassen et al. (2023), Dai et al. (2023), Lambillon and Chesney (2023), Scheitza and Busch (2024), Sautner et al. (2024)

<sup>&</sup>lt;sup>8</sup>Pastor et al. (2021) and Zerbib (2022) shed light on mechanisms by which environmental preferences create a taste premium for green stocks. Heeb et al. (2023) present experimental evidence that investors are willing to pay to align their portfolios with their sustainable preferences. Other studies show significant variability in "greenium" estimates (Baker et al., 2018; Zerbib, 2019; Colombage and Nanayakkara, 2020; Larcker and Watts, 2020; Caramichael and Rapp, 2022). Karpf and Mandel (2018) and Flammer (2021) suggest that factors beyond environmental preferences may influence the greenium estimates.

or Bassen et al. (2025). While the EU taxonomy is only starting to be implemented, in our study, we are able to test whether–in the past–firms started to shift towards green taxonomy-aligned business activities, what drives such shifts, and whether and how stock markets started to price these green revenues.

## 2 Sizing the Green Transition

Our sample comprises publicly listed firms in FactSet Fundamentals with a minimum market capitalization of USD \$100 million and domiciled in one of the 48 countries that are classified as developed or emerging markets by FTSE Russell. We obtain annual company financial information and monthly stock prices from FactSet Fundamentals. The sample period spans from 2008 to 2023. The companies in our sample represent more than 90% of the global total market capitalization. Table 1 shows the descriptive statistics of the sample.

#### 2.1 Green Revenues

Our main variable of interest is *Green Revenues* % – i.e., the percentage of revenues a company derives from "green" products and services. The data source is FTSE Russell (now an LSEG Business), a leading global index provider.<sup>9</sup> The Green Revenues Classification System (GRCS) provides firm-level revenue exposure to environmentally sustainable business activities for more than 16,000 publicly listed companies. The GRCS taxonomy comprises 10 green sectors and 64 subsectors classified based on their impact on climate change mitigation and adaptation, water, resource use, pollution, and agricultural efficiency (see Table A-1.1 in Appendix 1 for details). In the main analysis, the sample includes 36,725 firm-year observations where green revenues are larger than 0. In total, 3,306 unique firms show green revenues at some point during the sample period from 2008 to 2023.

<sup>&</sup>lt;sup>9</sup>More details can be found in LSEG FTSE Russell (2024) "Green Revenues Data Model - Methodology". A few recent papers have used this novel dataset on firm green revenues - Kruse et al. (2020); Bassen et al. (2023); Lel (2024); Bassen et al. (2025).

This classification system was originally launched by FTSE Russell with Impax Asset Management in 2008 in response to investor demand to track the performance of the green economy. Its purpose was to construct financial products that sought exposure to the green economy. Examples of such products include the FTSE Russell Environmental Markets Index Series where a stock's inclusion is based on green revenue thresholds. GRSC 1.0 was created by FTSE Russell in 2013 and the latest iteration of the classification system, GRCS 2.0 (which we use in this study), was launched in 2020. More recently, investors have also started using these data for regulatory reporting requirements, such as determining the eligibility of their portfolio companies' sustainable activities under the EUTSF. In fact, the GRCS was used by the European Commission's Joint Research Center in its EUTSF Impact Assessment Report and has shaped the proposal of the EU's High-Level Expert Group on Sustainable Finance. It is therefore no surprise that there is an alignment between the GRCS and the EU taxonomies (in subsequent sections, we show how our main results are robust using green revenues based on the EUTSF instead).<sup>10</sup> FTSE Russell uses three methods to calculate green revenues:

- 1. Disclosed: Approximately a quarter of the GRCS data come directly from detailed publicly disclosed information (company websites, annual reports, CSR or sustainability reports, etc.) where company-reported business segments are mapped into the GRCS classifications of business activities.<sup>11</sup> This is followed by semantic screening of keywords (for example: 'biofuel' or 'electric vehicles') and then FTSE Russell analysts verify a company's involvement in green products or services.
- 2. Company-specific estimates: This is the case for around three-quarters of the firm-year observations where FTSE Russell analysts start with other available non-revenue data (e.g. production volumes, market shares of a product, etc.) and then engage directly with companies to confirm the estimates on the breakdown of revenues by green activity.

<sup>&</sup>lt;sup>10</sup>The mapping of green revenues into the EUTSF is available here: LSEG FTSE Russell (2020) "Sizing the Green Economy - Green Revenues and the EU taxonomy".

<sup>&</sup>lt;sup>11</sup>We do not observe a significant trend in the disclosure percentage post Paris.

3. Sector-specific estimates: This occurs for only a few companies with known green revenues, but no available public disclosures. FTSE Russell then uses a quantitative model that takes reported data from sector peers to estimate a firm's revenues from each GRCS green sector.<sup>12</sup>

The GRCS Green Revenues 2.0 data model was launched in 2020 and provides point estimate data for *Green Revenues* % since 2016. It builds on earlier versions going back to 2008 that provided only upper and lower bounds of estimated green revenues. We consulted with FTSE Russell on how to backfill estimates from 2016 going back to 2008 and adopted the approach taken in their research reports.<sup>13</sup> Starting in 2016, FTSE Russell provides both point estimates and a confidence interval of green revenues for each firm, corresponding to a conservative and a more optimistic estimate. We then compute a factor that allows us to backfill the point estimates using the minimum and maximum green revenues in the data. The factor is obtained by calculating:

$$Factor_{i,2016} = \frac{GR_{i,2016} - GR_{i,min,2016}}{GR_{i,max,2016} - GR_{i,min,2016}}$$
(1)

where  $Factor_{i,2016}$  is the factor of firm i in 2016,  $GR_{i,2016}$  is the point estimate,  $GR_{i,min,2016}$ the lower limit and  $GR_{i,max,2016}$  the upper limit. We backfill this factor for the years 2008 to 2015 and then obtain the point estimate for these years by applying the formula:

$$GR_{i,t} = GR_{i,min,t} + Factor_{i,2016} \times (GR_{i,max,t} - GR_{i,min,t})$$

$$\tag{2}$$

where  $GR_{i,t}$  is the new point estimate,  $GR_{i,min,t}$  the lower bound in a given year between 2008 and 2015 and  $GR_{i,max,t}$  the upper bound, respectively. Companies without any green revenue are categorized as having zero contribution. This classification aligns with the methodology adopted by FTSE Russell in their research reports, wherein missing green revenue data is interpreted as zero. In later analysis, we conduct several robustness checks based on the treatment of the zeros and the backfilling.

<sup>&</sup>lt;sup>12</sup>This approach is akin to the estimated carbon emissions data from providers such as S&P Trucost and used frequently in the literature (e.g., Bolton and Kacperczyk (2021) and many other papers).

<sup>&</sup>lt;sup>13</sup>LSEG FTSE Russell (July 2024), "Investing in the Green Economy 2024".

Table A-1.2 in Appendix 1 provides the top-ranked companies by green revenues in USD for each of the top countries in different regions. The table shows many global leaders in energy generation from renewable and non-fossil fuel sources (nuclear: Electricité de France; wind: EnBW; hydro: Electrobras; solar: Canadian Solar), as well as firms producing the equipment (Hanwha) and enabling efficiencies via IT processes (e.g., Amazon and Microsoft with cloud computing) or building management and power storage. A second main category is transportation that minimizes environmental impacts, such as electric road vehicles (Tesla, BYD, or Toyota Motor) as well as railway manufacturers (Alstom), or operators (China Railway). Finally, the table provides examples of firms that are active in environmental resources such as key raw minerals and metals for the energy transition (SQM for lithium), sustainable forestry, waste management, or water infrastructure.

In our subsequent analyses, we tackle the active debate on the "greenness" of several business activities. The coloring in Table A-1.1 shows the GRCS tiering system that classifies green products and services with significant and clear environmental benefits (Tier 1), those with more limited but net positive environmental benefits (Tier 2), or those with some environmental benefits but being overall net neutral or negative (Tier 3). A prominent example of Tier 3 is nuclear energy, which is free of CO2 emissions but produces radioactive waste.<sup>14</sup> Another such case is cloud computing, which falls under the GRCS sector "IT Processes" and is labeled Tier 2. In the next sections, we therefore run robustness tests focusing on the more strict GRCS Tier 1 green revenues to alleviate concerns that the results might be driven by these controversial green activities.

To assess whether these new data offer new information on a firm's contributions to the green transition, we explore the correlations of green revenues with other measures of environmental sustainability used in prior literature (carbon emissions and environmental scores). There are several reasons why green revenues differ from those other measures. First, the greenness of products and services is not necessarily related to the sustainability of a company's production and business operations. For example, the environmental

<sup>&</sup>lt;sup>14</sup>The EUTSF also labeled nuclear energy as green despite some controversy (Reuters, 'EU Parliament Backs Labeling Gas and Nuclear Investments as Green", July 6, 2022)

efficiency in the production of cars is different from the environmental footprint of cars once they are used. Second, environmental scores mostly measure how firms implement or manage environmental issues, which is more related to their conduct rather than firms' contributions to the green transition through their output. It is easy to envision firms that have good best-in-class operations but sell products and services with a negative environmental impact (e.g., oil companies). Third, we computed the correlations between *Green Revenues* % and *Ad. MSCI ESG Score* (ESG ratings from from MSCI), *E-Score PST* (a modified version proposed by Pastor et al. (2022)) as well as corporate carbon emission intensities (see, e.g. Bolton and Kacperczyk (2021) or Bolton and Kacperczyk (2023)).

Table 2 shows that these commonly used measures have low correlations with the share of green revenues of a company. However, the correlation matrix further reveals that the main variable *Green Revenues* % is highly correlated with alternative definitions of greenness (*Tier 1 Green Revenues* %, *EUTSF Green Revenues* %). We also find similar patterns with Spearman rank-order correlations and for the intensive margin shown in Table I.A.1 of the Internet Appendix where we focus only on firms with non-zero green revenues.

### 2.2 The Growth of the Green Economy

Panel A of Figure 1 illustrates aggregate global green revenues in USD \$ trillions on the left axis, alongside the percentage of green revenues relative to total revenues on the right axis. Both absolute and relative measures of green revenues show an upward trend that accelerates post-2016 after the Paris Agreement, exceeding USD \$4 trillion and 6% of total revenues by 2023. Panel B of Figure 1 offers a breakdown of green revenues by the 10 GRCS sectors, showing that the highest proportions come from green energy (management, generation, and equipment) and transportation (solutions and equipment). Finally, panel C of Figure 1 uses the GRCS tiering system and illustrates that the acceleration after 2015 covers all tiers, including Tier 1 green revenues with clear environmental benefits, which we focus on in some of the tests in the next sections. For more details, Figures A-1.1 and A-1.2 in Appendix 1 display treemaps showing the distribution of green revenues across the 64 GRCS sub-sectors and by tier of "greeness".

Figure 2 illustrates that no single industry dominates the green economy. Naturally, certain sectors, such as Health Services, exhibit small to negligible green revenue contributions. In contrast, the Manufacturing and Utilities sectors collectively contribute approximately USD \$1.4 trillion in aggregate green revenues, while the Consumer Durables sector (mainly comprising electric vehicles), adds another USD \$0.5 trillion in green revenues. Within these top 3 industries, the green revenue share ranges from around 14% for Consumer Durables to up to 22% in Utilities. Interestingly, traditional Energy firms exhibit low green revenues, and we will analyze this sector in greater detail in the following sections.

Figure 3 shows that the United States is the leading economy with USD \$1 trillion dollars in terms of aggregate green revenues. It is not surprising that in the Asia-Pacific region green revenues are also concentrated in large economies such as China and Japan. The bottom panel of Figure 3 shows that Europe has a higher percentage share of green revenues compared to other regions of the world. At the end of our sample, there were already multiple European markets in which the green economy made up more than 10% of total revenues, while the US only had a green share of approximately 5%.

Table 1 shows that the pooled equal-weighted average firm has about 3.4% of green revenues. This is lower than the revenue-weighted averages shown in Figure 1. The divergence between equal- and revenue-weighted average green revenues suggests that green revenues tend to be higher among larger firms. Table I.A.2 in the Internet Appendix examines firm-level variables that correlate with green revenues. We document a positive association with a firm's scale (as measured by sales) and higher Tobin's Q ratio, suggesting that growth firms exhibit higher green revenue shares. The coefficients for ROA (lower profitability), CAPEX, and R&D (more investment) point to potential short-term costs associated with the green transition. In a similar spirit, firms with lower cash balances also exhibit higher green revenue shares. Compared to the rest of the world, European firms stand out as having higher green revenue shares on average, consistent with Figure 3.

## 3 The Paris Agreement as a Regime Shift

As the main empirical strategy for our analysis, we take advantage of the unexpected success of the 2015 United Nations Climate Change Conference. This led to the Paris Agreement, a commitment of 196 nations to reduce greenhouse gas emissions and enhance resilience to climate change. The conference took place in December 2015 and the Agreement entered into force on November 4, 2016. The primary pledge is to limit the increase in the global average temperature to 1.5 degrees Celsius compared to preindustrial levels. We argue that the Paris Agreement marks a regime shift in that it elevated environmental concerns for many economic agents (e.g., firms, investors, regulators, and consumers).

Importantly, for our empirical design, this regime shift was far from anticipated. In fact, media articles prior to the treaty were pessimistic about the outcome of the conference given the unsuccessful track record of prior climate negotiations.<sup>15</sup> The uncertain outcome of the conference provides us with a quasi-exogenous shock to expected beliefs about climate and environmental action. In fact, Ramadorai and Zeni (2024) show in a survey that managers believe that the Paris Agreement increased the likelihood of more stringent environmental regulations worldwide. Seltzer et al. (2022) exploit the same shock in their study and show that the Paris Agreement had a significant impact on bond prices and risk. In addition, Engle et al. (2020) also show that their climate attention index spiked during the Paris meeting.

Beyond regulation, the Paris Agreement heightened expectations for investments in more efficient resource use and green technologies. Hence, we further motivate our setting with prior economic theory on green innovation. Accemoglu et al. (2016) propose a dynamic general equilibrium model that emphasizes how environmental policies can steer innovation towards clean technologies that align with regulatory requirements. The model

<sup>&</sup>lt;sup>15</sup>Examples of article headlines before the meeting included Forbes "The Paris Climate Summit Will Fail, For A Pretty Simple Reason" (Nov 30, 2015) or BBC "Paris Climate Summit: Don't Mention Copenhagen" (Sep 16, 2015).

highlights that clean innovation can become self-sustaining over time if early investments are maintained. Our hypothesis aligns with this: on the one hand, stricter legislation could amplify the path dependency of green innovation by ensuring that firms investing in clean technologies capture higher green revenues. On the other hand, by introducing stricter green legislation, firms face stronger disincentives to rely on dirty technologies. The green shift around the Paris Agreement likely increased the marketability and profitability of green innovations, directly tying stricter regulation to green revenue growth.

In sum, the Paris regime shift is an interesting setting to use in a cross-sectional difference-in-differences research design to explore potential channels that can accelerate the corporate green transition. This econometric research design uses the Paris Agreement as a "regime shift" and we take predetermined firm characteristics to capture differential exogenous exposures to the common shock. We employ several predetermined variables to estimate the effect of (1) firms' internal green innovative capacities measured by green patents held before the Paris Agreement and (2) the level and sustainability-orientation of institutional ownership measured pre-Paris. Instead of using time-varying exposure variables for the full sample period, our difference-in-differences regressions keep the exposure before the common shock constant over time to estimate how the common shock affects firms' green revenues conditional on pre-shock differences. We employ both traditional difference-in-differences regressions with a binary treatment definition (for dummy variables) and continuous treatment models (for ratio or level variables), as proposed by Callaway et al. (2024). The continuous treatment approach is especially appealing as it extends beyond a binary grouping, which allows us to capture the nuanced variation in treatment intensity around the Paris Agreement. In our subsequent tests, we run OLS regressions of the following type:

$$GR_{i,t} = \alpha + \beta_1 PostParis_t + \beta_2 Treatment_{i,preParis} + \beta_3$$

$$PostParis_t \times Treatment_{i,preParis} + \beta_n X_{i,t} + \mu_j + \theta_r + \tau_t + \epsilon_{i,t},$$

$$(3)$$

where  $GR_{i,t}$  is the percentage green revenue share of company *i* in year *t*. PostParis<sub>t</sub> is

1

an indicator variable equal to 1 if the year is larger or equal to 2016. Treatment<sub>i,preParis</sub> is the conditioning variable measured before the Paris shock in 2015 and kept constant in the post-Paris period. Our regressions additionally include sector, country, and year-fixed effects in the form of  $\mu_j$ ,  $\theta_r$ , and  $\tau_t$ , respectively. Standard errors are clustered at the country-year level. We also estimate equations using firm-fixed effects.

In Appendix 2, we detail how we validate the Paris Agreement as a regime shift that raised expectations of a regulatory shift by presenting evidence from the multistage process that led to the introduction of the EUTSF. For example, Table A-2.1 shows that firms headquartered in European countries, on average, increased their green revenue shares during taxonomy roll-out process compared to firms located elsewhere. Overall, we conclude that the prospect of more stringent regulation post-Paris is associated with an acceleration in the transition towards a green economy. In Table A-2.2 we also provide evidence that supply factors related to a countries' environmental policies are more important than consumer demand aspects in the post-Paris green push (see also the discussion in Appendix 2).

## 4 Drivers of the Green Economy

Our main tests focus on two key drivers for a firm's successful green transition: (1) a firm's internal capabilities (which we proxy by having the technological knowledge to enable the green transition) and (2) the external support of its shareholder base (we look at the role played by institutional investors, in particular in terms of their sustainability-alignment and investment horizon).

#### 4.1 The Role of Green Innovation

The first economic channel we examine is whether a firm's innovation capacity prior to the Paris Agreement is associated with stronger green revenues afterward. For this purpose, we collect data from the Global Corporate Patent Dataset (GCPD) developed by Bena et al. (2017).<sup>16</sup> We measure green patents based on the technology classes that are classified by the OECD as related to the environment based on the mapping outlined in Haščič and Migotto (2015) and also used in Cohen et al. (2023), Hege et al. (2022) and Atta-Darkua et al. (2023). We then construct the variables *GP Indicator* and *GP Ratio*, calculated as a dummy variable if the firm had at least a green patent pre-Paris and also the ratio of green patents to total patents granted between 2008 and 2013. In cases of missing firm data, we impute zeros. The data on granted patents are available until the end of 2013, so we stop there.<sup>17</sup>

We follow the methodology outlined in Section 3. The results in Table 3 show that companies that were more successful in developing green technologies pre Paris generated higher green revenues post Paris. Our first and main proxy for a firm's green innovativeness is GP Indicator, an indicator variable equal to 1 when a firm created at least one green patent in any year between 2008 and 2013.<sup>18</sup> This measure addresses the possibility that a single or a few green patents are highly influential. The positive coefficients of the interaction terms GP Indicator  $\times$  PostParis in columns (1), (3), and (5) of Table 3 indicate that companies that had at least one green patent pre-Paris were more apt to respond to the Paris regime shift and transition to green at a faster pace. Since firms in some sectors can be more predisposed to patenting their inventions, we also include sector fixed effects in the regressions and use the ratio of green to total patents GP Ratio as a second measure for green innovation. We find that companies with higher green patent ratios exhibit significantly higher green revenue shares post-Paris (see columns (2), (4) and (6)). The specification using the *GP Indicator* variable is useful in evaluating the economic magnitude of the effect. Looking at the coefficient for the interaction effect Post  $Paris \times GP$  Indicator, we estimate that firms with at least one green patent before

<sup>&</sup>lt;sup>16</sup>This data is available at https://patents.darden.virginia.edu/. Although we consider green patents granted as a measure of successful technological innovation, we acknowledge its limitations as firms can strategically choose not to patent all inventions and the propensity to patent with the USPTO varies across industries or geographies.

<sup>&</sup>lt;sup>17</sup>We take the five years from 2008 to 2013 due to a time lag until filed patents are approved and incorporated into the last update of the GCPD database which took place in 2017. In future work, we will try to update the patent data set.

<sup>&</sup>lt;sup>18</sup>In unreported results, we also find that results are consistent if we use the count of green patents without adjusting for total patents generated by a firm.

the Paris Agreement experienced on average an increase in green revenues that is 2.3 percentage points higher than for firms without any green patents after the Agreement came into effect. The effect is economically meaningful and represents about one-sixth of the standard deviation of the green revenue share. To alleviate concerns related to unobserved firm heterogeneity and also other shocks beyond the Paris Agreement that could correlate with the shift to green in different countries and industries, we employ an alternative regression specification using Firm, Country  $\times$  Year, and Sector  $\times$  Year fixed effects. Panel B of Table 3 shows that the results are robust to using firm-fixed effects to control for time-invariant company unobservables.

We also split the sample by geographical regions. The differences between the United States, Asia-Pacific, and Europe are striking (see Table 4). In all regions, green innovation is positively correlated with more green revenues. However, only in the United States and the Asia-Pacific region the Paris regime shift led to an accelerated increase in green revenues post Paris for firms holding relatively more green patents prior to the Paris Agreement (as shown by the coefficient on *GP Indicator*  $\times$  *PostParis*). One possible interpretation is that the shift to green is primarily driven by firms with the technology know-how responding to market opportunities in the follow-up to Paris, rather than just a response to a regulatory push as in Europe. We will examine these explanations in more depth in Section 5 when we investigate how global markets valued these revenues.

We also focus on the energy sector to understand its role in the green transition. Previous findings by Cohen et al. (2023) suggest that firms in the energy sector have a lot of green patents, but the question remains open whether these translate into tangible outcomes. Our tests in columns (7) and (8) of Table 4 show that energy companies with more green patents actually do not accelerate their green revenues post Paris, differently from firms in other sectors. There are several possible explanations for this result. First, the transition for "brown" energy firms (which are more dependent on fossil fuels) could be slow, as it requires a fundamental change in their business models. They might prefer to license their patents to firms that have the facilities and equipment to bring these green technologies to market. Second, energy firms could also use patents to preempt new "greener" competitors from entering the market.

Columns (3) - (6) in Panels A and B of Table 3 repeat the previous regression analysis using Tier 1 and EUTSF-eligible green revenues as dependent variables. We observe that the results tend to be similar, both statistically and economically, for Tier 1 green revenues with clear environmental benefits (columns (3) and (4)) and green revenues that qualify under the EU Taxonomy (columns (5) and (6)). Firms that held at least one green patent before the Paris Agreement had on average 2.1 (2.5) percentage points higher Tier 1 (EUTSF-eligible) green revenue shares post-Paris. We also assess whether our findings could be explained by firms that are generally more innovative by replacing green patents with any type of patent. However, Table I.A.3 in the Internet Appendix does not support this notion. The positive relation with green revenues appears to be specific to the greenness of patents, while general patenting activity is not associated with higher green revenues post-Paris.

### 4.2 The Role of Institutional Investors

The second channel we test is the willingness of a firm's investor base to support the green transition. Institutional investors play an increasingly important role in capital markets around the world. Survey evidence by Krueger et al. (2020) finds that institutional investors are concerned about climate risk. Among others, Dyck et al. (2019) and Hoepner et al. (2024) suggest that institutional investors can push firms to improve their environmental profiles. Apart from institutional investors' direct preferences for ESG, institutions might also care about firms' green revenues for financial "value"-oriented reasons (Starks, 2023) if there are profitable opportunities in the green transition. Rather than examining the innovativeness as well as the industry or geographic location of the firm, as in Section 4.1, here we focus on the sustainability alignment and the investment horizon of investors.

We access data on institutional ownership from the FactSet/LionShares database (Ferreira and Matos (2008)). We capture the environmental concerns of an investor by evaluating if the investor has signed the United Nations' sponsored Principles for Responsible Investment (PRI, the world's largest initiative on ESG investing) or joined the CDP (formerly the Climate Disclosure Project and now focused on tackling also other environmental goals such as water, forests or plastics). We use data from Gibson Brandon et al. (2022) and Atta-Darkua et al. (2023) that matched the institution names in FactSet with the list of PRI and CDP signatories, respectively. Those papers find that PRI signatories who incorporate ESG into their active equity holdings have better portfolio ESG scores than non-PRI signatories (but less so for US-domiciled institutions) and that CDP signatories decarbonize their portfolios faster, particularly European-based institutions. A related paper by Pastor et al. (2023) also finds that after institutions become PRI signatories, their ESG portfolio tilts tend to become "greener" (and that this is more the case for European institutions than US-based ones). Another dimension we consider is investor patience for the transition, which we proxy by their investment horizon as in (Starks et al., 2024).

It is challenging to establish a causal link between sustainability-conscious institutional ownership and green revenues. On the one hand, investors can engage with companies to encourage more investment in green activities. On the other hand, investors with green mandates can pick stocks to "green their portfolios". To better isolate selection versus influence effects, we follow Ilhan et al. (2023) and our methodology described in Section 3. We estimate a regression model where sustainability-conscious institutional ownership is predetermined, that is, we consider a firm's pre-Paris institutional ownership and keep it constant in the post-Paris period. This approach allows us to rule out that the results are driven by institutional investors changing their holdings after the Paris Agreement.

In Table 5, we find that firms with higher institutional ownership pre-Paris indeed exhibit higher green revenue shares post-Paris. The three panels use different definitions of green revenues as the dependent variable (e.g., Tier 1). Panel A uses the baseline green revenue share as the dependent variable, and column (1) shows that firms with higher institutional ownership pre-Paris generate higher green revenues shares afterwards. We estimate that a one standard deviation higher level of pre-Paris institutional ownership is associated with an about 0.3 percentage points higher green revenue share post Paris. We find a stronger effect in column (2) with *IO High Pre Paris*. Then in columns (3) and (4) we observe that firms with higher ownership by PRI signatory institutions and CDP members tend to exhibit a stronger acceleration in green revenues after Paris. Finally, in column (5), we find that firms held by "patient" investors (as proxied by lower portfolio turnover) exhibit higher green revenue shares, however, the effect does not increase in strength after the Paris Agreement. Although the estimated coefficient is negative, it is not significant at conventional levels.

In Panel B, restricting ourselves to revenues from Tier 1 green business activities, we again find a significant association between the presence of PRI and CDP (but not long-term) institutions and green revenue shares with clear environmental benefits. The results are economically and statistically similar. In Panel C, we use EUTSF-eligible green revenues. The associations between EUTSF-eligible green revenues and our institutional ownership variables are stronger compared to the results in Panels A and B. For instance, we now also find a robust link between the green revenue share and long-term oriented institutional ownership (see column (5), Panel C).

#### 4.3 Robustness and Additional Tests

As an alternative to our main regression tests, we implemented additional difference-indifference tests for the two channels driving the green transition, the objective being to isolate the effect of the Paris regime shift from other concurrent changes. For instance, we use a balanced panel of firms and again keep green innovativeness and institutional ownership pre-Paris constant over time to test whether better initial conditions in these two dimensions allowed firms to generate more green revenues after the Paris Agreement. The results of these difference-in-differences regressions are presented in Figure 4, which shows that there is no pre-trend before Paris and there is an acceleration post-Paris. We find that a firm with at least one green patent pre-Paris experienced an increase of more than 1 percentage point in green revenues (Panel A). Firms that are above the sample median of institutional ownership pre-Paris, exhibit about 1.5 percentage points higher green revenue shares after the Agreement (Panel B). These results confirm the role of internal technological capabilities and also of external shareholder pressure in driving firms' green transition.

To investigate whether an increase in green dollar revenues reflects a substitution for brown revenues, we rerun our regression models across the two channels, this time focusing on "brown" US dollar revenues (which we define as total revenues minus green revenues). Our analysis in Tables I.A.5 and I.A.6 in the Internet Appendix yields interesting findings. We show that green revenues do not seem to replace brown revenues; the relation between green innovation and institutional ownership with brown dollar revenues is often insignificant after the Paris Agreement.

Lastly, we determine whether more firms began generating green revenues after the Paris Agreement. To do so, we look into the extensive margin and conduct the same regression analysis but replace the green revenue point estimates with a binary indicator variable set to 1 if the firm has any green revenues and 0 otherwise. In Tables I.A.7 and I.A.8 we find that firms with green patents and higher institutional ownership are indeed more likely to generate green revenues post-Paris. Overall, our main results seem to be driven by new entrants (extensive margin) rather than by firms with existing green revenues that are expanding their green businesses (intensive margin). In addition, we also examine the sensitivity of our results to the backfilling methodology applied to the 2008–2015 data. We conduct a subsample analysis focusing only on the post-Paris Agreement period, and an alternative approach that uses the midpoint between the minimum and maximum FTSE green revenue estimates. Overall, the results remain robust in these additional tests.

## 5 Do Investors Value Green Revenues?

Corporate environmental sustainability may be a desirable goal in itself. However, it remains an open question whether the stock market rewards firms with more green revenues and whether it is possible to generate profitable trading strategies from investing in green firms. As a reference, Figure 5 plots the cumulative returns for all stocks and compares them to portfolios of firms with different levels of green revenue. For these different "shades of green" we choose a portfolio consisting of firms with non-zero green revenues (solid green line), as well as two portfolios based on a 20% (short-dashed line) and 50% (long-dashed line) revenue cutoff (similar to those commonly used by FTSE Russell in their published indices). We observe that the 'All Green Revenues' portfolio does not outperform the all stocks portfolio (black line), but portfolios with higher green revenue shares appear to be associated with higher realized returns over the sample period (2008-2023). Do these seemingly higher returns reflect a green alpha, or might these be spanned by asset pricing factors commonly used in the finance literature?

In Panel A of Table 6, we test the Green Revenues > 20% portfolio against several benchmark portfolios and standard asset pricing models from Jensen et al. (2023). Column (1) shows the significant excess returns of the portfolio over the risk-free rate, consistent with the graphical evidence in Figure 5. In column (2) we use the portfolio's industry-hedged returns by benchmarking stock returns against sector returns based on the 10 GICS sectors. We find that portfolio outperformance is no longer significant, suggesting that excess returns based on green revenues reflect return differences across and not within industries. Using the CAPM model and switching back to value-weighted portfolio returns in excess of the risk-free rate, column (3) reports a statistically insignificant one factor alpha. This non-alpha result holds for all the other factor models that we employ in columns (4)-(8). The Green Revenues > 20% portfolio significantly loads on the market portfolio. The negative loading on the value factor indicates that stocks with high green revenues tend to be growth stocks (consistent with the analysis shown in Table I.A.2). Column (8) shows, as expected, that the portfolio does not load on the GMB factor proposed by Pastor et al. (2022) (we use the global GMB factor from Karolyi et al. (2023) given our international sample). This is consistent with the low correlations between green revenue shares and the ESG scores presented in Table 2 and supports the notion that green revenues capture aspects different from standard E(SG) scores.

In Panel B, we construct a factor portfolio GML that goes long firms with at least

20 % green revenues and short firms without green revenues. We refer to the short leg as the *Legacy* portfolio, hence the acronym GML. In Panel B, we rerun the analysis from Panel A using the factor returns and find insignificant alphas in each of the estimated factor models.

In Table 7, we construct GML portfolios with different green revenue % cutoffs for the long leg of the GML factor. We also use different types of green revenues across panels (Panel A: standard green revenues; Panel B: Tier 1 green revenues; Panel C: EUTSF-eligible green revenues). Overall, the results in this table are very similar to the findings in Table 6. The estimated alphas<sup>19</sup> are largely insignificant. If anything, there is weak positive alpha in the most extreme GML variants (i.e., those that go long in firms with at least 80 percent green revenues), and when using Tier 1 (Panel B) or EUTSFeligible (Panel C) green revenues. Overall, we conclude that there is no strong evidence of positive alpha from investing in green revenue stocks in our 2008-2023 sample period, apart from the more extreme green portfolios.

We know from the previous sections that green revenues were relatively flat until the Paris Agreement and accelerated strongly afterward as the Paris Agreement elevated the importance of environmental issues to many stakeholders.<sup>20</sup> Thus, in Table 7, we extend the analysis and divide the sample into two periods, one for the period prior to the Paris Agreement and one for the period afterward. We estimate the 6-factor alphas for different variants of the GML factor, which we construct based on the three blends of green revenues (i.e., regular, Tier 1 and EUTSF-eligible) and different cut-off levels. In the last column of Table 7, we consider a portfolio of "pure-play" green firms that have more than 80% green revenues. The idea is to examine the financial implications of companies that were created with the primary purpose of selling predominantly green products and services. The results are striking: while there does not appear to be much evidence of alpha in the period prior to the Paris Agreement, positive 6-factor alpha

<sup>&</sup>lt;sup>19</sup>We use a 6 factor model, i.e., Fama-French 5 factors augmented with a momentum factor.

 $<sup>^{20}</sup>$ Our focus is on portfolio returns but, in contemporaneous studies, Battiston et al. (2024) present panel regression evidence that the stock returns of utility firms with green revenues are higher following the Paris Agreement and Bassen et al. (2025) show that EUTSF-aligned green stocks outperformed as investor attention increased with the publication of the taxonomy.

materializes in the Post-Paris period for the GML factor, in particular when the long leg is constructed based on "pure-play" firms (Column 4).

Table 7 shows a positive alpha after the Paris Agreement for stocks with higher green revenues. We now further investigate where this alpha originates from by conducting a subsample analysis in Table 8. In Panels A-C, we split the sample by geographic regions. The positive green alpha appears to be driven primarily by US stocks. We do not find any strong positive alpha outside the United States. If anything, European firms with high green revenues experienced negative alpha in the years leading to the Paris Agreement. In Panel D, we focus on a sample comprising global energy stocks. In the energy sector, there were no firms with more than 50% in green revenues and there is no evidence of outperformance of green portfolios in the energy sector. In a final step, we construct double-sorted portfolios based on the insights from our prior analysis that firms with more green patents and higher institutional ownership were able to increase their green revenues more strongly after the Paris Agreement. In line with the previous analysis, we find that the alpha is strongest among firms with the highest green revenues holding green patents (columns (3) and (4) of Panel E) as well as high institutional ownership (columns (3) and (4) of Panel F).

In a nutshell, before the implementation of the Paris Agreement, profitable trading strategies based on green revenues seemed unattainable. After 2016, this seemed to have changed, but not everywhere in the world. Outperformance is strongest among firms that were well positioned for the green transition, that is, firms with green patents and shareholders open to investing in the green transition. The results on the financial profitability of investing in firms with (high) green revenues remain mixed, but portfolios of US firms with extreme green revenues shares appear to be most promising.

We perform a series of robustness checks. The first concern is the potential influence of a few firms on the returns of green portfolios. Theory models such as Acemoglu et al. (2016) highlight the role of winner-take-all breakthrough technologies that have low probability, but may become highly influential if successful. Empirical asset pricing studies, such as Bessembinder (2018), also have shown that a handful of highly impactful stocks often account for the majority of the equity premium. Specifically, large firms with substantial green revenues can significantly drive the observed green alpha in our valueweighted portfolios. Looking at Table I.A.9 in the Internet Appendix, it becomes apparent that Tesla comprises up to approximately 50% of the green US portfolio considering stocks with more than 50% in green revenues. This raises questions regarding the robustness of our results when Tesla's influence is omitted. Indeed, Figure I.A.1 shows that a significant portion of the initially observed green outperformance can be attributed to Tesla's returns. However, notably in the US post-Paris period (see lower sub-figure in Figure I.A.1), we continue to observe higher cumulative stock returns for portfolios consisting of stocks with higher green revenues. In particular, the portfolio containing stocks with more than 50% green revenues seems to perform much better than the all-stocks portfolio. This finding is further substantiated in Table I.A.10, where we estimate factor models. In Panels A and B, Tesla is excluded from the value-weighted global and US portfolios, respectively. Panels C and D present equally weighted portfolios, effectively mitigating the influence of outlier firms with high market capitalization. Despite these adjustments, the results consistently indicate a positive and significant green alpha post-Paris in the U.S. for stocks with at least 80% green revenues. The other portfolios neither under- nor outperform, suggesting, in turn, that investors do not need to sacrifice returns to invest in firms generating green revenues.

Finally, we explore possible explanations for the outperformance of some of the green revenue portfolios. Any observed alpha could be due to investors' under-reaction to positive earnings news, differences in discount rates, or perhaps both. Another possible explanation could be that unexpected shifts in climate concerns in the spirit of Pastor et al. (2022) and Ardia et al. (2023) drive outperformance. We do not believe that these explanations are mutually exclusive and possibly all contribute to the outperformance of the GML factor.

In Table 9 we examine the possibility of underreaction to earnings news and differences in discount rates (Atilgan et al., 2024; Eskildsen et al., 2024). Columns (1) and (2) suggest a lower implied cost of capital for firms with higher discount rates. The results for earnings surprises are less conclusive (columns 3 and 4). Although the estimated relation between earnings surprises and green revenue shares is positive in the Post 2016 sub-sample (column 4), the relation seems estimated with noise and not significant at conventional levels.

In Table 10, we explore whether unexpected shocks to climate concerns (using the Media Climate Change Concerns (MCCC) index of Ardia et al. (2023)) drive the returns of green revenue portfolios. Panel A focuses on returns in excess of the risk-free rate of portfolios formed on the basis of percentage green revenues. Panel B employs the GML factors. We find strong evidence that unexpected climate concerns and the ensuing shifts in investor and consumer demand positively impact the returns of green revenue portfolios. We conclude that a mix of discount rate effects and unexpected shifts in climate concerns drives the outperformance. One caveat is the limited time series used in our study as green technologies may take time to develop and be better understood. Next, we acknowledge that some sectors such as Healthcare cannot generate green revenues, which does not mean that their revenues are brown, but they simply do not play a key role in the green transition. Hence, we exclude industries with either no green revenues, or in an alternative specification, green revenue shares below 5% from the short legacy portfolio to test the robustness of our results. The estimated alphas are not significantly different from our baseline specification.<sup>21</sup> Lastly, we address the concern that GML portfolio returns might be driven by green measures previously examined in the finance literature. To investigate this, we test across various specifications whether the global green-minus-brown (GMB) factor based on MSCI environmental pillar scores proposed by Karolyi et al. (2023) explains our GML portfolio returns. Our results in Table I.A.11 show no evidence of such a relationship in any of the tested specifications.

## 6 Conclusions

In this paper, we use novel data on corporate green revenues to provide evidence of the green transition. This measure is not spanned by prior sustainability metrics used in the

<sup>&</sup>lt;sup>21</sup>Detailed results are available upon request.

sustainability finance literature. We start by sizing the green economy and show that the green transition has accelerated after the Paris Agreement and has grown to about \$4tn in total revenues. In absolute dollar terms, firms in large economies such as the US, China, and Japan generate the most green revenues, while European firms exhibit higher green revenue shares and appear to be more advanced in the green transition.

Next, we isolate two channels driving green revenues: technological innovation and institutional investor support. The analysis suggests that firms with (more) green patents held before the Paris Agreement were better positioned to increase their green revenue shares after the Paris Agreement, especially in the US, where regulatory pressure was less intense. We conclude that innovation is a critical driver of the green transition, allowing firms to overcome technological barriers and bring green products to market. Institutional investors have also played a role in supporting the green transition. We find that firms with higher levels of sustainability-focused institutional ownership before the Paris Agreement were more likely to see an increase in green revenues afterward.

Finally, we examine the stock market returns of firms undergoing the green transition. Although firms with higher green revenues tend to outperform the broader market, our tests reveal no overall green "alpha" once systematic asset pricing factors are accounted for. However, there is evidence of positive alpha for green firms in the United States post-Paris, suggesting that investors may have rewarded companies for voluntarily adopting greener business models. Interestingly, we do not observe similar returns for European firms, where regulatory pressure may have played a more significant role in driving the green transition. In a last step, we examine the drivers of the outperformance of firms with high green revenues post-Paris and find evidence that a mix of lower discount rates and unexpected shocks to climate concerns likely explain the higher realized returns of firms with the highest green revenue shares.

Since we are still in the early stages of the green transition, there are a lot of open questions that can be addressed by future work. For example, one question our paper leaves open is how much the shift to green revenues actually contributes to reducing corporate emissions and helps achieve broader environmental goals. One other aspect is that sustainability goals may be dynamic, while our study uses a static green classification. It would be interesting to examine how green technologies develop and better understand how markets price in their economic and environmental impacts.

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### Figures

### Figure 1. Sizing the Green Economy

Panel A illustrates the growth of corporate green revenues. The left axis shows total annual revenues derived from green products and services for publicly-listed companies worldwide (in USD \$ trillions). The right axis shows the percentage of green revenues relative to total company revenues. Panel B shows the growth of revenues by type of green business activity based on FTSE Russell's Green Revenue Classification System (GRCS). The graph plots the percentage of green revenues by each of the 10 GRCS green business activities relative to total revenues per year. The green coloring of Panel C is based on FTSE Russell's GRCS tiering system that ranks green products and services with significant and clear environmental benefits (Tier 1), those with more limited but net-positive environmental benefits (Tier 2), or those with some environmental benefits but overall net-neutral or negative environmental impact (Tier 3). More details on the GRCS taxonomy system are provided in Table A-1.1.



Panel A: The Growth of Green Corporate Revenues







Panel C: Green Revenues by GRCS Tier of "Greenness"

### Figure 2. Green Revenues by Industry

The figure maps green revenues into different traditional industries based on a company's FactSet sector classification in 2022. The green bar chart shows total annual green revenues (in USD \$ trillions) and the black dashed line plots green revenues relative to total revenues for companies in each FactSet sector.



### Figure 3. Green Revenues by Country

The figure shows annual revenues from green products and services by geographical regions based on each company's country of incorporation in 2022. The top graph shows total annual green revenues (in USD \$ trillions) while the bottom graph shows the percentage share of green revenues relative to total revenues for companies in each country.



**Figure 4.** Difference-in-differences Tests on the Drivers of Green Revenues The plots illustrate the annual regression coefficients for a balanced panel dataset, covering the years 2008 to 2023, both before and after the Paris Agreement. Blue dots represent the coefficient estimates, while the lines indicate 95% confidence intervals (CIs). The graph in Panel A displays the yearly regression coefficient estimates for an indicator variable equal to 1 if a firm held at least one green patent before the Paris Agreement, and 0 otherwise. The graph in Panel B presents a dynamic coefficient plot for an indicator variable equal to 1 if the firm's institutional ownership share is above the sample median, and 0 otherwise.





Panel B: Institutional Ownership



### Figure 5. Green Revenues Portfolio Returns

The figure plots cumulative returns per 1 USD invested for the value-weighted green stocks portfolio (light green) and we contrast it with portfolios containing stocks with at least 20% (dashed green) and 50% (dashed darker green) green revenues, respectively. The black line plots cumulative returns for the portfolio including all stocks in our sample and serves as a benchmark.



# Tables

### Table 1. Summary Statistics

This table provides summary statistics for the main variables used in the regression analysis. The sample period is from 2008 to 2023. Detailed definitions of the variables are provided in Table A-1.3. Accounting ratio variables are winsorized at the 1% and 99% levels.

Variable	Ν	Mean	SD	Min	Median	Max
Green Revenues %	267,576	3.3666	13.8646	0.0000	0.0000	100.0000
Green Revenues Indicator	267,576	0.1373	0.3441	0.0000	0.0000	1.0000
Tier 1 Green Revenues $\%$	267,576	2.1078	10.4023	0.0000	0.0000	100.0000
Tier 2 Green Revenues $\%$	$267,\!576$	0.9828	7.0425	0.0000	0.0000	100.0000
Tier 3 Green Revenues $\%$	$267,\!576$	0.2362	3.4485	0.0000	0.0000	100.0000
EUTSF Green Revenues $\%$	$267,\!576$	2.5576	11.7089	0.0000	0.0000	100.0000
Post Paris	$267,\!576$	0.5306	0.4991	0.0000	1.0000	1.0000
Post TEG	$267,\!576$	0.3923	0.4883	0.0000	0.0000	1.0000
Post EUTSF	$267,\!576$	0.2570	0.4370	0.0000	0.0000	1.0000
All Patents	$267,\!576$	1.9515	9.5517	0.0000	0.0000	65.5000
Green Patents	$267,\!576$	0.0948	0.5176	0.0000	0.0000	3.6667
GP Ratio	$267,\!576$	0.0056	0.0302	0.0000	0.0000	0.2222
GP Indicator	$267,\!576$	0.0554	0.2287	0.0000	0.0000	1.0000
Total Assets USD	$267,\!576$	12.4658	109.2394	0.0000	0.8245	12822.25
Total Sales USD	$267,\!576$	3.1190	13.4602	0.0000	0.4323	592.46
Green Revenues USD	$267,\!576$	0.1550	1.4778	0.0000	0.0000	102.55
Market Value USD	$267,\!576$	3.7128	21.7784	0.1000	0.6045	2490.54
Tobin's Q	$267,\!576$	1.8913	1.7600	0.5450	1.2903	17.0187
Leverage	$267,\!576$	0.2278	0.1937	0.0000	0.1972	0.8445
ROA	$267,\!576$	0.0627	0.0956	-0.4682	0.0596	0.4022
Cash	$267,\!576$	0.1750	0.1730	0.0003	0.1203	0.8717
CAPEX	$267,\!576$	0.0396	0.0478	0.0000	0.0241	0.3426
R&D	$267,\!576$	0.0143	0.0378	0.0000	0.0000	0.2825
Europe	$267,\!576$	0.1670	0.3730	0.0000	0.0000	1.0000
North America	$267,\!576$	0.2125	0.4091	0.0000	0.0000	1.0000
Asia-Pacific	$267,\!576$	0.5345	0.4988	0.0000	1.0000	1.0000
Rest of the World	$267,\!576$	0.0860	0.2803	0.0000	0.0000	1.0000
IO Pre Paris	220,241	0.2180	0.2834	0.0000	0.0909	1.0000
IO CDP Pre Paris	220,241	0.0787	0.1077	0.0000	0.0281	0.5774
IO PRI Pre Paris	220,241	0.1031	0.1402	0.0000	0.0405	0.7584
Turnover Pre Paris	209,056	0.2740	0.1673	0.0202	0.2089	1.4532

Table 2. Correlation of Green Revenues with other Environmental Measure
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This table shows pairwise Pearson correlation coefficients for % company green revenues, % tier 1 green revenues, % EUTSF eligible green revenues, and various environmental measures used in prior literature. These include scope 1, 2, and 3 carbon intensities from Trucost and environmental (ESG) scores from MSCI. *E-Score PST* is the modified environmental score proposed in Pastor et al. (2022), and *Ad. MSCI ESG Score* is the industry-adjusted ESG score from MSCI. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Green Revenues $\%$	1							
(2) Tier 1 Green Revenues $\%$	0.814***	1						
(3) EUTFS Green Revenues $\%$	0.889***	0.819***	1					
(4) CO2 Int. Scope 1	0.042***	0.011***	0.032***	1				
(5) CO2 Int. Scope $2$	0.013***	0.003	0.004	0.067***	1			
(6) CO2 Int. Scope 3	0.066***	0.085***	0.050***	0.245***	0.067***	1		
(7) E-Score PST	-0.119***	-0.075***	-0.085***	-0.360***	-0.171***	-0.505***	1	
(8) Adj. ESG Score	0.085***	0.092***	0.090***	-0.101***	-0.015*	-0.01	0.272***	1

#### Table 3. The Role of Green Innovation

This table examines the relation between corporate green patent innovation and green revenues. In Panel A, we test whether green innovation measured by *GP Indicator* (which equals one if a company had at least one green patent between 2008 and 2013) is associated with the sales of green products and services captured by *Green Revenues* %. Alternatively, we use *GP Ratio* which measures average annual green patents relative to all patents created by a company between 2008 and 2013. *Post Paris* is a dummy equal to 1 if the year  $\geq$  2016. In columns (3) & (4), we only consider Tier 1 green revenues (green products and services with significant and clear environmental benefits) as the dependent variable. In columns (5) & (6), we consider green revenues that are eligible under the EUTSF taxonomy. Panel A shows the results for our baseline model and Panel B employs an alternative regression specification using firm, country x year, and sector x year fixed effects. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)	(4)	(5)	(6)	
	Green Revenues %		Tier 1 Green	ı Revenues %	EUTSF Green Revenues %		
GP Indicator	4.524***		2.999***		2.947***		
	(0.418)		(0.258)		(0.259)		
GP Indicator $\times$ Post Paris	2.310***		2.095***		2.473***		
	(0.472)		(0.280)		(0.294)		
GP Ratio		51.34***		35.00***		32.76***	
		(4.326)		(3.054)		(2.637)	
GP Ratio $\times$ Post Paris		16.61***		13.61***		17.76***	
		(5.446)		(3.662)		(3.421)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	267,576	267,576	267,576	267,576	267,576	267,576	
Adjusted $R^2$	0.079	0.087	0.051	0.057	0.072	0.077	

#### Panel A: Baseline Results

### Panel B: Alternative Specification

Regressions	(1)	(2)	(3)	(4)	(5)	(6)	
	Green Re	Green Revenues %		Revenues %	EUTSF Green Revenues $\%$		
GP Indicator $\times$ Post Paris	1.294***		1.022***		1.208***		
	(0.104)		(0.124)		(0.104)		
GP Ratio $\times$ Post Paris		5.823***		4.496***		6.116***	
		(1.024)		(0.963)		(0.905)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	
Sector x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	
Country x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	264,658	264,658	264,658	264,658	264,658	264,658	
Adjusted $R^2$	0.856	0.856	0.852	0.851	0.847	0.847	

### Table 4. The Role of Green Innovation: Regions and the Energy Sector

This table examines the relation between corporate green innovation and green revenues for different geographical regions and the energy sector. We test whether corporate green innovation measured by the variable *GP Indicator* (which equals one if a company had at least one green patent between 2008 and 2013) is associated with the sales of green products and services captured by *Green Revenues* %. Alternatively, we use *GP Ratio* which measures average annual green patents relative to all patents created by a company between 2008 and 2013. *Post Paris* is a dummy equal to 1 if the year  $\geq$  2016. In columns (1) to (6), we conduct the analysis separately for firms headquartered in three regions: United States, Europe, and Asia-Pacific. In columns (7) and (8), we show results for firms in the energy sector, given its potential role in the energy transition. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors are clustered at the country-year level, except for columns (1) and (2), where robust standard errors are applied. Standard errors are reported in parentheses.

Dependent variable: Green Revenues $\%$								
	τ	JS	Eu	rope	Asia-	Pacific	Ene	ergy
Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GP Indicator	$6.876^{***}$ (0.374)		$4.312^{***}$ (0.550)		$1.143^{***}$ (0.347)		$1.962^{***}$ (0.598)	
GP Indicator $\times$ Post Paris	$2.450^{***}$ (0.554)		0.869 (0.845)		$2.756^{***}$ (0.463)		-0.818 (0.614)	
GP Ratio		$69.44^{***}$ (3.705)		49.88*** (4.616)		$13.96^{***}$ (2.687)		7.143*** (2.604)
GP Ratio $\times$ Post Paris		$18.21^{***}$ (5.551)		5.461 (6.930)		$20.50^{***}$ (3.283)		-1.868 (3.071)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Country FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	48,460	48,460	44,689	44,689	143,014	143,014	7,648	7,648
Adjusted R <sup>2</sup>	0.099	0.129	0.097	0.102	0.065	0.065	0.269	0.263

### Table 5. The Role of Institutional Ownership

The table examines the relation between institutional ownership and corporate green revenues. In Panel A, the dependent variable is *Green Revenues* %. The key explanatory variables of interest include the total share of institutional ownership (*IO Pre Paris*), institutional ownership above the sample median (*IO High Pre Paris*), the share of responsible institutional ownership (*IO PRI Pre Paris*), and climate-focused institutional ownership (*IO CDP Pre Paris*). *IO Turnover Pre Paris* represents the holdings-weighted churn ratio of institutional owners by firm. These explanatory variables are all measured as of 2015 and held constant over the sample period to analyze how pre-Paris institutional ownership and turnover impacted firms' green revenues post Paris. Post Paris is a dummy variable equal to 1 for years  $\geq$  2016. In Panel B, we restrict the analysis to GRCS Tier 1 green revenues as the dependent variable. Panel C focuses on green revenues that are eligible under the EUTSF taxonomy. By \*, \*\*, and \*\*\* we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	$2.669^{***}$				
IO Pre Paris $\times$ Post Paris	(0.328) $1.103^{***}$ (0.318)				
IO High Pre Paris	()	$1.549^{***}$ (0.117)			
IO High Pre Paris $\times$ Post Paris		0.650*** (0.152)			
IO PRI Pre Paris		(0.102)	$5.344^{***}$ (0.458)		
IO PRI Pre Paris $\times$ Post Paris			2.234*** (0.723)		
IO CDP Pre Paris			(01120)	$7.297^{***}$ (0.799)	
IO CDP Pre Paris $\times$ Post Paris				3.202*** (1.085)	
Turnover Pre Paris				(21000)	-2.908*** (0.672)
Turnover Pre Paris $\times$ Post Paris					-0.341 (0.466)
Controls Year FE	Yes	Yes Ves	Yes Ves	Yes Yes	Yes Ves
Sector FE Country FE	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
Observations Adjusted $R^2$	$220,241 \\ 0.076$	$220,241 \\ 0.078$	$220,241 \\ 0.077$	$220,241 \\ 0.077$	$209,056 \\ 0.079$

Panel A	4: Green	Revenues	%
I and I	I. OICCII	100 vonues	70

#### Panel B: Tier 1 Green Revenues %

Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	2.061***				
IO Pre Paris $\times$ Post Paris	(0.209) $0.927^{***}$ (0.208)				
IO High Pre Paris	(0.200)	$0.932^{***}$			
IO High Pre Paris $\times$ Post Paris		(0.0751) $0.502^{***}$ (0.114)			
IO PRI Pre Paris		(0.114)	$3.176^{***}$		
IO PRI Pre Paris $\times$ Post Paris			(0.391) $1.801^{***}$ (0.524)		
IO CDP Pre Paris			(0.534)	$4.409^{***}$	
IO CDP Pre Paris $\times$ Post Paris				(0.544) $2.616^{***}$ (0.762)	
Turnover Pre Paris				(0.762)	-1.550***
Turnover Pre Paris $\times$ Post Paris					(0.595) 0.236 (0.383)
Controls Vear FE	Yes Ves	Yes Ves	Yes Ves	Yes Ves	Yes Ves
Sector FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	$220,\!241$	220,241	220,241	220,241	209,056
Adjusted $R^2$	0.046	0.047	0.046	0.046	0.047

Panel C: EUTSF Green Revenue
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Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	$1.640^{***}$				
IO Pre Paris $\times$ Post Paris	(0.220) $1.359^{***}$ (0.254)				
IO High Pre Paris	(0.204)	$1.072^{***}$			
IO High Pre Paris $\times$ Post Paris		0.686***			
IO PRI Pre Paris		(0110)	$3.624^{***}$		
IO PRI Pre Paris $\times$ Post Paris			2.850*** (0.579)		
IO CDP Pre Paris			(0.0.0)	$4.843^{***}$ (0.600)	
IO CDP Pre Paris $\times$ Post Paris				4.095*** (0.886)	
Turnover Pre Paris				(0.000)	$-2.331^{***}$ (0.535)
Turnover Pre Paris × Post Paris					$-0.710^{*}$ (0.388)
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes
Country PE	res	I es	I ES	Ies	I es
Observations	220,241	220,241	220,241	220,241	209,056
Adjusted $R^2$	0.071	0.072	0.071	0.072	0.071

### Table 6. Green Revenues Portfolio Tests

This table presents the results of calendar-time portfolio regressions for monthly green stock portfolios from January 2008 to December 2023. In Panel A, the green testing portfolio is a long-only, value-weighted portfolio composed of firms with *Green Revenues* > 20%. In Panel B, we analyze the returns of a long-short portfolio, where the long position includes firms with *Green Revenues*  $\geq 20\%$ , and the short position consists of firms with *Green Revenues* = 0% (legacy portfolio). Column (1) reports monthly value-weighted excess returns (*Alpha*), while column (2) presents sector-adjusted excess returns. Column (3) provides results for the CAPM model, and column (4) implements the Fama-French 3-factor model (Fama and French (1993)). Column (5) uses the Carhart 4-factor model (Carhart (1997)), column (6) applies the Fama-French 5-factor model (Fama and French (2015)), and column (7) combines both the Carhart and Fama-French factors. Lastly, in column (8), we add the GMB factor proposed by Karolyi et al. (2023) that covers the 2012 to 2021 period. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Portfolio				Green Reve	enues $\geq 20\%$			
Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market - Rf			1.038***	1.084***	1.075***	1.046***	1.044***	1.095***
			(0.0207)	(0.0199)	(0.0202)	(0.0219)	(0.0213)	(0.0310)
Size				-0.0134	-0.0208	-0.0915	-0.0928	-0.0585
				(0.0616)	(0.0615)	(0.0803)	(0.0805)	(0.119)
Value				-0.207***	-0.260***	-0.113*	-0.157**	-0.108
				(0.0387)	(0.0485)	(0.0587)	(0.0768)	(0.118)
Momentum					-0.0714*		-0.0419	-0.0521
					(0.0374)		(0.0406)	(0.0733)
Profitability						-0.0765	-0.0824	-0.0392
						(0.0970)	(0.0980)	(0.125)
Investment						-0.230**	-0.204**	-0.230
						(0.0956)	(0.102)	(0.163)
GMB								-0.0657
								(0.0643)
Alpha	$0.952^{**}$	-0.0422	0.0323	-0.00736	0.0136	0.0714	0.0809	0.164
	(0.369)	(0.0680)	(0.0935)	(0.0853)	(0.0845)	(0.0983)	(0.0992)	(0.125)
Observations	192	192	192	192	192	192	192	109
Adjusted $\mathbb{R}^2$	0.000	0.000	0.931	0.942	0.943	0.944	0.944	0.924

### Panel A: Long Green Revenues Portfolio

ranei D. Long-Short Green nevenues Minus Legacy (GML) rottic	Panel B: I	Long-Short	Green R	levenues	Minus	Legacy (	(GML)	) Portfoli
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Portfolio			Green	Revenues $\geq 20\%$	% Minus Legacy	(GML)		
Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market - Rf			0.0596**	0.120***	0.108***	0.0756***	0.0733***	0.126***
			(0.0253)	(0.0243)	(0.0242)	(0.0252)	(0.0246)	(0.0368)
Size				-0.0444	-0.0538	-0.118	-0.119	-0.0810
				(0.0737)	(0.0737)	(0.0961)	(0.0963)	(0.143)
Value				-0.254***	-0.322***	-0.128*	-0.183**	-0.113
				(0.0453)	(0.0570)	(0.0690)	(0.0882)	(0.140)
Momentum					-0.0909**		-0.0524	-0.0573
					(0.0440)		(0.0472)	(0.0877)
Profitability						-0.0337	-0.0411	0.0204
						(0.113)	(0.113)	(0.145)
Investment						-0.290**	-0.257**	-0.292
						(0.114)	(0.120)	(0.197)
GMB								-0.0797
								(0.0793)
Alpha	-0.0041	-0.0426	-0.0568	-0.106	-0.0797	-0.0337	-0.0219	0.113
	(0.119)	(0.0681)	(0.114)	(0.103)	(0.102)	(0.119)	(0.120)	(0.145)
Observations	192	192	192	192	192	192	192	109
Adjusted $R^2$	0.000	0.000	0.024	0.202	0.212	0.231	0.231	0.167

### Table 7. GML Portfolios: Shades of Green

This table presents calendar-time portfolio regressions for the long-short green revenues minus legacy (GML) portfolio, categorized by different levels of "greenness" based on the percentage of green revenues. In Panel A, we report results for monthly value-weighted longshort portfolio returns, where the long portfolio consists of "green" stocks (stocks generating green revenues above a specified percentage threshold) and the short portfolio includes stocks that do not generate any green revenues (legacy firms). These GML portfolios are regressed on the 6-factor model proposed in column (7) of Table 6, but we display only the Alpha coefficient estimates. In column (1), the green portfolio includes all stocks with Green Revenues > 0%. Column (2) focuses on green stocks with Green Revenues > 20%, column (3) considers green stocks with Green Revenues > 50%, and column (4) examines a portfolio of "pure-play" green stocks with Green Revenues > 80%. In Panel A, we report the Alpha estimates for the full global sample as well as two sub-periods: Pre Paris (2008–2015) and Post Paris (2016–2023). Below, we present the number of firms and combined market value of the stocks in the long green (G) portfolio for both 2008 and 2022. In Panel B, we apply a stricter definition of green revenues based on the GRCS tiering system, considering only Tier 1 green revenues. In Panel C, revenues are classified as green if they are eligible under the EUTSF taxonomy. By \*, \*\*, and \*\*\* we denote p-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Regression	(1)	(2)	(3)	(4)				
	Panel A: G	reen Minus Lega	cy (GML)					
Portfolio	> 0%	> 20%	> 50%	> 80%				
Alpha	-0.199**	-0.0219	0.135	$0.595^{*}$				
	(0.0941)	(0.120)	(0.191)	(0.302)				
Pre Paris	$-0.409^{***}$	-0.292*	-0.286	-0.0426				
	(0.129)	(0.151)	(0.192)	(0.283)				
Post Paris	0.00602	0.242	$0.546^{*}$	$1.218^{***}$				
	(0.120)	(0.169)	(0.297)	(0.463)				
2008: Nr firms	1.462	493	221	129				
Total USD trln	\$7.79	\$2.00	\$0.70	\$0.25				
	0.790	1.014	F1C	200				
2022: Nr firms	2,730	1,014	010 00.07	302 ¢0.07				
Total USD trin	\$29.20	\$9.57	\$3.87	\$2.07				
Panel B: Tier 1 Green Minus Legacy (GML)								
Portfolio	> 0%	> 20%	> 50%	> 80%				
Alpha	-0.266**	0.0844	0.446	1.082**				
*	(0.103)	(0.182)	(0.277)	(0.482)				
Pre Paris	-0.503***	-0.279	-0.0204	0.202				
	(0.142)	(0.199)	(0.259)	(0.457)				
Post Paris	-0.0355	0.439	0.901* <sup>*</sup>	1.942***				
	(0.133)	(0.275)	(0.445)	(0.743)				
	Panel C: EUTS	F Green Minus	Legacy (GML)					
Portfolio	> 0%	> 20%	> 50%	> 80%				
Alpha	-0.186*	0.0665	0.260	0.753**				
*	(0.105)	(0.139)	(0.210)	(0.365)				
Pre Paris	-0.414***	-0.220	-0.138	-0.0138				
	(0.142)	(0.170)	(0.196)	(0.354)				
Post Paris	0.0358	$0.346^{\star}$	$0.648^{\star}$	1.501***				
	(0.136)	(0.199)	(0.334)	(0.555)				

### Table 8. GML Portfolios: Subsample Analysis

This table reports the *Alpha* of the long-short green revenues minus legacy (GML) portfolio across different shades of "greenness", as in Table 7. We provide results for various subsamples: Panels A–C categorize firms by their country of incorporation; Panel D focuses on energy sector firms (note that there are no energy companies with > 50% green revenues); and Panels E and F condition the analysis on whether the firm had at least one green patent prior to the Paris Agreement (*GP Indicator* = 1) or high institutional ownership pre-Paris (*IO High Pre-Paris* = 1). For more details on the specifications, refer to Tables 6 and 7. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Variable	Green Revenues %							
Regression	(1)	(2)	(3)	(4)				
Portfolio	> 0%	> 20%	> 50%	> 80%				
Sample								
Pre Paris	-0.308*	-0.380**	-0.331	0.0575				
	(0.159)	(0.173)	(0.318)	(0.417)				
Post Paris	0.126	0.394	1.319**	1.859**				
	(0.183)	(0.252)	(0.538)	(0.716)				
Sample	Panel B: Europe							
Pre Paris	-0.575***	-0.589***	-0.821***	-0.251				
	(0.158)	(0.180)	(0.276)	(0.334)				
Post Paris	-0.130	-0.0152	0.117	0.0518				
	(0.124)	(0.171)	(0.210)	(0.268)				
Sample	Panel C: Asia-Pacific							
Pre Paris	-0.423**	-0.0586	0.0589	0.347				
	(0.187)	(0.215)	(0.214)	(0.389)				
Post Paris	-0.0870	0.0950	0.0913	0.555				
	(0.167)	(0.248)	(0.309)	(0.339)				
Sample	Panel D: Energy							
Pre Paris	-0.220	-0.0574	-	-				
	(0.306)	(0.630)	-	-				
Post Paris	-0.443	0.429	-	-				
	(0.278)	(0.876)	-	-				
Sample		Panel E: Gr	een Patents					
Pre Paris	-0.404**	-0.296	-0.191	0.129				
	(0.181)	(0.204)	(0.330)	(0.530)				
Post Paris	0.113	0.408*	1.105**	2.254***				
	(0.173)	(0.241)	(0.544)	(0.813)				
Sample		Panel F: Institut	ional Ownership					
Pre Paris	-0.396***	-0.271*	-0.175	-0.0722				
	(0.129)	(0.156)	(0.206)	(0.323)				
Post Paris	0.0124	0.254	0.656*	1.471**				
	(0.130)	(0.187)	(0.362)	(0.567)				

**Table 9.** Green Revenues, Implied Cost of Capital and Earnings Surprises In this table, we present OLS regression results using the stock-level *Implied Cost of Capital* as the dependent variable in columns (1) and (2). In columns (3) and (4) we regress the median analyst *Earnings Surprise* on lagged company *Green Revenues* % and firm controls. The earnings surprise variable is defined as the difference between the actual earnings and the analyst consensus forecast 9 months prior to the end of the forecast period, scaled by the stock price at the end of the fiscal year at time t. Forecast errors are winsorized at the 1st and 99th percentiles, respectively. The coefficients for Green Revenues % are multiplied by 100. By \*, \*\*, and \*\*\* we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level, are in parentheses.

Dep. Variable	Implied Cos	st of Capital	Earnings S	Surprise t+1
Regressions	(1)	(2)	(3)	(4)
Green Revenues $\%$	$-0.622^{***}$ (0.168)	$-0.516^{***}$ (0.121)	-0.272 (0.173)	$0.161 \\ (0.175)$
Sample	Full	Post 2016	Full	Post 2016
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations Adjusted $R^2$	$63,319 \\ 0.028$	$24,473 \\ 0.240$	$116,\!872 \\ 0.029$	$64,491 \\ 0.023$

### Table 10. Unexpected Changes in Climate Concerns

We estimate monthly time-series regressions using data from January 2008 to December 2023. In Panel A, the dependent variable is the monthly return on value-weighted portfolios for different thresholds of *Green Revenues* % as in Tables 6 and 7. In Panel B, the dependent variable is a long-short portfolio of each value-weighted green portfolio return minus the legacy portfolio return (GML). The independent variable is the prediction error from an AR(1) model applied to the monthly MCCC index proposed by Ardia et al. (2023). Robust standard errors are in parentheses.

Variable		Green Re	evenues %	
Portfolio	> 0%	> 20%	> 50%	> 80%
Prediction Error	$2.405^{**}$ (1.093)	$2.718^{**} \\ (1.129)$	$3.803^{***}$ (1.298)	$4.500^{***}$ (1.508)
Observations Adjusted $R^2$	$\begin{array}{c} 192 \\ 0.019 \end{array}$	$\begin{array}{c} 192 \\ 0.025 \end{array}$	$192 \\ 0.041$	192 0.044

Panel A: Long Green Revenues Portfolio

Panel B: Long-Short Green Revenues Minus Legacy (GML) Por	rtfolio
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Variable		Green Minu	us Legacy %	
Portfolio	> 0%	> 20%	> 50%	> 80%
Prediction Error	$0.708^{**}$ (0.318)	$1.020^{***}$ (0.384)	$2.105^{***} \\ (0.576)$	$2.803^{***} \\ (0.856)$
Observations Adjusted $R^2$	$\begin{array}{c} 192 \\ 0.029 \end{array}$	$\begin{array}{c} 192 \\ 0.038 \end{array}$	$\begin{array}{c} 192 \\ 0.074 \end{array}$	$\begin{array}{c} 192 \\ 0.063 \end{array}$

## Appendix 1

### Figure A-1.1. Decomposition of Green Revenues by GRCS Business Activities

The tree map breaks down total green revenues based on the 10 GRCS green sectors (and into the 64 GRCS subsectors) of FTSE Russell's Green Revenue Classification System (GRCS) as of 2022. Total green revenues sum to approximately USD \$4 trillion. More details on the GRCS taxonomy are provided in Table A-1.1.



### Figure A-1.2. Decomposition of Green Revenues by Tiers of "Greenness" of GRCS Business Activities

The tree map breaks down total green revenues based on the 10 GRCS green sectors (and into the 64 GRCS subsectors) of FTSE Russell's Green Revenue Classification System (GRCS) as of 2022. The green coloring is based on FTSE Russell's GRCS tiering system: **Tier 1** covers green products and services with significant and clear environmental benefits; **Tier 2** covers green products and services with more limited but netpositive environmental benefits; **Tier 3** covers green products and services which have some environmental benefits but are overall net-neutral or negative. More details on the GRCS taxonomy are provided in Table A-1.1.



### Table A-1.1. FTSE Russell's Green Revenue Classification System

This table provides details on FTSE Russell's Green Revenue Classification System (GRCS), which identifies green products and services covering 10 sectors and 64 subsectors. Source: LSEG FTSE Russell "Green Revenues Data Model - Methodology" (2024) - https://www.lseg.com/content/ dam/ftse-russell/en\_us/documents/policy-documents/ftse-green-revenues-classification-system.pdf. The green coloring is based on FTSE Russell's GRCS tiering system: subsectors are colored in dark green if these are only classified as **Tier 1** covering green products and services with significant and clear environmental benefits; green if the subsectors include also activities with any **Tier 2** green products and services with more limited but net-positive environmental benefits; and light green if the sub-sector encompasses any **Tier 3** green products and services which have some environmental benefits but are overall net-neutral or negative.

Revenue generating activities from the generating activities from the generating activities from products preserves enabling in encewhole and alternative energy value claim, excluding power generating activities from the claim for the presence activities from the claim for the presence activities from the claim for the presence activities from the for the presence activities from the formation of the presence activities from the claim for the presence activities from the formation for the presence activities from the claim for the presence activities from the formation for the presence activities from the formation for the presence activities from the claim for the presence activities from the formation for the presence activities from the f	EG - ENERGY GENERATION	EQ - ENERGY EQUIPMENT	EM - ENERGY MANAGEMENT	ER - ENVIRONMENTAL RESOURCES	ES - ENVIRONMENTAL SUPPORT
Bio Fuels (Tier 27)       Bio Fuels Equipment (Tier 27)       Binklings & Property (Integrated) (Tier 1)       Advanced & Light Materials (Tier 1)       Furinemental Consultancies (Tier 2)         Cogeneration Fuels (Tier 1)       Clean Fossil Fuels (Tier 1)       Clean Fossil Fuels (Tier 1)       Clean Fossil Fuels (Tier 1)       Environmental Consultancies (Tier 2)       Furineme & Investment (Tier 2)         Geothemal (Tier 1)       Fuel Cells (Tier 2)       Industrial Processes (Tier 12)       Recyclable Produets & Materials (Tier 1)       Smart City Design & Engineering (Tier 2)         Hydro (Tier 1/2)       Geothemal (Tier 1)       Hydro (Tier 1)       Jugiting (Tier 1)       Smart & Efficient (Critic 2)	Revenue generating activities from the generation of power from renewable and alternative energy sources.	Revenue generating activities from the renewable and alternative energy value chain, excluding power generation activities.	Revenue generating activities from products and services enabling more efficient methods of energy usage and management.	Revenue generating activities from production, processing and sale of key and advanced materials which specifically enable the minimisation of negative environmental impacts and improve the efficiency of natural resource use	Revenue generating activities from environmental support services relating to consulting, investment or urban design that enable or indirectly contribute to green activities resulting in a large breadth of environmental utility
Cogeneration (Tier 1/2)         Cogeneration Equipment (Tier 1/2)         Controls (Tier 2)         Key Raw Minerals & Metals (Tier 3)         Finance & Investment (Tier 2)           Gentherman (Tier 1)         Fuel Cells (Tier 2)         II Processes (Tier 1/2)         Recentable Products & Materials (Tier 1)         Simant City Design & Engineering (Tier 2)           Hydro (Tier 1/2)         Geothermal (Tier 1)         Hydro (Tier 1/2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 1)         Simant & Efficient Grids (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Beothermal (Tier 1)         Simant & Efficient Grids (Tier 2)         Beothermal (Tier 1)         Beothermal (Tier 1)         Beothermal (Tier 2)         Beothermal (Tier 2)	Bio Fuels (Tier 2/3)	Bio Fuels Equipment (Tier 2/3)	Buildings & Property (Integrated) (Tier 1)	Advanced & Light Materials (Tier 1)	Environmental Consultancies (Tier 2)
Cleam Fossil Fuels (Tier 1)       Cleam Fossil Fuels (Tier 1)       Industrial Processes (Tier 1)       Recycluble Products & Materials (Tier 1)       Smart City Design & Engineering (Tier 2)         Hydro (Tier 1/2)       Geothermal (Tier 1)       Iphting (Tier 1)       Smart & Efficient (Tid. 2)       Smart & Efficient (Tid. 2)       Smart & Efficient (Tid. 2)         Nuclear (Tier 3)       Hydro (Tier 1/2)       Ocean & Tidal (Tier 1)       Smart & Efficient (Tid. 3)       Smart & Efficient (Ti	Cogeneration (Tier 1/2)	Cogeneration Equipment (Tier 1/2)	Controls (Tier 2)	Key Raw Minerals & Metals (Tier 3)	Finance & Investment (Tier 2)
Geothermal (Tier 1)       Fuel Cells (Tier 2)       IT Processes (Tier 1/2)         Hydro (Tier 12)       Geothermal (Tier 1)       Likhing (Tier 1)         Nuclear (Tier 3)       Hydro (Tier 12)       Power Storage (Tier 1)         Solar (Tier 1)       Nuclear (Tier 3)       Smart & Efficient (Gnick (Tier 1)         Solar (Tier 1)       Oceam & Tidda (Tier 1)       Sustainable Property Operator (Tier 2)         Wind (Tier 1)       Waste to Energy (Tier 1)       Sustainable Property Operator (Tier 2)         Wind (Tier 1)       Waste to Energy (Tier 1)       Sustainable Property Operator (Tier 2)         Wind (Tier 1)       Waste to Energy (Tier 1)       Sustainable Property Operator (Tier 2)         Wind (Tier 1)       Waste to Energy (Tier 1)       Sustainable Property Operator (Tier 2)         Revenue generating activities from products       Revenue generating activities from products       Revenue generating activities from products and services which minimiste from the provistion of technologies, systems and services which minimiste the environmental improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the restriction solutions and services which minimisting negative and resource use associated with the transportation industry       Revenue generating activities from trechnologies, system and services which minimisties the environmental insport the contamination of air, waste and services for waste management, reuse and recycling       Revenue generating activities	Clean Fossil Fuels (Tier 1)	Clean Fossil Fuels (Tier 1)	Industrial Processes (Tier 1)	Recyclable Products & Materials (Tier 1)	Smart City Design & Engineering (Tier 2)
Hydro (Tier 12)       Geothemal (Tier 1)       Lighting (Tier 1)         Nuclear (Tier 3)       Hydro (Tier 12)       Power Storage (Tier 1)         Solar (Tier 1)       Nuclear (Tier 3)       Smart & Efficient Grids (Tier 1)         Solar (Tier 1)       Solar (Tier 1)       Sustainable Property Operator (Tier 2)         Waste to Energy (Tier 1)       Solar (Tier 1)       Energy Management Legistics & Support (Tier 2)         Wind (Tier 1)       Waste to Energy (Tier 1)       Solar (Tier 2)         Wind (Tier 1)       Wind (Tier 1)       Energy Management Legistics & Support (Tier 2)         Revenue generating activities from products that improve yield, productivitor and sustainability in agriculture, silviculare, and inprove the efficiency of natural resource use associated with the transportation industry       Revenue generation advisites from the efficiency of natural resource use associated with the transportation industry       Revenue generating activities for tier 12)       Revenue generation and services for waste management, and soil to address global, regional and local, systems and services for waste management, ervices which reduce, monitor, or advistrimbulty in agriculture (Tier 1/2/3)       Aviation (Tier 2)       Real Venice (Tier 1/2)       Revenue generating activities from the transportation industry         Agriculture (Tier 1/2/3)       Aviation (Tier 2)       Railways Operator (Tier 1/2)       Cleaner Power (Tier 2)       Meteorological Solutions (Tier 1)         Aqriculture (Tier 1/3)       Railways (Tier 1	Geothermal (Tier 1)	Fuel Cells (Tier 2)	IT Processes (Tier1/2)		
Nuclear (Tier 3)       Hydro (Tier 12)       Power Storage (Tier 1)         Oceam & Tidal (Tier 1)       Nuclear (Tier 3)       Smart & Efficient (Grids (Tier 1)         Solar (Tier 1)       Oceam & Tidal (Tier 1)       Sustainable Property Operator (Tier 2)         Wind (Tier 1)       Solar (Tier 1)       Solar (Tier 1)         Wind (Tier 1)       Solar (Tier 1)       Sustainable Property Operator (Tier 2)         Energy Management Logistics & Support       TE - TRANSPORTATION EQUIPMENT       TS - TRANSPORTATION SOLUTIONS       WP - WASTE & POLLUTION CONTRoL       WI - WATER INFRASTRUCTURE         Revenue generating activities from products the provision of technologies, systems and services which minimisty negative and services which minimists the environmental impacts and improve the efficiency of distribution, whilst minimisty negative and and unprove the efficiency of distribution, whilst minimisty negative and services which minimisty negative and services which minimisty negative and services which minimisty negative and and unprove the efficiency of distribution, whilst minimisty negative and service use associated with the transportation industry       Revenue generating activities form troe or distribution (Tier 1/2/3)       Revine generating activities form industry       Revenue generating activities form technologies, systems and services which minimistic see and technologies, systems and services which minimistic see and services which minimistic see and services (the supply, management and services which minimistic see and services (the supply, management and services which minimistic see and services (the supply, management and services which minintesthe environ	Hydro (Tier 1/2)	Geothermal (Tier 1)	Lighting (Tier 1)		
Ocean & Tidal (Tier 1) Solar (Tier 1)       Nuclear (Tier 3)       Smart & Efficient Grids (Tier 1)         Waste to Energy (Tier 1) Wind (Tier 1)       Ocean & Tidal (Tier 1)       Sustainable Property Operator (Tier 2)       Energy Management Logistics & Support (Tier 2)       Energy Management Logistics & Support (Tier 2)       We - WASTE & POLLUTION CONTROL       WI - WATER INFRASTRUCTURE         FA - FOOD & AGRICULTURE       TE - TRANSPORTATION EQUIPMENT       TS - TRANSPORTATION SOLUTIONS       WP - WASTE & POLLUTION CONTROL       WI - WATER INFRASTRUCTURE         Revenue generating activities from products that improve yield, productivity and sustainability in agriculture, silviculture, aquaculture and food production or distribution, whilst minimisting negative environmental impacts       Revenue generating activities from the provision of technologies, systems and services which minimiste the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from products and services for water management, systems and services for water management, systems and services for water management, systems and services for water management, rease and technologies, systems and services for the supply, management and impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from provent the contamination of services for water management, rease and services for water management, systems and services for a services (Tier 1)       Neteorological Solutions (Tier 1)         Agriculture (Tier 1/2/3)       Aviation (Tier 2)       Railways Operator (Tier 1)/2	Nuclear (Tier 3)	Hydro (Tier 1/2)	Power Storage (Tier 1)		
Solar (Tier 1) Waste to Energy (Tier 1) Wind (Tier 1)       Ocean & Tidal (Tier 1) Solar (Tier 1)       Sustainable Property Operator (Tier 2) Energy Management Logistics & Support (Tier 2)       Sustainable Property Operator (Tier 2)         FA - FOOD & AGRICULTURE       TE - TRANSPORTATION EQUIPMENT Number of technologies, systems and sustainability in agriculture, stitculture, aquaculture and food productiving and sustainability in agriculture, stitculture, environmental Impacts       TE - TRANSPORTATION EQUIPMENT Revenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the contract and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the contract and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the contract and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the contract and the prove the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the contract and the prove the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the contract and the p	Ocean & Tidal (Tier 1)	Nuclear (Tier 3)	Smart & Efficient Grids (Tier 1)		
Waste to Energy (Tier 1) Wind (Tier 1)       Solar (Tier 1) Waste to Energy (Tier 1) Wind (Tier 1)       Solar (Tier 1) Waste to Energy (Tier 1) Wind (Tier 2)       Energy Management Logistics & Support (Tier 2)         FA - FOOD & AGRICULTURE       TE - TRANSPORTATION EQUIPMENT       TS - TRANSPORTATION SOLUTIONS       WP - WASTE & POLLUTION CONTROL       WI - WATER INFRASTRUCTURE         Revenue generating activities from products that improve yield, productivity and sustainability in agriculture, silviculture, aquaculture and food production or distribution, whilst minimising negative environmental impacts       Revenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the operation industry       Revenue generating activities from products and services of the supply, management and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from products and services of a date supply, management, reuse and recycling       Revenue generating activities from the operation industry       Revenue generating activities from the operation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the operation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the oprevices which reation of the supply, management, reuse	Solar (Tier 1)	Ocean & Tidal (Tier 1)	Sustainable Property Operator (Tier 2)		
Wind (Tier 1)Waste to Energy (Tier 1) Wind (Tier 1)(Tier 2)FA - FOOD & AGRICULTURETE - TRANSPORTATION EQUIPMENTTS - TRANSPORTATION SOLUTIONSWP - WASTE & POLLUTION CONTROLWI - WATER INFRASTRUCTURERevenue generating activities from products that improve yield, production or aquaculture and food production or distribution, whilst minimising negative environmental impactsRevenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation solutions and impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation industryRevenue generating activities fr	Waste to Energy (Tier 1)	Solar (Tier 1)	Energy Management Logistics & Support		
Wind (Tier 1)       Wind (Tier 1)       Wind (Tier 1)         FA - FOOD & AGRICULTURE       TE - TRANSPORTATION EQUIPMENT       TS - TRANSPORTATION SOLUTIONS       WP - WASTE & POLLUTION CONTROL       WI - WATER INFRASTRUCTURE         Revenue generating activities from products that improve yield, productivity and sustainability in agriculture, silviculture, aquaculture and food production or distribution, whilst minimisting negative environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the provision of transportation industry       Revenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry       Revenue generating activities from the operation of transportation industry       Revenue generating activities from products and services for waste management, reuse and recycling       Revenue generating activities from the operation of transportation industry       Revenue generating activities from products inductor (Tier 1/2)       Revenue generating activities from the operation of transportation industry       Revenue generating activities from products inductor (Tier 1/2)       Revenue generating activities from the operation of transportation industry       Revenue generating activities from the	Wind (Tier 1)	Waste to Energy (Tier 1)	(Tier 2)		
FA - FOOD & AGRICULTURETE - TRANSPORTATION EQUIPMENTTS - TRANSPORTATION SOLUTIONSWP - WASTE & POLLUTION CONTROLWI - WATER INFRASTRUCTURERevenue generating activities from products that improve yield, productivity and sustainability in agriculture, stiviculture, aquaculture and food production or distribution, whils minimising negative environmental impactsRevenue generating activities from the provision of technologies, systems and sustainability in agriculture (Tier 1/2/3) Aquaculture (Tier 1/3)Revenue generating activities from the frameware (Tier 1)Revenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryWP - WASTE & POLLUTION CONTROLWI - WATER INFRASTRUCTURERevenue generating activities from the provision of technologies, systems and aquaculture (Tier 1/2/3) Aquaculture (Tier 1/3)Revenue generating activities from the provision industryProof Safety, Efficient Processing & Sustainable Revenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the and services for waste management, reuse and recyclingRevenue generating activities from the and services for waste management, reuse and recyclingRevenue generating activities from the child nadces global, regional and local systems and services for waste management, reuse and recyclingRevenue generating activities from the and services for waste management, reuse and recyclingR		Wind (Tier 1)			
FA - FOOD & AGRICULTURETE - TRANSPORTATION EQUIPMENTTS - TRANSPORTATION SOLUTIONSWP - WASTE & POLLUTION CONTROLWI - WATER INFRASTRUCTURERevenue generating activities from products that improve yield, production or sustainability in agriculture, silviculture, aquaculture and food production or distribution, whilst minimisting negative environmental impactsRevenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from products and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation industryRevenue generating activities from products and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from products and services for waste management, reuse and recyclingRevenue generating activities from products and services for waste management, reuse and recyclingRevenue generating activities from the operation industryAgriculture (Tier 1/2/3)Aviation (Tier 2)Railways Operator (Tier 1/2)Cleaner Power (Tier 2)Meteorologial Solutions (Tier 1)Aquaculture (Tier 1/3)Road Vehicles (Tier 1)Nadod Vehicles (Tier 1)Decontamination Services & Gas Sensing (Tier 2)Flood Control (Tier 2)Food Safety, Efficien Processing & Sustainable Packaging (Tier 1)Shipping (Tier 2)Video Conferencing (Tier 2)P					I
Revenue generating activities from products that improve yield, productivity and sustainability in agriculture, stiviculture, aquaculture and food production or distribution, whilst minimising negative environmental impactsRevenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industryRevenue generating activities from the operation of transportation solutions and services which minimise the environmental isol to address global, regional and local environmental issue and technologies, systems and services for waste management, systems and services approxement of waterAgriculture (Tier 1/23)Aviation (Tier 2)Railways Operator (Tier 1/23)Revenue generating activities from the operation industryAquaculture (Tier 1/23)Aviation (Tier 2)Railways (Tier 1/2)Cleaner Power (Tier 2)Food Safety, Efficient Processing & Sustainable Packaging (Tier 1/3)Shipping (Tier 2)Video Conferencing (Tier 2)	FA - FOOD & AGRICULTURE	<b>TE - TRANSPORTATION EQUIPMENT</b>	TS - TRANSPORTATION SOLUTIONS	WP - WASTE & POLLUTION CONTROL	WI - WATER INFRASTRUCTURE
Agriculture (Tier 1/2/3)       Aviation (Tier 2)       Railways Operator (Tier 1/2)       Cleaner Power (Tier 2)       Meteorological Solutions (Tier 1)         Aquaculture (Tier 1/3)       Railways (Tier 1/2)       Road Vehicles (Tier 1/2/3)       Decontamination Services & Devices (Tier 1)       Desalination (Tier 1)         Land Erosion (Tier 1)       Road Vehicles (Tier 1)       Video Conferencing (Tier 2)       Environmental Testings on Reduction Devices       Flood Control (Tier 3)         Food Safety, Efficient Processing & Shipping (Tier 2)       Shipping (Tier 2)       Particles & Emission Reduction Devices       Advanced Irrigation Strevices 0         Sustainable Packaging (Tier 1/3)       Cleaner Power (Tier 2)       Recycling Equipment (Tier 1)       Natural Disaster Response (Tier 2)	Revenue generating activities from products that improve yield, productivity and sustainability in agriculture, silviculture, aquaculture and food production or distribution, whilst minimising negative environmental impacts	Revenue generating activities from the provision of technologies, systems and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry	Revenue generating activities from the operation of transportation solutions and services which minimise the environmental impacts and improve the efficiency of natural resource use associated with the transportation industry	Revenue generating activities from products and services which reduce, monitor, or prevent the contamination of air, water and soil to address global, regional and local environmental issue and technologies, systems and services for water management, reuse and recycling	Revenue generating activities from technologies, infrastructure, products and services for the supply, management and treatment of water
Aquaculture (Tier 1/3)       Railways (Tier 1/2)       Road Vehicles (Tier 1/2/3)       Decontamination Services & Devices (Tier 1)       Desalination (Tier 1)         Land Erosion (Tier 1)       Road Vehicles (Tier 1)       Video Conferencing (Tier 2)       Environmental Testing & Gas Sensing (Tier 2)       Flood Control (Tier 2)         Food Safety, Efficient Processing & Sustainable Packaging (Tier 1/3)       Shipping (Tier 2)       Particles & Emission Reduction Devices (Tier 1)       Advanced Irrigation Systems & Devices (Tier 1)         Logistics (Tier 1)       Recycling Equipment (Tier 1)       Natural Disaster Response (Tier 2)	Agriculture (Tier 1/2/3)	Aviation (Tier 2)	Railways Operator (Tier 1/2)	Cleaner Power (Tier 2)	Meteorological Solutions (Tier 1)
Land Erosion (Tier 1)         Road Vehicles (Tier 1)         Video Conferencing (Tier 2)         Environmental Testing & Gas Sensing (Tier 2)         Flood Control (Tier 2)           Food Safety, Efficient Processing & Sustainable Packaging (Tier 1/3)         Shipping (Tier 2)         Particles & Emission Reduction Devices (Tier 1)         Advanced Irrigation Systems & Devices (Tier 1)           Logistics (Tier 1)         Recycling Equipment (Tier 1)         Natural Disaster Response (Tier 2)	Aquaculture (Tier 1/3)	Railways (Tier 1/2)	Road Vehicles (Tier 1/2/3)	Decontamination Services & Devices (Tier 1)	Desalination (Tier 1)
Food Safety, Efficient Processing & Shipping (Tier 2)       Particles & Emission Reduction Devices       Advanced Irrigation Systems & Devices         Sustainable Packaging (Tier 1/3)       (Tier 1)       (Tier 1)       (Tier 1)         Logistics (Tier 1)       Recycling Equipment (Tier 1)       Natural Disaster Response (Tier 2)	Land Erosion (Tier 1)	Road Vehicles (Tier 1)	Video Conferencing (Tier 2)	Environmental Testing & Gas Sensing (Tier 2)	Flood Control (Tier 2)
Sustainable Packaging (Tier 1/3)       (Tier 1)       (Tier 1)         Logistics (Tier 1)       Recycling Equipment (Tier 1)       Natural Disaster Response (Tier 2)	Food Safety, Efficient Processing &	Shipping (Tier 2)		Particles & Emission Reduction Devices	Advanced Irrigation Systems & Devices
Logistics (Tier 1) Natural Disaster Response (Tier 2)	Sustainable Packaging (Tier 1/3)			(Tier 1)	(Tier 1)
	Logistics (Tier 1)			Recycling Equipment (Tier 1)	Natural Disaster Response (Tier 2)
Sustainable Plantations (Tier 2) Water Infrastructure (Tier 1)	Sustainable Plantations (Tier 2)			Recycling Services (Tier 1)	Water Infrastructure (Tier 1)
Waste Management (Tier 1/2)     Water Treatment (Tier 1/2)       Water Utilities (Tier 2)				Waste Management (Tier 1/2)	Water Treatment (Tier 1/2) Water Utilities (Tier 2)

### Table A-1.2. Top Green Revenue Firms by Region

This table provides green revenues for the companies with the highest USD green revenues incorporated in selected top countries for each geographical region. More details on the FTSE Russell's Green Revenue Classification System (GRCS) taxonomy are provided in Table A-1.1.

Region	Country	Nr of	2008	2008	Nrof	2022 Cream	2022 Cmm			TOP 1 - 5 by country		
		in 2008	Revenues	Revenues	in 2022	Revenues	Rev enues		Gr	een Revenues (in US\$	bln)	
		0.999,899	(in US\$	(in % )		(in US\$	(in % )			% of Green Revenues		
		3	trlns)			trlns)			(of which % in	top FT SE GRCS sector	& micro-sector)	
E urope	France	313	\$ 0.280	10.0	283	\$ 0.291	12.2	ELE CTRICITE DE	VE OLIA	SCHNEIDE R	ENGIE	AL ST OM
								FRANCE	ENVIRONNEMENT	ELE CTRIC	\$ 19 bln	\$ 14 bln
								\$ 97 bln	\$42 bln	\$ 26 bln	19%	85%
								(57% in FG - Nuclear)	(33 % in WI - Water	(23% in FM - Industrial	(5% ifi EG - 50laf)	(80% in IE - Irains Flactric)
								(52% III DO "INOCIEAI)	Utilities)	Processes)		Liecuic)
	Germany	289	\$ 0.150	5.1	285	\$ 0.274	9.8	ME RCE DE S-BE NZ	UNIPER	E.ON	EnBW	BASF
	100000000000000000000000000000000000000	0.000000			0.00004			\$ 30 bln	\$ 29 bln	\$ 28 bln	\$ 20 bln	\$ 20bln
								19%	10%	23%	35%	22%
								(10% in 1E -	(5% in EM - Power	(22% in EM - Energy	(/% in EG - Wind)	(/% in EK -
								Vehicles & Devices)	storage)	Management Logistics)		Recyclable Materials)
3	U.K.	655	\$ 0.112	4.8	596	\$ 0.150	6.8	SHELL	JOHNSON	BP	ANGLO AMERICAN	BARRATT
								\$ 34 bln	MATTHEY	\$9 bln	\$9bln	\$ 6 bln
								9%	\$ 21 bln	4%	26%	97%
								(7% in TE - Electrified	94%	(4% in TE - Electrified	(26% in ER - Platinum)	(97% in EM -
								Road Vehicles &	(/6% in EK - Platinum)	Road Vehicles &		(Interacted))
North	U.S.	2.848	\$ 0.303	2.4	2.515	\$ 1.034	5.2	AMAZON	TE SLA	MICROSOFT	BE RK SHIRE	FORD MOT OR
America								\$ 104 bln	\$ 81 bln	\$ 57 bln	HATHAWAY	\$ 21 bln
								20%	100%	29%	\$ 28 bln	13%
								(15% in EM - Cloud	(93% in TE -	(29 % in EM - Cloud	10%	(13 % in TE -
								Computing)	Electrified Road	Computing)	(7% in TS - Railways	Electrified Road
	Canada	450	\$ 0.026	23	457	\$ 0.073	47	CN RAIL WAV	WEST FRASER	CANADIAN SOLAR	Uperator)	CANFOR
	Canada	450	\$ 0.020	2.5	457	\$ 0.075	4.7	\$ 12 bln	TIMBER	\$7 bln	CONNECTIONS	\$ 5 bln
								91 %	\$9bln	100%	\$7bln	85%
								(91 % in TS - General	92%	(83% in EQ - Solar)	100%	(85% in FA -
								Railways)	(92% in FA -		(50% in WP - Waste	Sustainable Forestry)
									Sustainable Forestry)		Management &	
Asia	China	1 4 0 9	\$ 0.047	2.7	3 383	\$ 0.648	62	CHINA RAILWAY	CHINA RAIL WAY	POWER CHINA	BVD	ENERGY CHINA
Pacific								\$ 60 bln	CONST RUCTION	\$ 25 bln	\$ 24 bln	\$ 23 bln
								35%	\$34 bln	30%	38%	43%
								(35% in TE - Railway)	21%	(8% in EQ - Hydro)	(14% in TE -	(5% in EQ - S olar)
									(20% in TE - Railway)		Electrified Koad	
	Janan	1.808	\$ 0.370	57	1.956	\$ 0.526	8.4	TOVOTA MOTOR	ENE OS	BRID CF ST ONF	DAIKIN	TFI.
	o up un	-,000	• ••••	2	-,		0.1	\$ 71 bln	\$ 25 bln	\$ 24 bln	\$ 21 bln	\$ 14 bln
								30%	30%	76%	91%	94%
								(30% in TE -	(20% in EG - Solar)	(75% in TE - Energy	(91% in EM -	(94% in EM -
								Electrified Road		Use Reduction	Buildings & Property )	Industrial Processes)
	South	3.45	\$ 0.0.49	3.4	802	\$ 0.123	4.0	Vehicles & Devices)	HVUNDAL MOTOR	Devices)	HANWHA	SK INNOVATION
	Korea	_J4J	9 U.U49	0.4	072	9 U.123	7.7	\$ 17 bln	\$ 12 bln	\$ 10 bln	\$7bln	\$ 8 bln
								25%	11%	28%	15%	10%
								(25% in TE -	(11% in TE -	(28% in EM - Efficient	(7% in EQ - Solar)	(5% in EM - Power
								Electrified Road	Electrified Road	IT)		Storage)
Restof	Brazil	1.60	\$ 0.047	6.4	128	\$ 0.052	62	Vehicles & Devices) MARFRIC	vehicles & Devices)	SARE SD	FLECTRORRAS	METALURCICA
the	DINZ	105	J 0.04/	0.4	130	J 0.032	0.2	\$ 15 hln	\$ 14 hln	\$4 hln	\$4hin	CE RDAU
World								58%	85%	88%	56%	\$ 3 bln
1000000								(58% in FA - Meat &	(85% in ER -	(66% in WI -Water	(53% in EG - Hydro)	20%
								Dairy Alternatives)	Recyclable Materials)	Utilities)		(20% in WP -
3	<b>C1</b> .1	145	¢ 0.013	( )	1/0	é 0.000	0.0	6011	EX (DDE CAS COPE C	ENTL ALCONO.	ENEL CORE	Recycling Services)
	Chile	160	\$ 0.011	0.8	160	\$ 0.020	9.2	SQM S.4 blo	SAMPRE SAS COPEC	S 3 blo	\$ 2 hlo	\$ 2 hlo
								41%	12%	17%	48%	25%
								(33% in ER - Lithium)	(12% in EA -	(10% in EG - Hydro)	(36% in EG - Hydro)	(15% in ER -
									Sustainable Forestry)			Recyclable &
												Reusable Products)

Variable	Definition
Green Revenues %	Percentage of green revenues relative to total annual com-
	pany revenues, with missing values filled in as zeros (source:
	FTSE Russell GRCS). The data identifies products and ser-
	vices that positively impact climate change mitigation and
	adaptation, water management, resource use, pollution reduc-
	tion, and agricultural efficiency.
Tier 1 Green Revenues %	Percentage of green revenues relative to total annual company
	revenues according to the tiering definition of the $\ensuremath{\mathrm{FTSE}}$ Russell
	classification system <sup><math>22</math></sup> , with missing values filled in as zeros
	(source: FTSE Russell GRCS). Tier 1 covers business activities
	with significant and clear environmental benefits.
Tier 2 Green Revenues $\%$	Tier 2 covers business activities with more limited but net
	positive environmental benefits.
Tier 3 Green Revenues $\%$	Tier 3 covers business activities which have some environmen-
	tal benefits but are overall net neutral or negative (e.g. nu-
	clear).
EUTSF Green Revenues %	Percentage of green revenues relative to total annual company
	revenues that are eligible under the EUTSF. Eligibility means
	that an economic activity falls within the scope of the EUTSF,
	which is determined by whether it has a set of corresponding
	criteria in the EUTSF to be evaluated against. This is not the
	same as EUTSF alignment. <sup>23</sup> Missing values are filled in as
	zeros (source: FTSE Russell GRCS).

Table A-1.3. variable Demittions and Data Source	able A-1.3.	itions and Data Sourc	Variable Definitions	ources
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 <sup>&</sup>lt;sup>22</sup>LSEG FTSE Russell (2024) "Green Revenues Data Model - Methodology".
 <sup>23</sup>LSEG FTSE Russell (2020) "Sizing the Green Economy - Green Revenues and the EU taxonomy".

Variable	Definition
Post Paris	Dummy = 1 if the year $\geq$ 2016, which captures the period
	after the Paris Agreement.
Post TEG	Dummy = 1 if the year $\geq 2018$ , which captures the creation
	of the Technical Expert Group commissioned to create a tax-
	onomy for green investing (TEG).
Post EUTSF	Dummy = 1 if the year $\geq 2020$ , which captures the roll out of
	the EU Taxonomy on Sustainable Finance (EUTSF).
Europe	Dummy $= 1$ if the company is headquartered in Europe
	(source: FactSet).
North America	Dummy = 1 if the company is headquartered in North America
	(source: FactSet).
Asia Pacific	Dummy $= 1$ if the company is headquartered in the Asia-
	Pacific region (source: FactSet).
Rest of World	Dummy = 1 if the company is headquartered in another region
	(source: FactSet).
GP Ratio	Average annual ratio of green patents to total patents between
	2008 and 2013. Patent data is from the Global Corporate
	Patent Dataset <sup>24</sup> and green patents are classified using the
	OECD Environmental-related technology mapping developed
	by Hascic and Migotto (2015) and updated in $2020^{25}$ .
GP Indicator	Dummy $= 1$ if the company had at least one green patent
	between 2008 and 2013.
IO Pre-Paris	Holdings by institutional investors as a fraction of market cap-
	italization at the end of 2015 (source: FactSet Ownership).

 $<sup>^{24}\</sup>mathrm{UVA}$  Darden Global Corporate Patent Dataset.  $^{25}\mathrm{OECD}$  Green Patents Classification.

Variable	Definition				
IO PRI Pre Paris	Holdings by institutional investors that are signatories of the				
	Principles for Responsible Investment (PRI) as a fraction of				
	market capitalization at the end of $2015$ (sources: FactSet				
	Ownership and Gibson Brandon et al. (2022)).				
IO CDP Pre Paris	Holdings by institutional investors that are participants of the				
	Carbon Disclosure Project (CDP) as a fraction of market cap-				
	italization at the end of 2015 (sources: FactSet Ownership and				
	CDP).				
Turnover Pre Paris	Firm-level turnover measure of institutional owners equal to				
	the holdings-weighted Churn ratio of each institutional owner				
	at the end of 2015 (source: FactSet Ownership).				
Total Assets	Total assets in millions of US dollars (FactSet item				
	$FF\_ASSETS$ ).				
Total Sales	Total sales in millions of US dollars (FactSet item				
	$FF\_SALES$ ).				
Domestic Sales	Total revenues generated by a company from selling goods				
	or services within the borders of the country where the				
	company is headquartered (100 minus the FactSet item				
	$FF\_FOR\_SALES\_PCT$ ).				
Market Value	Market capitalization in millions of U.S. dollars (FactSet item				
	$FF\_MKT\_VAL$ ).				
Tobin's $Q$	Total assets (FactSet item $FF\_ASSETS$ ) plus market value				
	of equity (Fact stet item $FF\_MKT\_VAL)$ minus book value of				
	equity (Facts tet item $FF\_COM\_EQ)$ divided by total assets.				
Leverage	Total debt (FactSet item $FF\_DEBT$ ) divided by total assets				
	(FactSet item $FF\_ASSETS$ ).				

Variable	Definition					
ROA	Operating income (FactSet item $FF_OPER_INC$ ) plus inter-					
	est expenses (FactSet item $FF\_INT\_EXP\_DEBT)$ divided					
	by total assets (FactSet item $FF\_ASSETS$ ).					
Cash	Cash and short-term investments (FactSet item					
	$FF\_CASH\_ST$ ) divided by total assets (FactSet item					
	$FF\_ASSETS$ ).					
Capex	Capital expenditures (FactSet item $FF\_CAPEX\_FIX)$ di-					
	vided by total assets (FactSet item $FF\_ASSETS$ ).					
$R \ensuremath{\mathfrak{E}} D$	Research and development expenditures (FactSet item					
	$FF_RD_EXP$ ) divided by total assets (FactSet item					
	$FF\_ASSETS$ ).					
Returns	Monthly gross returns are calculated using stock prices from					
	Factset (item $ADJ_PRICE$ ). This variable is right-winsorized					
	at the $99.95\%$ level.					
Market - Rf	Value-weighted returns of all firms in our sample using prices					
	from Factset (item $ADJ_PRICE$ ) minus the one-month Trea-					
	sury bill rate from Kenneth French's website.					
Size	Global size factor from Jensen et al. (2023) (source:					
	https://jkpfactors.com/) and regional factors from Kenneth					
	French's website.					
Value	Global value factor from Jensen et al. (2023) (source:					
	https://jkpfactors.com/) and regional factors from Kenneth					
	French's website.					
Momentum	Global momentum factor from Jensen et al. (2023) (source:					
	https://jkpfactors.com/) and regional factors from Kenneth					
	French's website.					

Variable	Definition				
Profitability	Global profitability factor from Jensen et al. (2023) (source:				
	https://jkpfactors.com/) and regional factors from Kenneth				
	French's website.				
Investment	Global investment factor from Jensen et al. (2023) (source:				
	https://jkpfactors.com/) and regional factors from Kenneth				
	French's website.				
GMB	Global green-minus-brown factor provided by the authors of				
	the study Karolyi et al. (2023).				
Earnings surprises	The difference between actual earnings and the analyst consen-				
	sus forecast 9 months prior to the end of the forecast period,				
	scaled by the stock price at the end of the fiscal year.				
MCCC	Media Climate Change Concerns Index provided by the au-				
	thors of Ardia et al. $(2023)$ .				
EPI	The Environmental Performance Index (EPI) provides a				
	country-year summary of the state of sustainability around				
	the world using 58 performance indicators.				
IVS	IVS E-Norms is a survey-based index of the environmental				
	awareness in a country-year.				

### Appendix 2

# Validating the Paris Agreement Regime Shift: Evidence from the EUTSF Rollout

As a validation for using the Paris Agreement as a regime shift that raised expectations of a regulatory shift, we present evidence from the multi-stage process that led to the introduction of the EUTSF. This was the first framework in the world to establish benchmark criteria for "green" investments and positioned Europe as having the most stringent green regulations compared to other regions of the world.<sup>26</sup> Under the EUTSF, a green activity is defined as one that contributes positively to at least one of the six environmental objectives of the EU without causing harm to any of the others.<sup>27</sup>

We examine the effects of three milestones in the progression towards the implementation of the EUTSF. Phase 1 started after the Paris Agreement, where the EU launched a call for applications in 2016 to establish an expert group commissioned to develop the first large-scale taxonomy on sustainable investing. In 2018, the Technical Expert Group (TEG) convened for the first time. In 2020, the EUTSF was formally enacted.<sup>28</sup> We study the impact of each phase independently and in combination by employing the following regression model:

<sup>&</sup>lt;sup>26</sup>This regulatory push stands out prominently among other European initiatives aimed at promoting green investing, such as Article 173 (Ilhan et al., 2023) in France or mandatory disclosures of greenhouse gases (GHG) in the UK (Downar et al., 2021; Jouvenot and Krueger, 2019).

<sup>&</sup>lt;sup>27</sup>The EU Taxonomy on Sustainable Finance (Regulation (EU) 2020/852 - see https://finance.ec. europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities\_ en). At the core of the EUTSF are six climate and environmental goals: (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) transition to a circular economy, (5) pollution prevention and control, and (6) protection and restoration of biodiversity and ecosystems. The EUTSF considers a business activity as "green" if it positively contributes to one of the goals without harming any of the other environmental objectives.

<sup>&</sup>lt;sup>28</sup>The actual roll out of the EU taxonomy occurs after our sample period ends. Starting in 2022, financial institutions that offer investment products in the EU were required to report to what extent their portfolios were taxonomy-aligned. In 2023, EU banks started to disclose lending indicators directly related to the taxonomy. In the coming years, large EU firms will be required to disclose information about their taxonomy-aligned activities. The EU has also established the International Platform on Sustainable Finance to map common agendas and promote consistency across the emerging national taxonomies.

Green Revenues 
$$\%_{i,t} = \alpha + \beta_1 Post_t + \beta_2 Europe_i + \beta_3 Post_t \times Europe_i + \beta_n X_{i,t} + \mu_j + \tau_t + \epsilon_{i,t},$$

$$(4)$$

where the dependent variable is Green Revenues  $\%_{i,t}$ , the green revenue share of company *i* in year *t*, Post<sub>t</sub> is the Post Paris indicator equal to 1 if the year is  $\geq 2016$ , Post TEG is an indicator equal to 1 for years  $\geq 2018$ , and Post EUTSF is an indicator equal to 1 for years  $\geq 2020$  following the rollout of the EUTSF. The variable Europe<sub>i</sub> is a dummy indicator variable equal to 1 if a firm is headquartered in Europe. We account for unobserved differences across sectors and years, where  $\mu_j$  are sector fixed effects and  $\tau_t$ year fixed effects. We also control for several firm characteristics contained in the vector  $X_{i,t}$ .

Table A-2.1 shows that European firms, on average, increased their green revenue shares more in the post-Paris era compared to firms located elsewhere. The uptick we observe post-Paris (column 1) becomes even more pronounced following the creation of the TEG (column 2), and later upon the official enactment of the taxonomy (column 3). Furthermore, the findings indicate that the acceleration already occurred before 2020 (column 4), suggesting that firms anticipated the roll-out of the EUTSF. The economic magnitude is significant, as European firms exhibit on average 1% higher green revenues, which is equivalent to 7% of a standard deviation change in green revenues.

We perform several robustness checks. First, we excluded firms from European countries outside the EU (Norway, Switzerland, and the UK), which did not significantly alter our results. It is worth noting that the UK engaged in the green taxonomy post-Brexit. The results are also robust if we focus only on Tier 1 green revenues (Panel B, thus excluding controversial technologies such as nuclear power generation), or if we use EUTSF-eligible green revenues (Panel C). Additionally, we observe in Table I.A.4 that firms in Europe generate more USD green revenues post Paris, however, the results tend to be slightly less significant. Finally, we employed a propensity score matching approach for the European firms but the policy findings remain unchanged.

### Table A-2.1. Evidence on the Regulatory Push

In this table, we estimate the effect of increased green regulation on firm *Green Revenues* %. We split the sample into firms incorporated in *Europe*, where a strong regulatory push occurred after the Paris Agreement, and the rest of the sample. *Post Paris* is a dummy equal to 1 if the year  $\geq 2016$ . *Post TEG* is equal to 1 if the year  $\geq 2018$ , where *TEG* indicates the creation of the Technical Expert Group commissioned to create the EU green taxonomy. *Post EUTSF* is equal to 1 if the year  $\geq 2020$ , where *EUTSF* stands for the EU Taxonomy on Sustainable Finance that was rolled out in 2020. In Panel A, the dependent variable is corporate % green revenues as defined by the FTSE Russell GRCS. In Panel B, we alternatively use the GRCS Tier 1 green revenues as the dependent variable. Panel C focuses on green revenues that are eligible under the EUTSF taxonomy. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)	(4)
	Green Revenues %			
Europe $\times$ Post Paris	$0.983^{***}$ (0.128)			$0.477^{***}$ (0.138)
Europe $\times$ Post TEG	(0.120)	1.063***		0.459***
Europe $\times$ Post EUTSF		(0.141)	$1.042^{***}$ (0.184)	(0.134) $0.355^{*}$ (0.201)
Controls	Yes	Yes	Yes	Yes
Year FE Sector FE	Yes	Yes Yes	Yes	Yes Yes
Country FE	Yes	Yes	Yes	Yes
Observations	267,576	267,576	267,576	267,576
Adjusted $R^2$	0.072	0.072	0.072	0.072

### Panel A: Green Revenues %

### Panel B: Tier 1 Green Revenues %

Regressions	(1)	1) (2)		(4)
	Tier 1 Green Revenues %			
Europe $\times$ Post Paris	$0.674^{***}$ (0.0763)			$0.326^{***}$ (0.0922)
Europe $\times$ Post TEG	(0.0.00)	$0.730^{***}$		0.262*** (0.0979)
Europe $\times$ Post EUTSF		(0.0000)	$0.755^{***}$ (0.109)	$0.328^{***}$ (0.116)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	267,576	267,576	267,576	267,576
Adjusted R <sup>2</sup>	0.044	0.044	0.044	0.044

### Panel C: EUTSF Green Revenues %

Regressions	(1)	(2)	(3)	(4)
		EUTSF Gree	n Revenues %	
Europe $\times$ Post Paris	$0.810^{***}$ (0.0973)			$0.411^{***}$ (0.108)
Europe $\times$ Post TEG	(0.0010)	$0.866^{***}$ (0.108)		$0.334^{***}$ (0.115)
Europe $\times$ Post EUTSF			$0.864^{***}$ (0.139)	$0.323^{**}$ (0.148)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	267,576	267,576	267,576	267,576
Adjusted $R^2$	0.066	0.066	0.066	0.066

# Evidence on Supply and Demand Factors behind the post-Paris Green Push

An important question is whether the increase in green revenues post-Paris is driven by demand or supply factors. Separating demand from supply is difficult, mainly because we do not observe separate price and quantity data, but only equilibrium green revenues in dollar or percentage terms. To indirectly address the issue, we use country-level data capturing (i) the quality of a country's environmental policies and institutions and (ii) a country's consumer preferences with respect to environmental issues.

To capture the first aspect, namely the stringency of a country's environmental policies, we use Yale's Environmental Performance Index (EPI) (e.g. Dyck et al. (2019); Ilhan et al. (2023); Krueger et al. (2024)). The EPI relies on national regulatory frameworks, institutional capacities, and policy-based performance metrics, which directly shape corporate environmental decisions. Since the EPI emphasizes the impact of government enforcement and compliance requirements, it reflects the constraints and incentives that influence environmental policies of firms more than individual consumer choices. In other words, we believe that the EPI captures the external pressure that firms face to supply green products and services.

On the other hand, to capture the second aspect, that is, the environmental preferences of consumers, we obtain data from the Integrated Values Survey (IVS), which constructs an environmental awareness index at the country-year level. To do so, the Integrated Values Survey captures citizens' values and attitudes toward environmental stewardship, focusing on personal norms and beliefs. By emphasizing individual-level perspectives, rather than policy-based metrics, the IVS environmental index more directly captures consumer preferences and priorities with respect to environmental challenges. Therefore, we argue that this measure captures the demand pressure for green products and services.

In Table A-2.2 we estimate difference-in-differences regressions in which we use these country-level variables. In column (1) we provide evidence that firms in countries with more stringent environmental regulations generate higher green revenues, and more so after the Paris Agreement (column 2). These regressions include country fixed effects, which implies that the results are identified from within-country changes in environmental regulations, which aligns with the previously presented evidence on the European regulatory push.

In Column (3), the Integrated Values Survey (IVS) does not have a significant association with the share of green revenues, potentially reflecting that consumer-level environmental values (captured by IVS) do not automatically translate into higher green revenues. Prima facie, this could mean that our effects are primarily supply-driven. However, it is important to consider that not all company revenues are generated in the domestic market. IVS - which captures consumer-level environmental values in a company's country of headquarters - should matter more for domestic sales. In column (4) we find that firms that face stronger local demand in countries with more environmentally conscious consumers (higher values of IVS) exhibit higher green revenues, and even more so in the post-Paris period (column 5). Overall, this implies that consumer demand and global policy momentum together can drive higher green revenues for domestically oriented firms.

### Table A-2.2. Green Revenues: Supply or Demand-Driven?

In this table, we examine whether the growth in green revenues is driven by supply and/or demand factors. *EPI* stands for the Environmental Performance Index, which provides a summary of the state of sustainability for each country-year. *Post Paris* is a binary variable equal to 1 if the year is  $\geq 2016$ . *IVS* is a survey-based index measuring environmental awareness in a given country-year. *Domestic Sales* represents the percentage of a firm's revenues generated within its country of incorporation. By \*, \*\*, and \*\*\*, we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)	(4)	(5)
	Green Revenues %				
EPI	$0.0352^{***}$ (0.0135)	$0.0672^{***}$ (0.0145)			
EPI $\times$ Post Paris		$0.0186^{***}$ (0.00288)			
IVS			-0.0277 (0.970)	$-3.814^{**}$ (1.553)	-1.660 (1.531)
Domestic Sales				-0.0423*** (0.00677)	$-0.0285^{***}$ (0.00671)
IVS $\times$ Domestic Sales				$0.0493^{***}$ (0.0152)	$0.0263^{*}$ (0.0148)
IVS $\times$ Post Paris					$-7.511^{***}$ (2.301)
Domestic Sales $\times$ Post Paris					$-0.0441^{***}$ (0.0124)
IVS $\times$ Dom. Sales $\times$ Post Paris					$0.0777^{***}$ (0.0274)
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations Adjusted $R^2$	$216,232 \\ 0.069$	$216,232 \\ 0.069$	$233,171 \\ 0.069$	$227,420 \\ 0.070$	227,420 0.070
## **Internet Appendix**

The Green Transition:

**Evidence from Corporate Green Revenues** 

## Figures

### Figure I.A.1. Green Revenues Portfolio - Excluding Tesla

We analyze the impact of excluding Tesla on the green revenues portfolio return series in Figure 5. In the top graph, we plot the cumulative returns for 1 USD invested in the value-weighted green stocks portfolio (light green) and compare it with portfolios containing stocks with at least 20% (dashed green) and 50% (dashed darker green) green revenues, all excluding Tesla. The black line represents cumulative returns for the portfolio containing all stocks in our sample, serving as a benchmark. The bottom graph repeats this analysis while restricting the sample to firms incorporated in the United States.



## Tables

**Table I.A.1.** Correlation of Green Revenues with other Environmental Measures (for firms with non-zero Green Revenues) We re-run the correlations in Table 2 but restrict the sample to firms with Green Revenues % > 0. This table shows pairwise Pearson correlation coefficients for % company green revenues, % tier 1 green revenues, % EUTSF eligible green revenues, and various environmental measures used in prior literature. These include scope 1, 2, and 3 carbon intensities from Trucost and environmental (ESG) scores from MSCI. *E-Score PST* is the modified environmental score proposed in Pastor et al. (2022), and *Ad. MSCI ESG Score* is the industry-adjusted ESG score from MSCI. By \*, \*\*, and \*\*\* we denote *p*-levels below 10\%, 5\%, and 1\%, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Green Revenues $\%$	1							
(2) Tier 1 Green Revenues $\%$	0.739***	1						
(3) EUTSF Green Revenues $\%$	0.837***	0.750***	1					
(4) CO2 Int. Scope 1	-0.045***	-0.072***	-0.048***	1				
(5) CO2 Int. Scope $2$	0.001	-0.021***	-0.021***	0.059***	1			
(6) CO2 Int. Scope $3$	-0.101***	-0.002	-0.112***	0.317***	0.096***	1		
(7) E-Score PST	0.001	0.056***	0.051***	-0.416***	-0.117***	-0.439***	1	
(8) Adj. ESG Score	0.021*	0.065***	0.050***	-0.179***	-0.036**	-0.154***	0.409***	1

Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(Sales)	$0.820^{***}$	$0.818^{***}$	$0.816^{***}$	$0.787^{***}$	$0.736^{***}$	$0.794^{***}$	$0.744^{***}$
Tobin's Q	(0.0324)	(0.0311) $0.176^{***}$ (0.0241)	(0.0313) $0.131^{***}$ (0.0250)	(0.0350) $0.167^{***}$ (0.0258)	(0.0375) $0.196^{***}$ (0.0227)	(0.0313) $0.118^{***}$ (0.0230)	(0.0359) $0.142^{***}$ (0.0225)
Leverage		(0.0241) $2.214^{***}$ (0.216)	(0.0250) $2.044^{***}$ (0.212)	(0.0258) $0.933^{***}$	(0.0227) $0.975^{***}$ (0.167)	(0.0239) $2.070^{***}$ (0.221)	(0.0255) $0.894^{***}$
ROA		(0.210) -2.542*** (0.221)	(0.212) $-2.592^{***}$ (0.241)	(0.158) -2.644*** (0.276)	(0.107) -2.882*** (0.267)	(0.221) -2.462*** (0.246)	(0.101) -2.574*** (0.260)
Cash		(0.331) -1.737***	(0.341) -1.737***	(0.370) -1.252*** (0.172)	(0.367) -1.009***	(0.340) -1.518***	(0.300) - $0.846^{***}$
CAPEX		(0.186)	(0.189) 9.786***	(0.173) $9.826^{***}$	(0.220) $11.37^{***}$	(0.194) $10.17^{***}$	(0.188) $10.48^{***}$
R&D			(1.153) $4.660^{***}$	(1.064) $6.481^{***}$	(1.093) 1.091	(1.144) $3.089^{***}$	(1.099) $3.121^{**}$
Europe			(0.966)	(1.159)	(1.226)	(1.042) $2.160^{***}$	(1.239) $2.414^{***}$
Asia-Pacific						(0.193) $1.211^{***}$	$(0.138) \\ 1.078^{***}$
North America						(0.150) $1.500^{***}$	$(0.104) \\ 2.018^{***}$
Constant	$-1.676^{***}$ (0.191)	$-2.036^{***}$ (0.233)	$-2.352^{***}$ (0.239)	$-2.098^{***}$ (0.260)	$-1.857^{***}$ (0.261)	$(0.227) \\ -3.560^{***} \\ (0.257)$	(0.0940) - $3.238^{***}$ (0.252)
Year FE	No	No	No	Yes	Yes	No	Yes
Sector FE Country	No No	No No	No No	Yes No	Yes Yes	No No	Yes No
Observations Adjusted $R^2$	$267,576 \\ 0.013$	$267,576 \\ 0.015$	$267,576 \\ 0.016$	$267,576 \\ 0.065$	$267,576 \\ 0.072$	$267,576 \\ 0.018$	$267,576 \\ 0.068$

 Table I.A.2.
 Determinants of Green Revenues

This table shows firm-level determinants of green revenues that are defined in Table A-1.3. We further add geographic regions in columns (6) and (7). By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

## Table I.A.3. The Role of Green Innovation: Placebo Test

In this table, we examine whether our results in Table 3 could be driven by the general innovativeness of a firm and not specifically green innovation. Corporate green innovation is measured by the variable *GP Indicator*, which is equal to one if a company had at least one green patent between 2008 and 2013. The variable *Patent Indicator* is equal to one if a company had at least one patent between 2008 and 2013. For the latter variable, we consider all patents (green and non-green). By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)
	Green Revenues $\%$	Tier 1 Green Revenues %	EUTSF Green Revenues %
GP Indicator $\times$ Post Paris	1.286***	1.040***	1.263***
	(0.238)	(0.346)	(0.212)
Patent Indicator $\times$ Post Paris	0.0099	-0.0233	-0.0691
	(0.251)	(0.255)	(0.206)
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	$264,\!658$	264,658	264,658
Adjusted $R^2$	0.856	0.852	0.847

#### Table I.A.4. The Role of Regulatory Push: US Dollar Revenues

In this table, we estimate the effect of increased green regulation in Europe on firm USD Green Revenues. We follow the regression specifications of Table A-2.1 in Appendix 2. In Panel A, the dependent variable is USD Green Revenues = (Green Revenues %/100) x USD Total Sales. In Panel B, we conduct the same analysis using USD Brown Revenues =  $(100 - Green Revenues \%)/100 \times USD$  Total Sales, which represents all US dollar revenues of a firm not classified as green by the FTSE Russell GRCS. By \*, \*\*, and \*\*\* we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Panel A: USD Green Revenues							
Regression	(1)	(2)	(3)	(4)			
Europe $\times$ Post Paris	-11.71			-54.36***			
	(12.97)			(14.47)			
Europe $\times$ Post TEG		15.80		$29.68^{**}$			
		(14.22)		(14.32)			
Europe $\times$ Post EUTSF			33.33*	$43.87^{**}$			
			(18.58)	(19.09)			
Controls	Yes	Yes	Yes	Yes			
Year FE	Yes	Yes	Yes	Yes			
Sector FE	Yes	Yes	Yes	Yes			
Country	Yes	Yes	Yes	Yes			
Observations	267,576	267,576	267,576	267,576			
Adjusted $\mathbb{R}^2$	0.058	0.058	0.058	0.058			
	Panel B: US	D Brown Reven	les				
Regression	(1)	(2)	(3)	(4)			
Europe $\times$ Post Paris	-471.1***			-404.5***			
	(101.1)			(118.8)			
Europe $\times$ Post TEG		-406.9***		-77.64			
		(108.0)		(112.6)			
Europe $\times$ Post EUTSF			-345.6**	-20.53			
			(138.7)	(139.3)			
Controls	Yes	Yes	Yes	Yes			
Year FE	Yes	Yes	Yes	Yes			
Sector FE	Yes	Yes	Yes	Yes			
Country	Yes	Yes	Yes	Yes			
Observations	267,576	267,576	267,576	267,576			
Adjusted $\mathbb{R}^2$	0.234	0.234	0.234	0.234			

#### Table I.A.5. The Role of Green Innovation: US Dollar Revenues

This table examines the relation between corporate green patent innovation and firm USD Green Revenues. We follow the regression specifications of Table 3. In columns (1) and (2), the dependent variable is USD Green Revenues = (Green Revenues %/100) x USD Total Sales. In columns (3) and (4), we conduct the same analysis using USD Brown Revenues =  $(100 - Green Revenues \%)/100 \times USD$  Total Sales, which represents all US dollar revenues of a firm not classified as green by the FTSE Russell GRCS. By \*, \*\*, and \*\*\*, we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country level (except in column (3)) are in parentheses.

Dep. Variable	USD Green Revenues		USD Brow	n Revenues
Regression	(1)	(2)	(3)	(4)
GP Indicator	$551.3^{***}$ (71.71)		$6600.2^{***}$ (736.7)	
GP Indicator $\times$ Post Paris	$506.9^{***}$ (106.8)		$1830.9^{*}$ (981.4)	
GP Ratio	· · · ·	$5538.0^{***}$ (792.2)	· · · ·	$53132.9^{***}$ (7855.8)
GP Ratio $\times$ Post Paris		$3022.1^{***}$ (1109.8)		5687.6 (11044.6)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations Adjusted $R^2$	267,576 0.072	$267,576 \\ 0.077$	267,576 0.248	$267,576 \\ 0.249$

#### Table I.A.6. The Role of Institutional Investors: US Dollar Revenues

This table examines the relation between institutional ownership and firm USD Green Revenues. We follow the regression specifications of Table 5. In Panel A, the dependent variable is USD Green Revenues = (Green Revenues %/100) x USD Total Sales. In Panel B, we conduct the same analysis using USD Brown Revenues = (100 - Green Revenues %)/100 x USD Total Sales which represents all US dollar revenues of a firm not classified as green by the FTSE Russell GRCS. By \*, \*\*, and \*\*\*, we denote p-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Panel A: USD Green Revenues							
Regression	(1)	(2)	(3)	(4)	(5)		
IO Pre Paris	-300.9***						
IO Pre Paris $\times$ Post Paris	(38.89) $150.6^{***}$						
IO High Pre Paris	(24.61)	-84.21***					
IO High Pre Paris $\times$ Post Paris		(14.19) $54.52^{***}$					
IO PRI Pre Paris		(13.16)	-434.6***				
IO PRI Pre Paris $\times$ Post Paris			(59.16) $420.8^{***}$ (50.20)				
IO CDP Pre Paris			(59.38)	-397.0***			
IO CDP Pre Paris $\times$ Post Paris				(93.67) 556.7***			
Turnover Pre Paris				(99.17)	14.92		
Turnover Pre Paris $\times$ Post Paris					(48.15) -238.0*** (49.28)		
Observations Adjusted $R^2$	$220,241 \\ 0.066$	$220,241 \\ 0.066$	$220,241 \\ 0.066$	$220,241 \\ 0.066$	$209,056 \\ 0.068$		
Controls Year FE Sector FE Country FE	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes		
	Panel	B: USD Brown Re	evenues				
Regression	(1)	(2)	(3)	(4)	(5)		
IO Pre Paris	-7680.4***						
IO Pre Paris $\times$ Post Paris	(679.5) $618.1^{*}$ (242.7)						
IO High Pre Paris	(343.7)	-1558.9***					
IO High Pre Paris $\times$ Post Paris		(247.7) 138.6 (108.0)					
IO PRI Pre Paris		(198.0)	-9986.3***				
IO PRI Pre Paris $\times$ Post Paris			(893.8) 2118.2**				
IO CDP Pre Paris			(862.3)	-9101.1***			
IO CDP Pre Paris $\times$ Post Paris				(1327.7) $2721.5^{**}$			
Turnover Pre Paris				(1148.1)	-136.3		
Turnover Pre Paris $\times$ Post Paris					(694.3) $-2850.5^{***}$ (824.6)		
Observations Adjusted $R^2$	$220,241 \\ 0.260$	$220,241 \\ 0.256$	$220,241 \\ 0.257$	$220,241 \\ 0.256$	$209,056 \\ 0.259$		
Controls Year FE Sector FE Country FE	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes	Yes Yes Yes Yes		

**Table I.A.7.** The Role of Green Innovation: Backfilling Robustness Checks This table assesses the sensitivity of the results in Table 3 to the backfilling of FTSE Russell GRCS green revenue point estimates. In Panel A, the independent variable is *GP Indicator* while in Panel B we use *GP Ratio*. In column (1), we use the FTSE Russell GRCS green revenue point estimates post-Paris (when the green revenue data is not backfilled) as the dependent variable. In column (2), the dependent variable *Green Revenues Indicator* is an indicator for whether a firm reports any green revenues in a given year. Finally, in column (3), we apply an alternative measure *Green Revenues % Midpoint* of green revenues, where missing values between 2008 and 2015 are backfilled with the midpoint between the minimum and maximum FTSE Russell GRCS estimates. In columns (2)–(3), we interact *GP Ratio/Indicator* with *Post Paris* to explore how firms with varying levels of green innovation are differently positioned for a green transition following the Paris Agreement. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)
	Green Revenues $\%$	Green Revenues Indicator	Green Revenues % Midpoint
GP Indicator	6.291***	0.198***	7.567***
	(0.484)	(0.00717)	(0.367)
GP Indicator $\times$ Post Paris		0.0712***	4.113***
		(0.00987)	(0.427)
Sample	Post Paris	Full	Full
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Country	Yes	Yes	Yes
Observations	141,977	267,576	267,576
Adjusted $R^2$	0.089	0.189	0.132

#### Panel B: Green Patent Ratio

Regressions	(1)	(2)	(3)
	Green Revenues $\%$	Green Revenues Indicator	Green Revenues % Midpoint
GP Ratio	63.51***	1.747***	75.81***
	(4.533)	(0.0504)	(3.137)
GP Ratio $\times$ Post Paris		0.417***	28.11***
		(0.0716)	(3.376)
Sample	Post Paris	Full	Full
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Country	Yes	Yes	Yes
Observations	141,977	267,576	267,576
Adjusted $R^2$	0.095	0.196	0.141

## Table I.A.8. The Role of Institutional Ownership: Backfilling Robustness Checks Checks

This table assesses the sensitivity of the results in Table 5 to the backfilling of FTSE Russell GRCS green revenue point estimates. In Panel A, the dependent variable is *Green Revenues* %, and the sample is restricted to the post-Paris period. Panel B considers the full sample period, using a binary dependent variable equal to 1 if a firm exhibits FTSE Russell GRCS green revenues in a given year and 0 otherwise. Panel C employs an alternative measure of green revenues, using point estimates where missing values from 2008 to 2015 are backfilled with the midpoint between the minimum and maximum FTSE Russell GRCS green revenue estimates. In Panels B and C, *Post Paris* is a binary variable equal to 1 for years  $\geq$  2016. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Standard errors clustered on the country-year level are in parentheses.

Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	3.911***				
IO High Pre Paris	(0.525)	2.124***			
IO PRI Pre Paris		(0.193)	6.775***		
IO CDP Pre Paris			(0.949)	9.329***	
Turnover Pre Paris				(1.378)	$-4.267^{***}$ (0.938)
Sample	Post Paris				
Controls Voar FE	Yes Vos	Yes	Yes	Yes	Yes
Sector FE	Ves	Ves	Ves	Ves	Ves
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	115,129	115,129	115,129	115,129	107,972
Adjusted $R^2$	0.085	0.087	0.085	0.086	0.086

## Panel B: Green Revenues Indicator

Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	0.0948***				
IO Pre Paris $\times$ Post Paris	0.0173*				
IO High Pre Paris	(0.00989)	$0.0612^{***}$			
IO High Pre Paris $\times$ Post Paris		(0.00508) $0.0200^{***}$ (0.00664)			
IO PRI Pre Paris		(0.0004)	$0.218^{***}$		
IO PRI Pre Paris $\times$ Post Paris			(0.0193) $0.0561^{**}$ (0.0250)		
IO CDP Pre Paris			(0.0239)	$0.258^{***}$	
IO CDP Pre Paris $\times$ Post Paris				(0.0287) $0.0634^{*}$ (0.0251)	
Turnover Pre Paris				(0.0351)	$-0.132^{***}$
Turnover Pre Paris $\times$ Post Paris					(0.0137) $-0.0669^{***}$ (0.0125)
Sample Controls	Full Yes	Full Yes	Full Yes	Full Yes	Full Yes
Year FE Sector FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	220,241	220,241	220,241	220,241	209,056
Adjusted R <sup>2</sup>	0.176	0.180	0.177	0.177	0.181

			-		
Regressions	(1)	(2)	(3)	(4)	(5)
IO Pre Paris	4.276***				
IO Pre Paris $\times$ Post Paris	(0.462) $1.361^{***}$ (0.429)				
IO High Pre Paris	(01120)	$2.523^{***}$			
IO High Pre Paris $\times$ Post Paris		(0.138) $1.036^{***}$ (0.223)			
IO PRI Pre Paris		(0.223)	8.418***		
IO PRI Pre Paris $\times$ Post Paris			(0.790) $3.355^{***}$ (1.085)		
IO CDP Pre Paris			(1.085)	$10.76^{***}$	
IO CDP Pre Paris $\times$ Post Paris				(1.201) $4.297^{***}$ (1.515)	
Turnover Pre Paris				(1.515)	-4.112***
Turnover Pre Paris $\times$ Post Paris					(0.674) -2.315*** (0.529)
Sample	Full	Full	Full	Full	Full
Vear FE	Ves	Ves	Ves	1 es Ves	1 es Ves
Sector FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	220,241	220,241	220,241	220,241	209,056
Adjusted $R^2$	0.122	0.125	0.122	0.122	0.126

## Panel C: Green Revenues % Midpoint Estimates

## Table I.A.9. Tesla Portfolio Weight

This table presents annual weights of Tesla in the different green portfolios of Table 7, categorized by their percentage levels of green revenues. The weights are determined annually as of December.

	Panel A: Tes	la Weight in Global G	reen Revenues Portfoli	os (%)
Year	> 0%	> 20%	> 50%	> 80%
2010	0.022	0.083	0.293	0.646
2011	0.030	0.116	0.421	1.066
2012	0.035	0.136	0.488	1.316
2013	0.141	0.572	1.858	4.837
2014	0.204	0.852	2.647	6.848
2015	0.225	0.931	2.698	6.315
2016	0.198	0.772	1.876	4.143
2017	0.236	0.909	2.118	4.826
2018	0.273	1.078	2.744	5.413
2019	0.308	1.010	2.853	5.378
2020	2.300	6.764	15.482	28.930
2021	3.067	8.520	19.660	34.221
2022	1.291	3.943	9.757	18.250
2023	2.332	7.107	17.560	32.386
	Panel B: T	esla Weight in US Gree	en Revenues Portfolios	s (%)
Year	> 0%	> 20%	> 50%	> 80%
2010	0.072	0.312	1.378	2.374
2011	0.091	0.370	1.839	3.554
2012	0.099	0.417	2.013	4.028
2013	0.358	1.803	7.791	14.543
2014	0.509	2.488	9.351	19.680
2015	0.548	2.969	11.324	21.118
2016	0.456	2.023	5.516	10.573
2017	0.551	2.478	7.175	13.038
2018	0.601	2.928	8.581	13.362
2019	0.657	2.178	8.519	13.002
2020	4.409	13.118	39.798	54.164
2021	5.727	16.557	48.424	62.055
2022	2.448	7.991	28.609	41.245
2023	4.186	13.340	42.251	56.284

### Table I.A.10. Green Revenues Portfolios: Robustness

As in Table 7, this table reports the *Alpha* of the long-short green revenues minus legacy (GML) portfolio across different shades of "greenness". Panel A shows value-weighted portfolio returns for the global sample, excluding Tesla. Panel B shows value-weighted portfolio returns for the US sample, excluding Tesla. Panel C considers equally-weighted global portfolio returns. Lastly, in Panel D, we investigate equally-weighted portfolio returns for US firms. By \*, \*\*, and \*\*\*, we denote p-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Regression	(1)	(2)	(3)	(4)
Variable	Green Minus Legacy (GML)			
Portfolio	> 0%	> 20%	> 50%	> 80%
	Panel A: All Firms without Tesla Value-Weighted			
Alpha (Pre Paris)	-0.412***	-0.302**	-0.323**	-0.126
Alpha (Post Paris)	$(0.125) \\ -0.0746 \\ (0.108)$	$egin{array}{c} (0.139) \ 0.00995 \ (0.126) \end{array}$	$(0.160) \\ 0.00794 \\ (0.172)$	$(0.227) \\ 0.289 \\ (0.209)$
Panel B: US Firms without Tesla Value-Weighted				
Alpha (Pre Paris)	$-0.302^{*}$ (0.155)	$-0.385^{**}$ (0.162)	$-0.422^{*}$ (0.252)	-0.171 (0.291)
Alpha (Post Paris)	$0.000520 \\ (0.169)$	$0.0162 \\ (0.192)$	$\begin{pmatrix} 0.192 \\ (0.205) \end{pmatrix}$	$0.454^{\star}$ (0.268)
Panel C: All Firms Equally-Weighted				
Alpha (Pre Paris)	$-0.234^{*}$ (0.119)	-0.102 (0.128)	-0.112 (0.174)	-0.0298 (0.226)
Alpha (Post Paris)	$-0.169^{*}$ (0.0977)	$-0.040\acute{6}$ (0.125)	$\stackrel{0.0839}{(0.162)}$	$egin{array}{c} 0.310\ (0.205) \end{array}$
Panel D: US Firms Equally-Weighted				
Alpha (Pre Paris)	$-0.280^{**}$ (0.135)	$-0.282^{*}$ (0.152)	-0.260 (0.240)	-0.243 (0.286)
Alpha (Post Paris)	-0.0650 (0.137)	0.0195 (0.164)	0.345 (0.216)	$0.646^{**}$ (0.274)

### Table I.A.11. GML Loadings on GMB

This table investigates the relation between various GML (Green Minus Legacy) portfolios as defined in Table 7 and the GMB (Green Minus Brown) factor proposed by Karolyi et al. (2023). The regression analysis explores potential correlations between our GML factor and a GMB factor constructed using MSCI environmental scores. Panel A presents results from univariate regressions where different long-short GML portfolios are tested against the GMB factor. Panel B extends the analysis by controlling for the Fama-French 6-factor asset pricing model. By \*, \*\*, and \*\*\* we denote *p*-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Variable	Green Minus Legacy (GML)			
Regression	(1)	(2)	(3)	(4)
Portfolio	> 0%	> 20%	> 50%	> 80%
Pa	nel A: Univaria	ate GML Loadings	s on GMB	
GMB	0.0738	0.0445	-0.128	-0.0626
	(0.104)	(0.110)	(0.118)	(0.172)
Alpha	0.148	-0.0325	$0.341^{*}$	$0.718^{***}$
	(0.150)	(0.156)	(0.173)	(0.234)
Fama-French 6 Factors	No	No	No	No
Observations	109	109	109	109
Adjusted $R^2$	0.00	0.00	0.00	0.00
Panel B: GML Loadings on GMB in 6-Factor Model				
GMB	-0.113	-0.0964	-0.157	-0.111
	(0.0897)	(0.0948)	(0.120)	(0.175)
Alpha	-0.00470	-0.0314	0.285	$0.665^{**}$
	(0.158)	(0.166)	(0.212)	(0.280)
Fama-French 6 Factors	Yes	Yes	Yes	Yes
Observations	109	109	109	109
Adjusted $R^2$	0.26	0.09	0.02	0.02

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