

The Green Transition: Evidence from Corporate Green Revenues ^{*}

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Abstract

We introduce a global firm-level measure of revenues from environmentally beneficial products and services that is not spanned by emissions or conventional sustainability metrics. Green revenues accelerate after the Paris Agreement, particularly among firms whose pre-existing green product patents reflect technological capabilities that can be commercialized. This relation is strongest in the United States, where the relative valuation of green firms increases most after Paris, consistent with market-based commercialization. In contrast, European green-revenue growth is associated with environmental regulation rather than valuation gains. We find modest evidence of green alpha: positive abnormal returns emerge post Paris among firms with high green-revenue shares and are concentrated among U.S. firms with pre-Paris green technological capabilities.

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

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

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1 Introduction

The transition to a more environmentally sustainable economy requires firms not only to reduce the environmental harm of their operations but also to change what they sell. Yet comparatively little is known about this transformation of corporate output. The finance literature has primarily evaluated firms through the externalities they produce (carbon emissions, industrial pollution, etc.) or through ESG ratings that assess operations, policies, and conduct. Neither approach reveals whether firms are bringing environmentally beneficial products and services to market. As a result, we still know relatively little about the scale of the green transition, the capabilities that allow firms to participate in it, or how financial markets value firms' exposure to it.

In this paper, we study *green revenues*: revenues generated by products and services that contribute positively to environmental objectives. Green revenues provide a direct, economically meaningful measure of environmentally beneficial corporate output. They capture not merely whether a firm has developed a green technology, but whether it has commercialized that technology into a product and generated sales from it. This lets us observe the step through which green innovation reaches the market, a step that environmental commitments alone cannot reveal. This distinction allows us to address three questions. How large is the publicly listed green economy, and how has it evolved? Which technological and external conditions are associated with firms' ability to expand green commercial activity? And how have financial markets valued firms with different degrees of exposure to green revenues?

These questions are particularly important against a backdrop where first-best environmental policies remain difficult to implement. Despite the broad international commitments embodied in the 2015 Paris Agreement, progress toward its emissions goals has been uneven, and a comprehensive global carbon price remains elusive (Tirole, 2008). In this setting, technological innovation, product-market demand, financial intermediation, and second-best regulatory tools may all affect the direction of corporate activity (Acemoglu et al., 2016; Aghion et al., 2016; Oehmke and Opp, 2024). Governments have increasingly complemented emissions policies with classification systems that iden-

tify environmentally sustainable economic activities. The most prominent example is the EU Taxonomy for Sustainable Activities (EUTSF), which covers climate mitigation and adaptation as well as water, circular-economy, pollution-prevention, and biodiversity objectives.¹ Such taxonomies may help direct capital and demand toward green activities when first-best policies are unavailable, while reducing ambiguity about what constitutes an environmentally sustainable activity (Inderst and Opp, 2025).

A challenge in the finance literature has been the lack of systematic data that identify firms’ green products and activities and quantify their commercial importance. We overcome this challenge using data from the FTSE Russell Green Revenues Classification System (GRCS), a rules-based taxonomy that identifies revenues from environmentally beneficial products and services. The GRCS assesses the impact of firms’ economic activities not only on climate change mitigation and adaptation (e.g. energy efficiency, renewable energy, sustainable transportation) but also on other environmental concerns, such as water and resource management or pollution control. It predates the EUTSF but shares its activity-based approach. Our sample contains more than 16,000 publicly listed firms from 48 developed and emerging markets over 2008–2023. This breadth allows us to distinguish firms with no green revenues, diversified firms combining green and non-green businesses, and “pure-play” firms whose revenues are almost entirely green.

Green revenues differ from conventional measures of corporate environmental performance. Emissions measure environmentally harmful inputs or by-products of production, whereas green revenues measure the environmentally beneficial output sold by a firm. ESG ratings, in turn, frequently assess operational policies and corporate conduct rather than the environmental contributions of products. A firm may therefore have carbon-intensive operations while developing products that facilitate decarbonization, or operate with a relatively small carbon footprint without selling any environmental solution. Consistent with this distinction, we find that green-revenue shares have very low correlations with firms’ Scope 1, Scope 2, and Scope 3 carbon intensities and with widely

¹Regulation (EU) 2020/852; see <https://ec.europa.eu/sustainable-finance-taxonomy/>.

used environmental and ESG scores.² Green revenues thus contain information about firms’ environmental exposure that is not subsumed by their operational footprint or ESG classification.

We begin by documenting the scale and distribution of green commercial activity. The average firm-year green-revenue share is 3.4%, and only 13.7% of firm-years report positive green revenues. Thus, although green activity has become economically significant in aggregate, it remains concentrated among a minority of publicly listed firms. The global green-revenue share was approximately 4% before the Paris Agreement and subsequently increased to more than 6% by 2023. At the end of the sample, listed firms generated approximately \$4 trillion in annual green revenues.³ Green activity spans multiple industries rather than forming a narrow renewable-energy sector: manufacturing includes electric vehicles, rail equipment, and renewable-energy components; utilities generate revenues from renewable and nuclear power; and technology firms provide activities such as energy-efficient cloud computing and related services. The United States, China, and Japan account for large amounts of green revenues in dollars, while several European markets exhibit particularly high green-revenue shares.

The post-2015 acceleration is consistent with the Paris Agreement marking a regime shift in the economic environment surrounding green commercial activity. [Seltzer et al. \(2022\)](#) and other papers have used the unexpected passage of the Paris Agreement as a shift in the global commitment to address environmental challenges. We examine some channels that both validate this interpretation and help explain the supply- and demand-side forces behind the acceleration. First, we show that European firms’ green-revenue shares increase more strongly as the regulatory framework becomes progressively more concrete, through the European Green Deal, the creation of a Technical Expert Group and the subsequent roll-out of the EUTSF. Exploring cross-country variation, we also find that countries with more stringent environmental policies are associated

²Prior research documents both the economic importance of corporate emissions and substantial disagreement across ESG ratings; see, among others, [Bolton and Kacperczyk \(2021, 2023\)](#); [Aswani et al. \(2024\)](#); [Pastor et al. \(2022\)](#); [Berg et al. \(2022b\)](#).

³This positioned the green economy at the time at about the same size as the oil and gas exploration and production sector, to which it is often compared. IBISWorld, “Global Oil and Gas Exploration - Production Market Size 2005–2028.”

with greater post-Paris green commercial activity. Second, on the demand side, green-revenue growth is stronger where local consumer environmental preferences are higher, particularly among firms with more domestic sales, and where pre-Paris ownership by environmentally oriented institutional investors is greater. Taken together, these findings support our interpretation of Paris as a meaningful regime shift and motivate using it to identify which firms were best positioned to respond.

Our main analysis asks whether firms with pre-existing green technological capabilities were better positioned to expand environmentally beneficial output after Paris. Innovation is a necessary but incomplete step in the green transition: a patent establishes that a firm has developed an invention, but not that the invention has been successfully commercialized. By linking pre-Paris green patents to post-Paris green revenues, we examine whether pre-existing green innovation enabled firms to translate the post-Paris shift in the relative valuation of green versus legacy products (driven by regulatory and demand-based incentives) into actual green revenues.

We classify firms according to whether they had green patents before the Paris Agreement. Firms with at least one pre-Paris green patent experience a 1.6 percentage-point larger post-Paris increase in their green-revenue share than firms without such patents. We document that this relation is specific to green innovation capacity; non-green patenting does not predict post-Paris green revenue growth. Dynamic estimates show that the difference emerges only after Paris, with no observable pre-trend.

The nature of innovation matters. We distinguish patents that cover environmentally beneficial products from patents pertaining to production processes. Pre-Paris green product patents are associated with a 2.2 percentage-point larger post-Paris increase in green-revenue shares. In contrast, green process patents do not predict more green revenues post Paris. Process innovation can reduce the environmental cost of producing a firm's existing output without changing the products from which it earns revenue. These results connect the post-Paris growth in green revenues specifically to firms' ability to develop marketable green products, rather than to environmental innovation in general.

A broad set of tests further corroborates this interpretation. The positive relation

persists when we use alternative patent definitions and restrict the sample to firms already generating green revenues, for which the estimated post-Paris increase is 1.7 percentage points. It is stronger when patents are weighted by measures of technological importance, including subsequent citations. Moreover, the result appears in green revenues measured in dollars, not only as a share of total firm revenues: firms with pre-Paris green patents generate approximately \$461 million more in annual green revenues after Paris. The dollar result helps rule out the mechanical explanation that green-revenue shares rise merely because non-green revenues contract. The evidence therefore indicates that pre-existing green product innovation predicts both entry into green commercial activity and expansion among firms already operating in green markets.

The final part of the paper examines how stock markets value green exposure. Environmental products may create profitable growth opportunities, but their development can require substantial investment, face technological and regulatory uncertainty, or attract competition. Moreover, realized returns depend on both subsequent cash-flow outcomes and the discount rates at which investors value green firms. Investors with environmental preferences may accept lower expected returns from green firms, while unexpected increases in environmental concerns or demand can generate positive realized returns (Pastor et al., 2021; Zerbib, 2022). We therefore examine portfolios formed on firms' green-revenue shares, the Paris announcement return, and the channels explaining the financial performance post Paris.

The portfolio results reject a general "green alpha." A broad portfolio containing all firms with positive green revenues does not earn reliably positive abnormal returns after controlling for standard asset pricing factors. Abnormal performance instead increases with the intensity of firms' green commercial exposure. In the post-Paris period, the estimated alpha reaches 1.2% per month for firms generating more than 80% of their revenues from green activities. This outperformance is concentrated in US companies in the post Paris period and is particularly pronounced among firms that already had green patents before Paris. Thus, the market evidence is strongest for firms with substantial green product-market exposure and the technological capacity to exploit the changing

environment. The conclusions are also robust to excluding Tesla (an influential observation as its weight in the highest-green U.S. portfolio becomes substantial in the later part of our sample period) and to using equally weighted portfolio returns.

Event study returns around the announcement of the Paris Agreement reinforce this conditional interpretation. Relative cumulative abnormal returns increase with firms' green-revenue exposure. Over the $[-10, +10]$ trading-day window surrounding the agreement, firms above the 80% green-revenue threshold outperform low-green firms by 8.75 percentage points. This positive market reaction indicates that investors perceived Paris as a shift in the relative valuation of green versus legacy commercial activities. Economically, the agreement increased the value of firms' exposure to green revenues, consistent with green products and investments becoming more likely to generate positive NPV under the new regime.

Additional tests provide evidence on the drivers of this abnormal performance. Firms with higher green-revenue exposure experience more positive earnings surprises in the post Paris era, suggesting that investors did not fully anticipate their subsequent cash-flow performance. By contrast, we find little evidence that differences in discount rates explain the return patterns. We also find that high-green-revenue stocks perform particularly well when climate concerns unexpectedly increase, consistent with shifts in environmental concerns increasing the relative value of firms with greater green commercial exposure. At the same time, the concentration of performance among very high-green U.S. firms cautions against interpreting the estimates as a broad premium earned by environmentally responsible companies. The findings instead point to a conditional excess performance of firms with intensive green commercial exposure.

Our paper makes several contributions to the literature. First, prior work has examined how carbon emissions, pollution, and climate exposures matter for firm value and expected returns (Bolton and Kacperczyk, 2021, 2023; Ilhan et al., 2021; Hsu et al., 2023; Aswani et al., 2024). Related studies examine environmental and ESG ratings, their determinants, and disagreement among data providers (Pastor et al., 2022; Karolyi et al., 2023; Alves et al., 2023; Eskildsen et al., 2024; Berg et al., 2022a,b). We com-

plement this literature by measuring what firms sell rather than how they produce it. Green revenues capture the extent to which firms participate commercially in supplying environmentally beneficial solutions and therefore illuminate a dimension of the green transition that emissions and ESG scores cannot measure.

Second, we connect green invention to commercialization. Prior work has examined green patenting (Cohen et al., 2023; Hege et al., 2022; Bolton et al., 2022). We show that having green patents and earning revenue from environmental products are empirically distinct stages. The post-Paris expansion in green revenues is concentrated among firms with pre-existing green product patents, not green process patents or patents in general. This evidence identifies technological capability as an important predictor of which firms convert a change in the environmental regime into marketable output. Our paper also reveals a disconnect in parts of the traditional energy sector: the possession of green patents does not necessarily translate into a commensurate expansion of green revenues.

Third, we contribute to the asset-pricing evidence on green firms. Theoretical and empirical research shows that environmental preferences and climate risks can affect asset prices, but estimates of a green premium vary across assets, periods, and measures of greenness (Pastor et al., 2021; Zerbib, 2019, 2022; Baker et al., 2018; Colombage and Nanayakkara, 2020; Larcker and Watts, 2020; Caramichael and Rapp, 2022). We find no pervasive abnormal return associated with merely having green revenues. Instead, the return evidence only emerges after Paris and among firms with high green-revenue shares, is concentrated in the United States, and is strongest for firms with pre-existing green technological capabilities. These findings shift the question from whether “green firms” uniformly outperform to when commercially meaningful exposure to environmental solutions is repriced.

More broadly, the paper provides evidence relevant to emerging sustainable-activity taxonomies (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; Bassen et al., 2025). Rather than evaluating taxonomy alignment only after formal implementation, we use a global activity-based revenue classification to examine the eco-

conomic transformation that such policies are intended to promote. The evidence shows that the green transition is neither adequately captured by operational emissions nor accomplished by invention alone. It depends on whether firms can convert green technological capabilities into products and services that customers buy. Green revenues make that commercialization visible.

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.⁴ 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

⁴More 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).

from 2008 to 2023.

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. GRCS 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.⁵ 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).⁶ 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.⁷ 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

⁵Many subsequent global jurisdictions used the EUTSF as a structural blueprint by adopting its core criteria, though they modified specific technical benchmarks to fit local economic needs and transition paths.

⁶The mapping of green revenues into the EUTSF is available here: [LSEG FTSE Russell \(2020\) “Sizing the Green Economy - Green Revenues and the EU taxonomy”](#).

⁷We do not observe a significant trend in the disclosure percentage post Paris.

then engage directly with companies to confirm the estimates on the breakdown of revenues by green activity.

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.⁸

The GRCS Green Revenues 2.0 data model was launched in 2020 and provides point estimates for *Green Revenues %* from 2016 onward. Importantly, GRCS reports lower and upper bounds of estimated green revenues consistently throughout our entire sample period, including both before and after 2016. Earlier versions of the data, going back to 2008, did not additionally provide point estimates. To construct a consistent point-estimate series over the full sample period, we consulted with FTSE Russell on how to infer point estimates from the reported bounds and follow the approach used in their research reports.⁹ 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 that are available over the full sample period from 2008 to 2023. The factor is obtained by calculating:

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

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:

$$GR_{i,t} = GR_{i,min,t} + Factor_{i,2016} \times (GR_{i,max,t} - GR_{i,min,t}) \quad (2)$$

where $GR_{i,t}$ is the new point estimate, $GR_{i,min,t}$ the lower bound in a given year between

⁸This 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).

⁹LSEG FTSE Russell (July 2024), "Investing in the Green Economy 2024".

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 its research reports, wherein missing green revenue data can be interpreted as zero. In later analyses, we conduct several robustness tests addressing both the treatment of zero observations and the sensitivity of our results to excluding technologies whose classification as green is debatable, such as nuclear energy and cloud computing. First, we construct green revenue estimates using the midpoint between the lower and upper bounds, which are consistently reported throughout our sample period. Second, we restrict the analysis to Tier 1 green revenues—products with clear environmental benefits, such as solar—to mitigate concerns that environmentally controversial technologies drive our results. Further, we replicate our analysis using green revenue estimates from another data provider (MSCI), providing corroborating evidence. Lastly, we repeat the analysis using audited data from EUTSF regulatory reporting.

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: Eletrobras; 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).¹⁰ 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 analyzes, we tackle the active debate on the “greenness” of several

¹⁰The example of Tesla illustrates how green revenues data differ from ESG ratings. 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). However, 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. Wall Street Journal, “Is Tesla or Exxon More Sustainable? It Depends Whom You Ask” (Sept. 17, 2018).

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.¹¹ 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 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 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 %*, *Midpoint Green Revenues %*). We also find similar

¹¹The EUTSF also labeled nuclear energy as green despite some controversy (Reuters, “EU Parliament Backs Labeling Gas and Nuclear Investments as Green”, July 6, 2022)

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 “greenness”.

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

Our empirical design exploits the unexpected success of the 2015 United Nations Climate Change Conference. The resulting Paris Agreement committed 196 countries to reduce greenhouse-gas emissions and strengthen climate resilience. The conference took place in December 2015, and the Agreement entered into force on November 4, 2016. We interpret Paris as a regime shift that raised the salience of climate change and altered expectations about future environmental policy and the value of green products among firms, investors, and consumers.

The outcome was not widely anticipated. Contemporary reporting in the media emphasized the failure of prior climate negotiations and expressed considerable skepticism

that the Paris conference would produce a meaningful agreement.¹² Consistent with a shift in beliefs, [Ramadorai and Zeni \(2024\)](#) document that managers viewed Paris as increasing the likelihood of more stringent environmental regulation, [Seltzer et al. \(2022\)](#) show effects on corporate bond prices and risk, and the climate-attention index of [Engle et al. \(2020\)](#) rises sharply during the meeting. Paris therefore provides a common shock to expectations about climate policy and green economic activity.

The shock can accelerate the green transition through complementary supply- and demand-side forces. First, on the supply side, anticipated regulation raises the expected cost of environmentally harmful activities and improves the relative attractiveness of taxonomy-aligned products. Firms with existing green technologies may consequently have stronger incentives to commercialize them. Second, on the demand side, the Agreement can increase consumer demand for green products and capital-market demand for firms positioned to supply them. These mechanisms all raise the relative value of converting pre-existing green innovative capacity into commercial revenues.

To further validate this regime shift and examine these three forces that could accelerate the provision of green products and services, we estimate cross-sectional difference-in-differences regressions of the following form:

$$GR_{i,t} = \beta (\text{PostParis}_t \times \text{Treatment}_{i,\text{pre-Paris}}) + \gamma X_{i,t} + \mu_i + \theta_{s \times t} + \tau_{c \times t} + \varepsilon_{i,t}, \quad (3)$$

where $GR_{i,t}$ is firm i 's green-revenue share in year t , PostParis_t equals one from 2016 onward, and $\text{Treatment}_{i,\text{pre-Paris}}$ measures a predetermined firm characteristic before Paris and is held fixed throughout the sample. The coefficient β captures whether firms with greater pre-Paris exposure experience a larger post-Paris change in green revenues. The baseline regressions include firm fixed effects, sector-by-year fixed effects, country-by-year fixed effects (where possible), and time-varying controls. Standard errors are clustered at the country-year level. Depending on the treatment variable, we use either a binary-

¹²Examples of articles include 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).

treatment or a continuous-treatment specification.

To capture *regulatory exposure*, we exploit two sources of cross-sectional variation: firms' exposure to the subsequent rollout of the EU Taxonomy for Sustainable Finance (EUTSF) and the environmental stringency of their home countries, measured using the Environmental Performance Index (EPI). To capture *consumer demand*, we use the IVS, a survey-based measure of consumers' environmental preferences. Finally, to capture *capital-market demand*, we use firms' pre-Paris institutional ownership; and in particular, environmentally oriented investors such as the Principles for Responsible Investment and CCDP signatories (Gaspar et al., 2005; Starks et al., 2024; Gibson Brandon et al., 2022; Atta-Darkua et al., 2023). We also consider investors' investment horizons, given the previous evidence in the literature that they are more likely to exhibit green preferences (Gaspar et al., 2005; Starks et al., 2024). These would be consistent with sustainability-oriented and longer-horizon owners supporting investments whose commercialization may take time (Dimson et al., 2015; Dyck et al., 2019; Krueger et al., 2020; Dimson et al., 2021; Pastor et al., 2024)

Appendix 2 provides three validation exercises. First, the multi-stage rollout of the EU Taxonomy for Sustainable Activities (EUTSF) shows that European firms' green-revenue shares rose relative to those of firms elsewhere as the European regulatory framework became progressively more concrete through the European Green Deal, the creation of a Technical Expert Group and the subsequent development of the EUTSF. Second, cross-country tests show a stronger post-Paris expansion of green revenues where environmental policy and enforcement are stronger. Third, the expansion is also more pronounced among firms with more domestic sales, where consumer environmental preferences are stronger, and where pre-Paris ownership by environmentally oriented institutional investors is higher. Because institutional ownership is not randomly assigned, however, this evidence is associative: investors may facilitate green investment, select firms already positioned to expand it, or both. Taken together, these tests support the interpretation that Paris marked a meaningful shift in the environment for green commercialization and that the subsequent transition reflects both regulatory supply incentives and higher consumer

as well as market demand. More details on each channel are provided in Appendix 2.

4 Does Green Corporate Innovation Drive the Green Economy?

4.1 The Role of Green Innovation

Our main analysis examines whether firms with greater green innovation capabilities before the Paris Agreement generate higher green revenues afterward. We proxy these capabilities using pre-existing green patents, which capture firms’ accumulated technological knowledge in green innovation. The central question is whether this knowledge translates into commercial activity as developing green technologies does not necessarily imply that firms successfully bring green products and services to market. By linking pre-existing green patents to subsequent green revenues, we examine this step from innovation to commercialization and assess whether green innovation capabilities help firms capitalize on the increased economic value of green activity following the Paris Agreement.

For this purpose, we collect data from the Global Corporate Patent Dataset (GCPD) developed by Bena et al. (2017).¹³ 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 Haščić and Migotto (2015) and also used in Cohen et al. (2023), Hege et al. (2022) and Atta-Darkua et al. (2023). We then construct our main variable, *GP Indicator*, which equals one if a firm was granted at least one green patent before the Paris Agreement and zero otherwise. We also construct two alternative measures: *GP Count*, the number of green patents granted to the firm before Paris, and *GP Ratio*, the ratio of green patents to all patents granted to the firm between 2008 and 2015. In cases of missing firm data, we impute zeros.

We follow the methodology outlined in Section 3. The results in Table 3 show that

¹³This 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.

companies that were more successful in developing green technologies pre Paris generated higher green revenues post Paris. Our 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 2015. 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 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. The specification using the *GP Indicator* variable is particularly useful for 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 the Paris Agreement experienced, on average, an increase in green revenues that is 1.6 percentage points higher than for firms without any green patents after the Agreement came into effect. The effect is economically meaningful and represents about 12% of the standard deviation of the green revenue share.

We conduct two robustness tests using alternative definitions of green revenues. First, we reestimate the regressions using the midpoint between FTSE Russell’s minimum and maximum green-revenue estimates, which are available throughout the sample period and constructed using a consistent methodology. This test addresses the concern that our baseline results may be affected by the backfilling required because FTSE Russell provides its main point estimate only from 2016 onward. The results using the midpoint measure are highly significant and economically larger than the baseline estimates. Second, we restrict green revenues to Tier 1 activities whose environmental benefits are unambiguous, such as solar power. This restriction addresses the concern that firms may have classified controversial technologies as green after Paris to improve their perceived environmental performance. The results remain economically and statistically strong for Tier 1 revenues, which suggests that our findings are neither driven by the backfilling procedure nor by the inclusion of environmentally ambiguous activities.

Lastly, we assess the parallel-trends assumption underlying our main tests. Figure 4 presents dynamic estimates of the relation between firms’ pre-Paris green technological

capabilities and their green revenues. The coefficients are economically small and statistically indistinguishable from zero before the Paris Agreement. After Paris, the coefficients become positive and continuously increase through the end of the sample. Thus, the post-Paris divergence in green revenues does not appear to reflect differential trends that predate the Agreement.

4.2 Heterogeneity in Corporate Green Innovation Capabilities

We next examine how the results vary across geographic regions before focusing on the energy sector, given its central role in the transition to a low-carbon economy. Table 4 reveals striking differences between the United States, Asia-Pacific and Europe. The interaction between *GP Indicator* and *Post Paris* is positive and significant only in the United States and Asia-Pacific. Thus, firms with pre-Paris green technological capabilities expanded their green revenues more rapidly after Paris in these two regions, whereas we find no comparable acceleration in Europe.

One interpretation is that these patterns reflect differences in the relative roles of market incentives and regulation. A market-based mechanism, consistent with Roy-style sorting (Cauthorn et al., 2024), predicts that firms with stronger pre-existing green technological capabilities are better positioned to pursue green commercial opportunities as their relative profitability increases. The stronger association between green patents and subsequent green revenues in the United States and Asia-Pacific is consistent with this mechanism. In Europe, regulatory incentives may instead have encouraged green commercial activity more broadly, making its expansion less dependent on firms' pre-existing patented green technologies. Our results do not directly distinguish these mechanisms, but the regional patterns motivate our subsequent analysis. In Section 5, we examine whether regions with a stronger association between green innovation and subsequent green revenues also exhibited a larger capital-market valuation premium for green commercial activity and find support for this mechanism.

In column (4) of Table 4, we focus on the energy sector. Cohen et al. (2023) document substantial green patenting by energy firms, but whether these inventions translate into

commercial green output remains an open question. Within the energy sector, firms with pre-Paris green patents experience a smaller post-Paris increase in their green-revenue shares than firms without such patents. This contrasts with the positive post-Paris relation between green patents and green revenues outside the energy sector.

Several mechanisms could explain this disconnect between green invention and commercialization. Fossil-fuel-dependent energy firms may face high adjustment costs because commercializing green technologies requires fundamental changes to their assets and business models. Alternatively, these firms may monetize their inventions through licensing rather than through their own product revenues or use patents strategically to limit entry by greener competitors. Although our analysis does not distinguish among these mechanisms, the findings suggest that green technological capabilities are not sufficient for commercial success. In the energy sector, a larger stock of pre-existing green patents is not associated with faster growth in green revenues following the Paris Agreement.

In Panel B, we distinguish between green product and process patents. We classify patents as product patents when the underlying invention can be embodied in an environmentally beneficial product or service sold by the firm, and as process patents when the invention improves the environmental efficiency of the firm’s production activities without directly changing its commercial output.¹⁴ This distinction allows us to identify the type of innovation most closely associated with green commercialization. The results show that the post-Paris increase in green revenues is driven by firms with pre-Paris green product patents. These firms experience a 2.23-percentage-point larger increase in their green-revenue shares after Paris, whereas green process patents do not predict a comparable increase. Thus, the baseline relation reflects firms converting green product technologies into marketable output rather than merely adopting cleaner production processes.

Lastly, in Panel C, we run a placebo test that distinguishes firms with at least one green patent before Paris from those with any pre-Paris patent, regardless of its envi-

¹⁴Patent abstracts use standardized phrasing that facilitates classification. For example, process patents frequently describe “a process for” or “a method of” performing a particular task.

ronmental content. This comparison allows us to assess whether the post-Paris increase in green revenues reflects green technological capabilities specifically or firms' broader capacity to innovate. The results are driven by firms with pre-Paris green patents: possessing patents in general does not predict an acceleration in green revenues after Paris. Thus, the relation between pre-Paris innovation and subsequent green commercialization is specific to green innovation rather than innovation more broadly.

4.3 Robustness and Additional Tests

We conduct several additional tests to assess the robustness of our results. These tests examine the measurement of green revenues, the extensive and intensive margins of green activities, changes in the composition of firm revenues, and alternative measures of green innovation.

4.3.1 Extensive and Intensive Margins

First, we examine whether our findings depend on the construction and measurement of green revenues. We begin by comparing our primary green revenue measure with alternative environmental measures used in the literature, yet, unlike in the previous section, we only focus on firms with non-zero green revenues. Table I.A.1 shows that the baseline, midpoint, and Tier 1 green revenue measures are strongly correlated with one another among firms with positive green revenues. In contrast, green revenues exhibit relatively low correlations with carbon intensities and conventional environmental scores. These results indicate that even in the intensive margin, the alternative green-revenue definitions capture a common dimension of firm output while containing information that is distinct from measures of firms' emissions and environmental practices.

To further study the intensive margin, we re-estimate our main regression in Table 3, restricting the sample to firm-year observations with positive green revenues. Table I.A.3 shows that firms with pre-Paris green patents experience a larger post-Paris increase in green revenue shares within this conditional sample. The result holds for the baseline, midpoint, and Tier 1 green-revenue measures. Thus, pre-Paris green innovation predicts

both entry into green product markets and expansion among firms already generating green revenues.

4.3.2 Alternative Green-Revenue Measures

Second, we replicate the main analysis using green-revenue estimates from MSCI. The advantage is that it is independent measure but the downside is that its coverage only starts post-Paris. Table I.A.4 shows that firms with pre-Paris green patents have higher green revenues using the measure by MSCI. The result holds both in the sample for which MSCI reports green revenues and when missing observations within the MSCI ACWI universe are assigned zero. The results are also robust when green innovation is measured by the share of a firm’s pre-Paris patents that are green.

Internet Appendix Table I.A.5 provides additional evidence on the relation between the two data providers. MSCI green-revenue estimates are strongly positively associated with FTSE Russell’s baseline, midpoint, and Tier 1 green-revenue measures. This relation holds both among firms with positive green revenues and in the broader MSCI ACWI universe. Thus, although FTSE Russell and MSCI construct their estimates independently, the two measures identify similar cross-sectional variation in corporate green activity.

Finally, we examine several environmental outcomes reported by firms under the EU Taxonomy, for which data are available only for 2022–2023. Table I.A.6 shows that firms with pre-Paris green patents subsequently report higher shares of both taxonomy-eligible and taxonomy-aligned green revenues, green capital expenditures, and green operating expenditures. These findings are important because the EU Taxonomy outcomes are reported by firms and only cover eligible *and* aligned activities defined by the EUTSF. These reported numbers are also audited and verified by a third party. The results, therefore, extend beyond provider-estimated green revenues and indicate that pre-existing green innovation predicts firms’ subsequently reported green investment and operating activity.

4.3.3 Alternative Measures of Green Innovation

Third, we examine whether the results depend on how we measure firms' pre-Paris green innovation capabilities. Our baseline measure is an indicator equal to one if a firm owns at least one green patent before the Paris Agreement. Table I.A.7 replaces this indicator with two continuous measures. The first is the natural logarithm of one plus the number of green patents granted before Paris, which captures the scale of a firm's pre-existing green patent portfolio. The second is the ratio of green patents to all patents granted by the firm before Paris, which captures the green orientation, or green tilt, of its innovative activity.

Both measures predict higher green revenues after Paris. The results hold when green activity is measured using FTSE Russell's baseline green-revenue estimate, the midpoint between its minimum and maximum estimates, or revenues from Tier 1 activities. These findings show that the baseline results are not specific to the use of a green-patent indicator. Firms with larger pre-Paris green patent portfolios and firms whose innovative activity was more strongly oriented toward green technologies both experience greater increases in green revenues after the Paris Agreement.

We next distinguish patents by their subsequent influence. Table I.A.8 measures influence using the number of citations received by a firm's green patents, green citations relative to all patent citations, and green citations relative to the corresponding industry average. Each measure is positively associated with post-Paris green revenues. The relation between pre-Paris green innovation and subsequent commercialization is therefore stronger when firms' green patents have greater technological influence.

Table I.A.9 examines whether the results are attributable to individual highly influential inventions. Firms owning a green patent in the top 5% of the citation distribution experience a larger post-Paris increase in baseline, midpoint, and Tier 1 green revenues. Results using the top 1% threshold are positive for the baseline and midpoint measures but are not statistically significant for Tier 1 revenues. Taken together, these findings indicate that highly cited individual inventions contribute to the relation between pre-Paris green innovation and post-Paris green revenues, although the evidence at the most

restrictive citation and revenue thresholds is weaker.

4.3.4 Dollar Revenues and Revenue Composition

Finally, we examine green revenues in U.S. dollars rather than as a share of total revenues. This analysis addresses the possibility that green revenue shares increase mechanically because total revenues or non-green revenues decline.

Table I.A.10 shows that firms with pre-Paris green patents generate greater dollar green revenues after Paris. This result holds when green innovation is measured using either an indicator for owning a pre-Paris green patent or the share of pre-Paris patents that are green. We then define “brown” revenues as total revenues minus green revenues and re-estimate the specifications using brown dollar revenues as the dependent variable. The estimates provide no evidence that the increase in green revenues among firms with a high pre-Paris green-patent share is attributable to a decline in brown revenues. For firms with any pre-Paris green patent, both green and brown revenues increase, consistent with an expansion in firm scale rather than a mechanical reclassification of existing revenues.

Table I.A.11 presents the corresponding analysis for institutional ownership. Firms with greater pre-Paris institutional ownership generate higher dollar green revenues after Paris. Brown revenues do not decline and, for several ownership measures, also increase. The institutional-ownership results therefore reflect an expansion of green activity rather than a substitution induced by contracting non-green revenues. The results for investor horizon exhibit a similar pattern: firms with higher pre-Paris turnover generate lower green and brown revenues after Paris.

We also examine the regulatory results using dollar revenues. Table I.A.18 shows that the later stages of the European regulatory process, particularly the creation of the Technical Expert Group and the enactment of the EU Taxonomy, are associated with higher dollar green revenues among European firms. The corresponding brown-revenue results do not indicate that the increase in green revenues following the later regulatory milestones is driven by a contemporaneous reclassification of brown revenues. These findings complement the green-revenue-share results and support the interpretation

that the European regulatory progression was associated with an expansion of green commercial activity.

Taken together, these tests show that our findings are not specific to a particular data provider, green-revenue definition, backfilling procedure, patent measure, or regression sample. The results hold using independently constructed MSCI data, FTSE Russell’s midpoint and Tier 1 measures, and firm-reported EU Taxonomy outcomes. They operate through both entry into green product markets and growth among firms already generating green revenues. They also translate into higher dollar green revenues without a simultaneous contraction in brown revenues. Finally, the results are stronger for more influential green patents. The combined evidence supports the conclusion that pre-existing green technological capabilities are a key driver of the post-Paris expansion in corporate green revenues.

5 Do Investors Value Green Revenues?

5.1 Green Portfolio Returns

Corporate environmental sustainability may be a desirable goal in itself. However, it remains an open question whether the stock market perceives firms with more green revenues as more valuable relative to firms without green products, especially after Paris, and whether it is possible to generate profitable trading strategies from investing in green revenue firms.

Panel A of 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, especially after the Paris

Agreement.

In Panel B, we exclude Tesla from all portfolios because value-weighted portfolio returns may be disproportionately affected by the performance of influential observations. Table I.A.12 shows that Tesla accounts for a substantial share of the green portfolios, particularly toward the end of the sample. Its exclusion materially affects cumulative returns. Nevertheless, the main time series pattern remains: green stocks tend to underperform before the Paris Agreement, whereas the green portfolios—especially the portfolio comprising firms with green-revenue shares above 50%—begin to outperform afterward.

In Panel C, we restrict the analysis to the United States for two reasons. First, our earlier results show that the post-Paris commercialization of green innovation is strongest among U.S. firms. Second, relative to Europe, where the expansion of green revenues is more closely associated with environmental regulation, the United States provides a more market-based setting which allows us to examine whether investors revalue firms with greater exposure to emerging green commercial opportunities. We find that U.S. firms with higher green-revenue shares outperform after Paris even when Tesla is excluded. In the rest of the world, shown in Panel D, green portfolios also improve after Paris, but the increase in relative performance is considerably less pronounced.

5.2 Short-Term Performance and the Role of Covid

To address the possibility that the longer-run outperformance is driven primarily by the 2020 period, and to more directly test whether the Paris Agreement led investors to revalue firms based on their exposure to green commercial opportunities, we conduct a short-window event study around the adoption of the Agreement on December 12, 2015. We focus on U.S. firms, for which the post-Paris outperformance of green stocks is concentrated. The United States also provides a particularly useful setting for this test because, relative to Europe, the expansion of green revenues is less directly tied to environmental regulation. Stock-price reactions around the Paris Agreement therefore allow us to examine whether investors perceived firms with greater exposure to green commercial activities as relatively more valuable (positive NPV) following the agreement.

Table 5 reports cumulative abnormal returns (CARs) over four event windows, ranging from three trading days $[-1, +1]$ to 21 trading days $[-10, +10]$. We compare firms exceeding different green-revenue thresholds with firms reporting no green revenues. The results reveal a striking monotonic relation between the share of green revenues and relative stock-price performance around Paris. For firms with any green revenues, the difference relative to non-green firms is relatively small, ranging from 0.14 to 1.64 percentage points depending on the event window. Once we focus on firms deriving more than 20% of their revenues from green activities, however, the return differential increases to 1.15 percentage points over the $[-1, +1]$ window, 2.25 percentage points over $[-3, +3]$, 3.02 percentage points over $[-5, +5]$, and 4.61 percentage points over $[-10, +10]$, with all four estimates statistically significant.

The effects become considerably larger as firms' exposure to green activities increases. Firms with more than 50% green revenues outperform non-green firms by 1.79 percentage points over $[-1, +1]$, 4.26 percentage points over $[-3, +3]$, 5.77 percentage points over $[-5, +5]$, and 6.77 percentage points over $[-10, +10]$. For "pure-play" green firms deriving more than 80% of revenues from green activities, these differences increase further to 2.63, 5.93, 8.34, and 8.75 percentage points, respectively. The latter three estimates are statistically significant at the 1% level. Importantly, the results are not driven solely by particularly poor performance among non-green firms. The greenest firms themselves earn positive CARs: firms above the 80% threshold experience abnormal returns of 4.13% over $[-3, +3]$, 4.30% over $[-5, +5]$, and 6.01% over $[-10, +10]$. Thus, the event study points both to an absolute increase in the valuation of highly green firms and, even more strongly, to a revaluation of these firms relative to firms without green revenues.

In Table 6, we link this test back to our analysis in the main part of this paper combining firms' realized green commercial exposure with their pre-existing capacity for green innovation. Specifically, we double-sort firms by their green-revenue share and whether they held at least one green patent prior to Paris. The amplification is particularly pronounced among firms with the greatest green-revenue exposure. Among firms with green patents and more than 50% green revenues, the return differential relative to non-green

firms reaches 4.76 percentage points over $[-3, +3]$, 5.48 percentage points over $[-5, +5]$, and 7.84 percentage points over $[-10, +10]$. For firms combining pre-Paris green innovation with more than 80% green revenues, the corresponding differences increase to 2.71, 7.56, 9.79, and 10.44 percentage points across the four event windows. The firms most strongly positioned for the green transition therefore experience the largest valuation gains around Paris.

Taken together, these findings provide evidence of a market-based valuation channel around the Paris Agreement. The stock-market response increases systematically with firms' realized exposure to green economic activity and is particularly large when high green revenues are combined with pre-existing green innovative capacity. This pattern is consistent with investors revising upward the value of firms positioned to benefit from an anticipated expansion of the green economy. In this sense, the Paris Agreement appears to have increased the relative NPV of green business activities: firms with the greatest exposure to those activities experienced the strongest positive revaluation relative to firms without green revenues.

5.3 Long-Term Performance

Although the raw returns in Figure 5 suggest that green-revenue stocks outperform following Paris, these returns may reflect exposure to common asset-pricing factors rather than abnormal performance. We therefore examine whether the green alpha persists after controlling for standard factor models. We also characterize the factor exposures of green-revenue portfolios and assess the extent to which these exposures account for their average returns. Panel A of Table I.A.13 analyzes a value-weighted portfolio of firms with *Green Revenues* $\geq 20\%$ using the global factors from Jensen et al. (2023). Column (1) confirms that this portfolio earns significant excess returns over the risk-free rate. However, its industry-adjusted return in column (2), calculated relative to returns in the 10 GICS sectors, is statistically insignificant.

Columns (3)–(7) characterize the portfolio's exposures to standard asset-pricing factors. The portfolio has a market beta slightly above one, indicating that firms with

substantial green revenues have somewhat greater exposure to aggregate market risk. Its most consistent characteristic exposure is a negative loading on the value factor, which implies that high-green-revenue firms behave more like growth stocks. The portfolio also loads negatively on the investment factor in the Fama–French five- and six-factor specifications, consistent with a tilt toward firms pursuing relatively aggressive investment policies. By contrast, its size and profitability loadings are statistically insignificant. The negative momentum exposure is comparatively weak and is not robust across specifications. Thus, high-green-revenue firms are not distinguished by a general loading on every conventional factor; they are primarily characterized by growth and investment tilts. Column (8) adds the global green-minus-brown (*GMB*) factor of Karolyi et al. (2023), based on the environmental-score factor proposed by Pastor et al. (2022).¹⁵ The high-green-revenue portfolio does not load significantly on *GMB*. This result is consistent with the low correlations between green-revenue shares and conventional environmental and ESG scores reported in Table 2. Green revenues, therefore, capture firms’ exposure to environmentally beneficial products and services rather than simply reproducing a portfolio sort based on standard environmental ratings.

Panel B shows similar factor exposures for the *Green Minus Legacy* (*GML*) portfolio, which is long firms with green-revenue shares of at least 20% and short firms without green revenues. *GML* loads positively on the market and negatively on the value and investment factors, but not on the conventional *GMB* factor. Alphas are insignificant once these standard factors are included. We therefore use the Fama–French five factors augmented with momentum in our subsequent analysis of different green-revenue thresholds and sample periods.

We next examine whether abnormal returns vary across different shades of green. In Table 7, we construct *GML* portfolios using increasingly stringent green revenue thresholds for the long leg, while the short leg consists of firms without green revenues. We estimate monthly alphas using the six-factor model of Fama and French (2018), which augments the Fama-French five-factor model with momentum. Over the full 2008-2023

¹⁵Note that the sample period is shorter since the global *GMB* factor is not available for the full sample period. Yet, we conduct US-specific tests in our robustness section considering a longer sample period.

sample, there is little evidence of a broad green-revenue premium. In Panel A, the portfolio containing all firms with positive green revenues earns a negative alpha of -0.20% per month, whereas alphas become positive as the threshold increases and reach 0.60% for “pure-play” firms with green revenue shares above 80% . Similar patterns obtain using midpoint and Tier 1 green revenues: the corresponding pure-play alphas are 0.68% and 1.08% per month, respectively. Thus, any positive green alpha is concentrated among firms with the greatest commercial exposure to green activities.

Because green revenues accelerated following the Paris Agreement, we separately estimate alphas before and after 2016.¹⁶ Before Paris, we find no positive alpha; for example, the baseline *GML* portfolios with positive and above- 20% green revenues earn monthly alphas of -0.41% and -0.29% , respectively. After Paris, alphas increase monotonically with the green-revenue threshold. In Panel A, the post-Paris alpha rises from approximately zero for firms with any green revenues to 0.55% for firms above the 50% threshold and 1.22% for pure-play firms. The pattern is stronger for more restrictive definitions of green activity. Post-Paris alphas for the above- 50% and above- 80% portfolios are 0.72% and 1.22% using midpoint green revenues and 0.90% and 1.94% using Tier 1 green revenues. The post-Paris outperformance is therefore concentrated among firms whose revenues are most heavily exposed to the green transition.

5.4 Heterogeneity across Regions and the Energy Sector

Mirroring the structure of the previous section, Table 8 examines which geographic markets account for this outperformance. In the United States, post-Paris alphas equal 1.32% per month for firms with green-revenue shares above 50% and 1.86% for pure-play firms. In contrast, none of the post-Paris alphas is statistically significant in Europe or Asia-Pacific. European green portfolios instead earn significantly negative alphas before Paris, ranging from -0.58% for firms with any green revenues to -0.82% for firms above the 50% threshold. We also find no significant alpha in the energy sector. These regional

¹⁶Related studies find that utility firms with green revenues earned higher returns following Paris Battiston et al. (2024) and that EUTSF-aligned firms outperformed as investor attention increased around the publication of the taxonomy Bassen et al. (2025).

differences are consistent with distinct mechanisms underlying the green transition. In the United States, where the post-Paris regulatory response was comparatively limited, the transition appears to operate through a market-driven revaluation of green relative to legacy firms. In a Roy-style sorting mechanism (Cauthorn et al., 2024), the increase in the relative value of green activities disproportionately benefits firms already positioned to commercialize green products, inducing capital and productive resources to shift toward these firms. This mechanism generates a return spread between firms with high and low green-revenue exposure. In Europe, by contrast, our earlier results indicate that the expansion of green revenues was more closely associated with environmental legislation. A broader regulatory push affects both green and legacy firms and can accelerate green investment without generating a comparable relative return premium for firms that were already green. Thus, the results do not support a global green premium; they instead suggest a market-driven revaluation in the United States and a more regulation-driven transition in Europe.

The energy sector provides an informative contrast. Energy is central to the green transition and accounts for a substantial share of green patenting Cohen et al. (2023), yet we find no evidence that energy firms with green revenues outperform their legacy peers. Post-Paris alphas are -0.44% for firms with any green revenues and 0.43% for firms above the 20% threshold, and neither estimate is statistically significant; moreover, no energy firms exceed the 50% threshold. This finding is consistent with our earlier evidence that green patents held by energy firms do not translate into faster green-revenue growth. Commercializing these technologies may require large adjustments to existing assets and business models or may cannibalize rents from incumbent fossil-fuel operations. Energy firms may also license their inventions or use green patents strategically to protect existing market positions and deter entry rather than commercialize the technologies themselves. Although we cannot distinguish among these mechanisms, the evidence shows that green innovation alone does not generate either substantial green commercial activity or investor outperformance in the energy sector.

Table 9 links the return evidence to our main analysis by double-sorting firms on their

pre-Paris green innovation capacity and green-revenue exposure. Among firms with pre-Paris green patents, post-Paris alpha increases sharply with the green-revenue threshold. In the global sample, monthly alpha rises from an insignificant 0.40% for firms above the 20% threshold to 1.03% for firms above 50% and 2.18% for pure-play firms. These estimates are substantially larger than the corresponding alphas of 0.55% and 1.22% in the unconditional portfolios. The pattern is again concentrated in the United States, where post-Paris alphas reach 1.60% and 2.01% for the above-50% and pure-play portfolios, respectively. We find no comparable outperformance in Europe, Asia-Pacific, or the energy sector.

These results reinforce the technological-capability channel documented in our main analysis. The post-Paris revaluation is strongest among firms that combined substantial realized green revenues with green technologies developed before the Agreement. Pre-existing green patents appear to identify firms that were better prepared to respond when the relative value of green products increased. Thus, the return evidence mirrors the revenue evidence: green innovation creates value when firms possess both the technological capacity and the commercial exposure needed to benefit from the transition.

5.5 Explaining the Outperformance

Finally, we examine three potential explanations for the post-Paris outperformance of green-revenue firms: cash-flow news, changes in discount rates, and unexpected shifts in investor demand following increases in environmental awareness. These channels have different implications. If investors initially underestimated the commercial potential of green activities, firms with greater green-revenue exposure should subsequently report more positive earnings surprises. Alternatively, their outperformance could reflect a decline in required returns. A third possibility, emphasized by [Pastor et al. \(2022\)](#), is that unexpected increases in environmental concerns generate demand for green stocks and raise their contemporaneous returns.

Table [I.A.14](#) distinguishes between the cash-flow and discount-rate channels. Columns (1) and (2) show that the relation between lagged green revenues and earnings surprises

becomes significantly more positive after Paris. The coefficient on *Lagged Green Revenues* $\% \times \text{Post Paris}$ is 0.0147 in the global sample and 0.0136 in the United States, significant at the 5% and 1% levels, respectively. This evidence suggests that investors did not fully anticipate the post-Paris earnings performance of firms with greater green-revenue exposure. In contrast, columns (3)–(6) provide no evidence that green revenues are associated with a lower implied cost of capital: the post-Paris interaction is statistically insignificant under both cost-of-capital measures and in both the global and U.S. samples. Thus, Table I.A.14 points to a cash-flow-news channel rather than a persistent discount-rate channel.

Table I.A.15 examines the demand channel using innovations in the Media Climate Change Concerns index of Ardia et al. (2023). We regress monthly *GML* returns on prediction errors from an AR(1) model of the index. Unexpected increases in climate concerns are associated with positive *GML* returns at every green-revenue threshold, and the sensitivity increases monotonically with firms’ green exposure. The coefficient rises from 0.708 for the portfolio containing all firms with positive green revenues to 1.020, 2.105, and 2.803 for portfolios using the 20%, 50%, and 80% thresholds, respectively. These results are consistent with unexpected environmental news inducing demand for green stocks, with the largest price response among firms most exposed to green commercial activity.

In sum, Tables I.A.14 and I.A.15 suggest that the post-Paris outperformance reflects both unexpectedly strong earnings and demand shifts following increases in environmental awareness, rather than a lower cost of capital. The results are robust to alternative definitions of the legacy portfolio that exclude industries with little capacity to generate green revenues.¹⁷ They also cannot be explained by conventional environmental-score factors: Table I.A.13 shows that the global green-minus-brown factor of Karolyi et al. (2023) does not significantly load on the *GML* factor. Green-revenue portfolios therefore capture firms’ exposure to green commercial activity rather than repackaging previously documented ESG-based return factors.

¹⁷Detailed results are available upon request.

5.6 Robustness

We conduct several robustness tests addressing the concentration of green-portfolio returns. Breakthrough technologies can generate highly skewed outcomes, and Bessembinder (2018) shows that a small number of stocks account for a substantial share of aggregate equity-market wealth creation. This concern is particularly relevant for our value-weighted portfolios. Table I.A.12 shows that Tesla’s weight in the U.S. portfolio of firms with green-revenue shares above 50% reaches 48% in 2021. Its weight in the U.S. pure-play portfolio is even larger, exceeding 50% in 2020, 2021, and 2023 and reaching 62% in 2021. Panel B of Figure 5 confirms that Tesla accounts for a substantial portion of the cumulative outperformance of the green portfolios. Nevertheless, after excluding Tesla, U.S. portfolios with greater green-revenue exposure continue to outperform after Paris.

Table I.A.16 examines this result using six-factor alphas. Panels A and B exclude Tesla from the value-weighted global and U.S. portfolios, while Panels C and D use equal weights to reduce the influence of all large firms. In the U.S. sample, the post-Paris alpha of the pure-play portfolio remains positive at 0.45% per month after excluding Tesla and 0.65% under equal weighting, significant at the 10% and 5% levels, respectively. The corresponding global estimates are positive but statistically insignificant. We also find no significant post-Paris alpha for the less restrictive U.S. green-revenue thresholds. Thus, Tesla accounts for an important share of the baseline outperformance, but not all of it. The remaining evidence continues to point to a positive post-Paris alpha among U.S. firms with the most intensive green commercial exposure rather than to a broad green premium.

Lastly, we examine whether the outperformance of U.S. green-revenue portfolios is spanned by an existing green factor. We augment the six-factor model with the green-minus-brown (*GMB*) factor of Pastor et al. (2022). Table I.A.17 shows that controlling for *GMB* does not materially affect the post-Paris alphas and that the *GML* portfolios do not load significantly on *GMB*. Thus, green revenues capture a dimension of firms’ environmental exposure that is distinct from existing ESG-based green factors.

6 Conclusions

In this paper, we use green revenues to study the commercialization of environmentally beneficial products and services. Unlike emissions and ESG ratings, which primarily characterize firms' production externalities, policies, and conduct, green revenues measure environmentally beneficial output sold by firms. We document that the publicly listed green economy increased from approximately 4% of global revenues before the Paris Agreement to about 6% by 2023, corresponding to roughly \$4 trillion in annual revenues. Green activity nevertheless remains concentrated: only 13.7% of firm-years generate positive green revenues. The United States, China, and Japan account for large amounts of green revenues, while several European markets have the highest green-revenue shares.

The post-Paris acceleration is consistent with a change in the economic environment surrounding green commercial activity. We interpret Paris as a regime shift that altered expectations about environmental policy and demand rather than as a treatment identifying a single causal effect. Supporting evidence from the subsequent European policy sequence shows that green revenues increase as environmental regulation becomes more concrete. Across countries, green-revenue growth is also stronger where environmental policies are more stringent and where firms are more exposed to domestic consumers with stronger environmental preferences. These findings are consistent with complementary regulatory supply and product-demand channels.

Our main firm-level results link green invention to subsequent commercialization. Firms with pre-Paris green patents experience a 1.6 percentage-point larger post-Paris increase in their green-revenue shares than firms without such patents. This relation is driven by green product patents, which are associated with a 2.2 percentage-point increase, rather than by process patents or patenting more generally. The relation also appears in levels: firms with pre-Paris green patents generate approximately \$461 million more in annual green revenues after Paris. These results distinguish the development of green technologies from their commercialization and identify pre-existing green product capabilities as an important predictor of firms' responses to the post-Paris shift. We also find larger increases in green revenues among firms with greater pre-Paris ownership by

sustainability-oriented and longer-horizon institutions. Because institutional ownership is endogenous, this evidence is consistent with both investor influence and selection.

The asset-pricing results provide no evidence of a pervasive green premium. Portfolios containing all firms with positive green revenues do not earn reliably positive abnormal returns after controlling for standard factors. Post-Paris alpha instead increases with the intensity of green commercial exposure and reaches 1.2% per month among firms generating more than 80% of their revenues from green activities. This outperformance is concentrated in the United States and is strongest among firms with pre-Paris green patents. Firms subsequently revealed to have the greatest green-revenue exposure also experience the largest announcement returns around Paris. We find no comparable post-Paris alpha in Europe, where the expansion of green revenues is more closely associated with regulation. This geographic contrast is consistent with a market-driven revaluation in the United States and a more regulation-driven transition in Europe.

Finally, we examine the sources of the post-Paris return differential. Firms with greater green-revenue exposure experience more positive earnings surprises after Paris, whereas we find no evidence that their implied cost of capital declines. The results therefore favor a cash-flow-news channel over a persistent discount-rate channel. Green-minus-legacy returns also respond positively to unexpected increases in climate concerns, and this sensitivity rises monotonically with firms' green-revenue exposure. These findings are consistent with both unexpectedly strong cash flows and shifts in investor demand contributing to the post-Paris revaluation of high-green-revenue firms. The results are robust to excluding Tesla and are not explained by an existing ESG-based green factor.

Our findings emphasize that the green transition depends not only on reducing harmful production or developing green technologies, but also on converting those technologies into products and services that customers purchase. An important question for future research is whether growth in green revenues produces corresponding reductions in emissions and improvements in environmental outcomes. Future work could also examine how changes in technology, regulation, and sustainable-activity classifications affect the commercialization and valuation of green corporate output.

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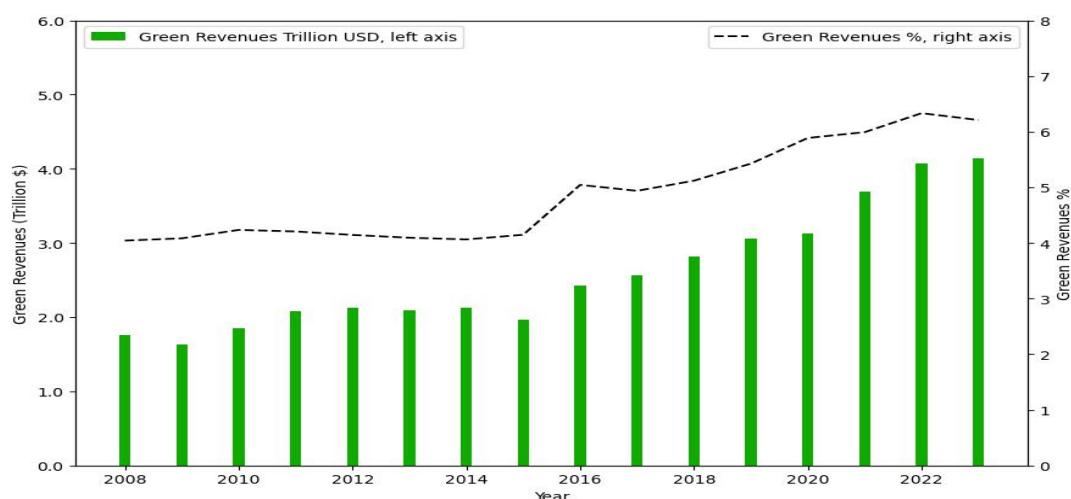
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Figures

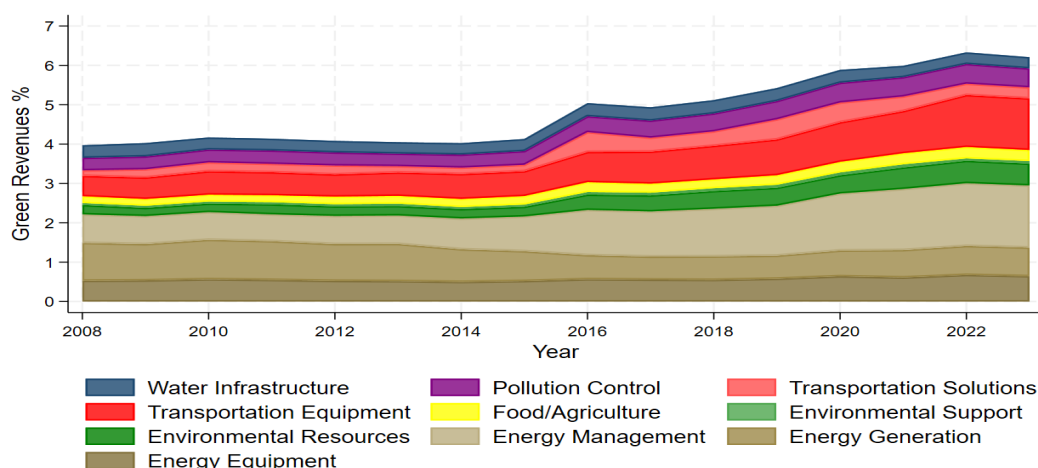
Figure 1. Sizing the Green Economy

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 B: Green Revenues by GRCS Business Activity



Panel C: Green Revenues by GRCS Tier of “Greenness”

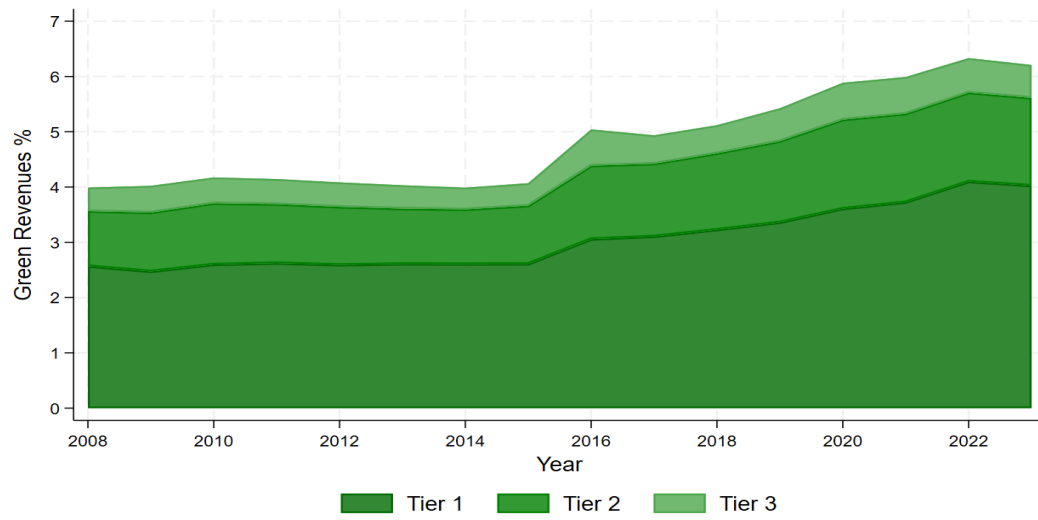


Figure 2. Green Revenues by Industry

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.

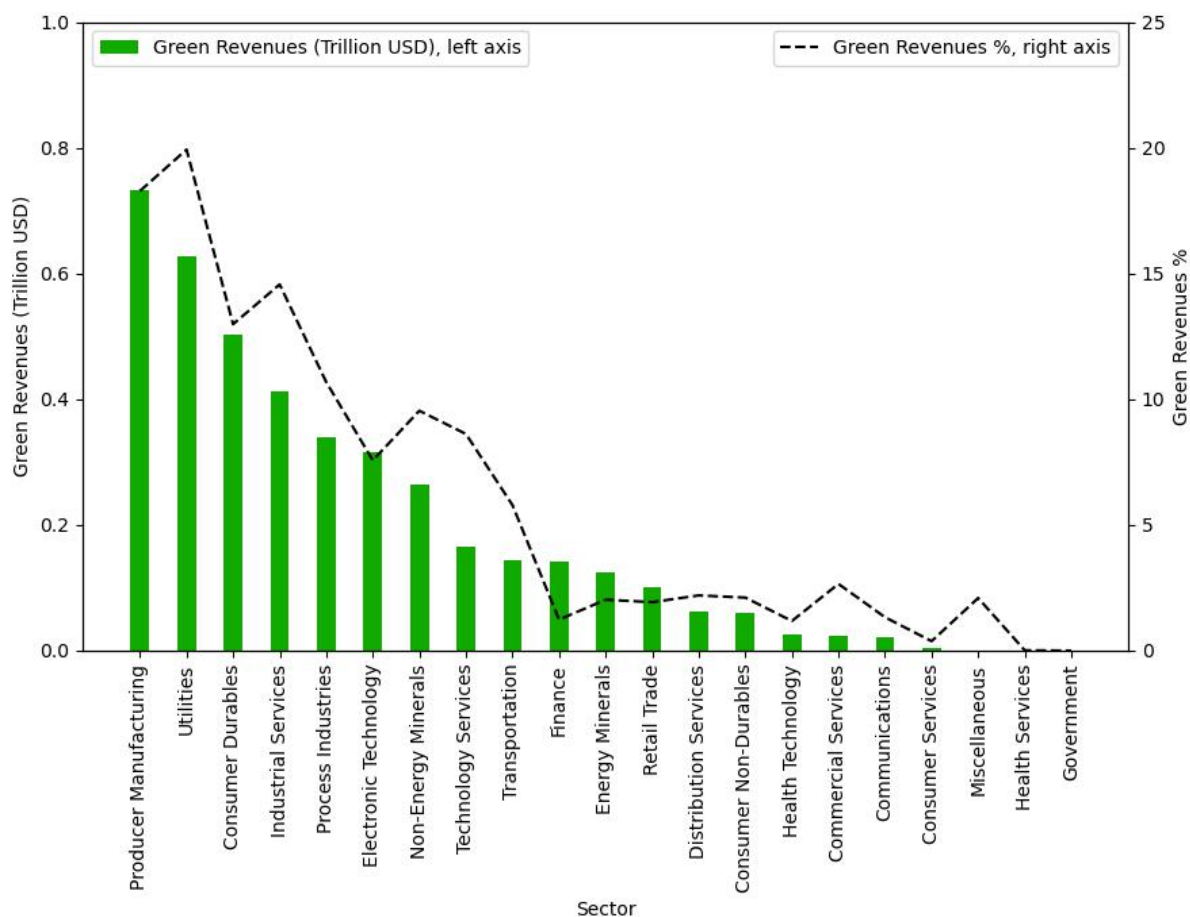


Figure 3. Green Revenues by Country

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.

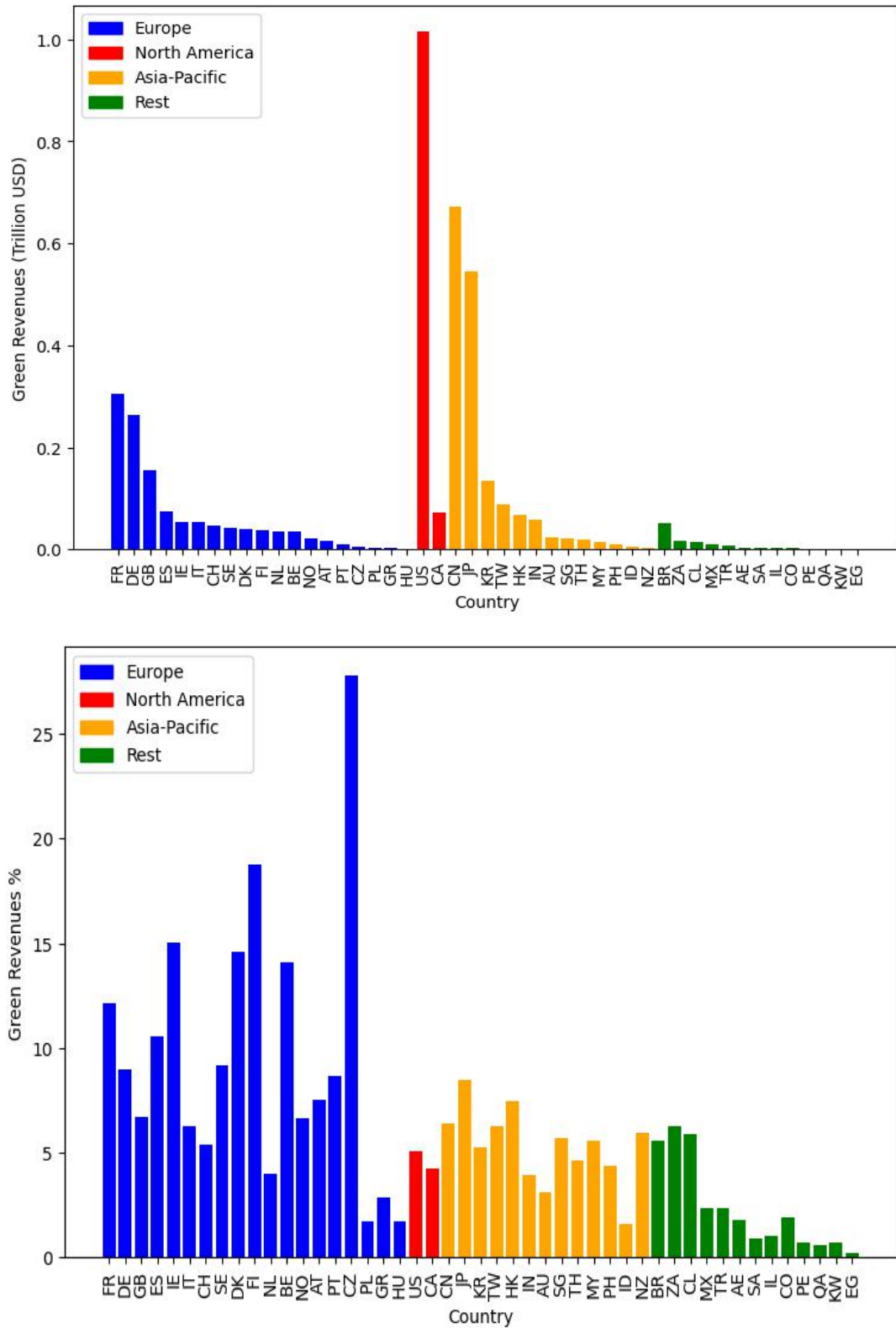


Figure 4. Dynamic Treatment Effect of Green Patenting

The plot illustrates 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 gray shaded area indicates 95% confidence intervals (CIs). The graph 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 treatment year (2015) is omitted from the figure and serves as the reference category.

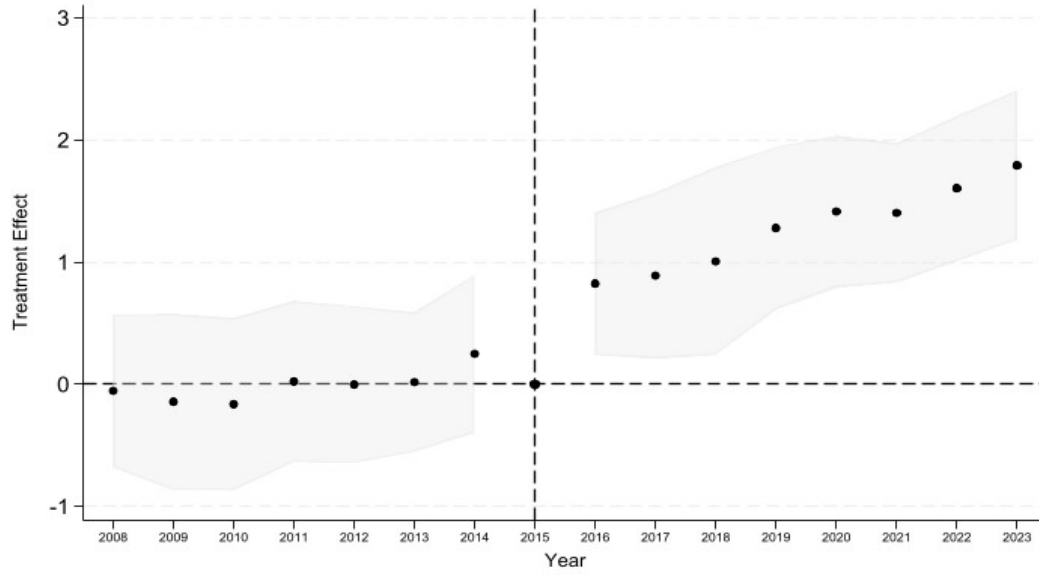
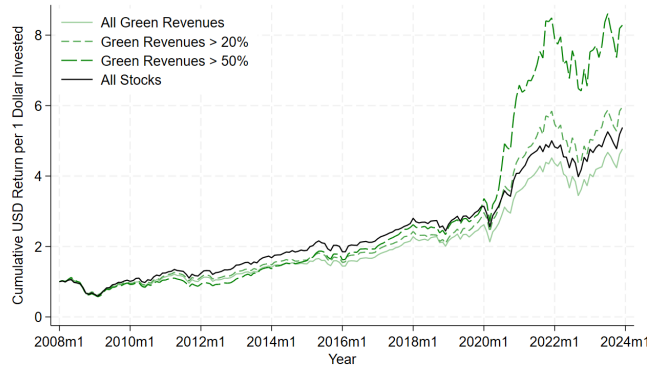
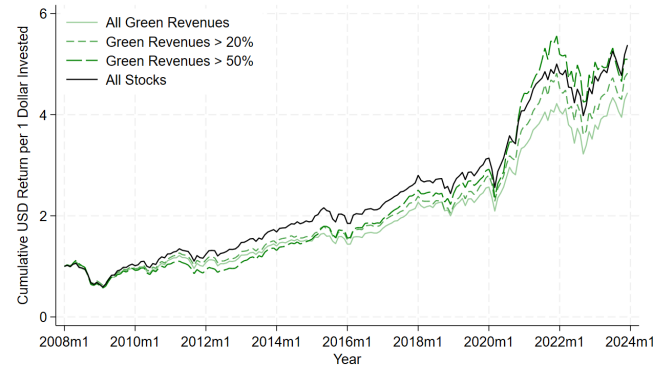


Figure 5. Green Revenues Portfolio Returns

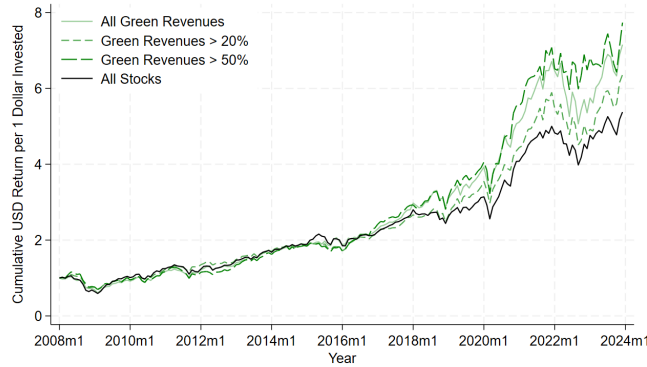
We analyze the stock returns of portfolios sorted by their share of green revenues. We plot the cumulative returns for 1 USD invested in the value-weighted green stocks portfolio (light green) and compare them with portfolios containing stocks with at least 20% (dashed green) and 50% (dashed darker green) green revenues. The black line represents the cumulative returns of a portfolio containing all stocks in our sample, serving as a benchmark. Panel A considers the full global universe. Panel B excludes Tesla from the global universe. In Panel C, we consider only US stocks, excluding Tesla. Panel D focuses on stocks outside the US.



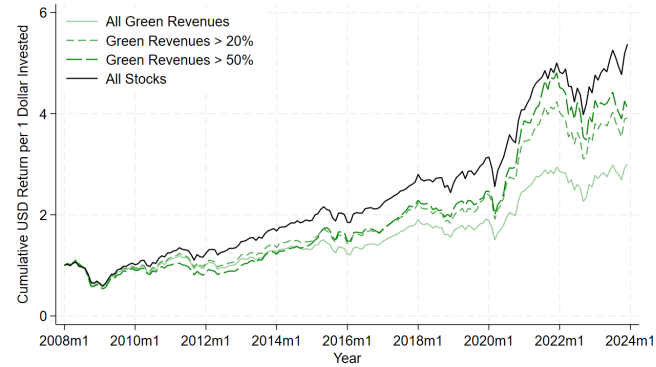
(a) Global



(b) Global excluding Tesla



(c) United States excluding Tesla



(d) Rest of the World

Tables

Table 1. Summary Statistics

This table provides summary statistics for the main variables used in the regression analysis over the sample period 2008 to 2023. Detailed definitions of the variables are provided in Table A-1.4. Continuous ratio variables are winsorized at the 1% and 99% levels.

Variable	N	Mean	SD	Min	Median	Max
<i>Panel A: Green Revenues</i>						
Green Revenues %	267,576	3.367	13.865	0.000	0.000	100.000
Green Revenues Midpoint %	267,576	5.379	16.274	0.000	0.000	100.000
Green Revenues Dummy	267,576	0.137	0.344	0.000	0.000	1.000
Tier 1 Green Revenues %	267,576	2.108	10.402	0.000	0.000	100.000
Tier 2 Green Revenues %	267,576	0.983	7.043	0.000	0.000	100.000
Tier 3 Green Revenues %	267,576	0.236	3.449	0.000	0.000	100.000
EUTSF Green Revenues %	267,576	2.558	11.709	0.000	0.000	100.000
Green Revenues USD	267,576	0.155	1.478	0.000	0.000	102.546
<i>Panel B: Time-Period Indicators</i>						
Post 2016	267,576	0.531	0.499	0.000	1.000	1.000
Post 2018	267,576	0.392	0.488	0.000	0.000	1.000
Post 2020	267,576	0.257	0.437	0.000	0.000	1.000
<i>Panel C: Innovation and Patents</i>						
All Patents	267,576	2.884	15.719	0.000	0.000	128.625
Green Patents	267,576	0.189	1.133	0.000	0.000	9.500
Green Patents / All Patents	267,576	0.008	0.042	0.000	0.000	0.333
Green Patents Dummy	267,576	0.062	0.241	0.000	0.000	1.000
Green Process Patent	267,576	0.111	2.616	0.000	0.000	324.000
Green Product Patent	267,576	0.698	12.623	0.000	0.000	1,228.000
Brown Process Patent	267,576	0.873	15.820	0.000	0.000	1,608.000

Continued on next page

Table 1 – continued from previous page

Variable	N	Mean	SD	Min	Median	Max
Brown Product Patent	267,576	6.438	92.986	0.000	0.000	7,582.000
Green Process Patent Only	267,576	0.002	0.049	0.000	0.000	1.000
<i>Panel D: Firm Characteristics</i>						
Total Assets (USD bn)	267,576	12.466	109.239	0.000	0.825	12,822.253
Total Sales (USD bn)	267,576	3.119	13.460	0.000	0.432	592.460
Market Value (USD bn)	267,576	3.713	21.778	0.100	0.605	2,490.538
Tobin's Q	267,576	1.891	1.760	0.545	1.290	17.019
Leverage	267,576	0.228	0.194	0.000	0.197	0.845
ROA	267,576	0.063	0.096	-0.468	0.060	0.402
Cash	267,576	0.175	0.173	0.000	0.120	0.872
CAPEX	267,576	0.040	0.048	0.000	0.024	0.343
R&D	267,576	0.014	0.038	0.000	0.000	0.283
<i>Panel E: Geographic Indicators</i>						
Europe	267,576	0.167	0.373	0.000	0.000	1.000
North America	267,576	0.213	0.409	0.000	0.000	1.000
Asia-Pacific	267,576	0.535	0.499	0.000	1.000	1.000
Rest of the World	267,576	0.086	0.280	0.000	0.000	1.000
<i>Panel F: Institutional Ownership and Trading</i>						
Pre-Paris IO	202,994	0.226	0.288	0.000	0.098	1.000
Pre-Paris IO CDP	202,994	0.083	0.110	0.000	0.033	0.577
Pre-Paris IO PRI	202,994	0.108	0.143	0.000	0.046	0.758
Pre-Paris IO Climate 100+	202,994	0.083	0.110	0.000	0.033	0.577
Pre-Paris Turnover	209,056	0.274	0.167	0.020	0.209	1.453

Table 2. Correlation of Green Revenues with other Environmental Measures

This table shows pairwise Pearson correlation coefficients for % company green revenues, % tier 1 green revenues, % midpoint estimates, 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) Midpoint %	0.844***	1						
(3) Tier 1 Green Revenues %	0.814***	0.692***	1					
(4) CO2 Int. Scope 1	0.042***	0.068***	0.011***	1				
(5) CO2 Int. Scope 2	0.013***	0.015***	0.003	0.067***	1			
(6) CO2 Int. Scope 3	0.066***	0.118***	0.085***	0.245***	0.067***	1		
(7) E-Score PST	-0.119***	-0.176***	-0.075***	-0.360***	-0.171***	-0.505***	1	
(8) Adj. ESG Score	0.085***	0.102***	0.092***	-0.101***	-0.015*	-0.01	0.272***	1

Table 3. Green Patents and Green Revenues

This table reports difference-in-differences estimates relating pre-Paris green innovation to changes in green revenues after the Paris Agreement. The dependent variables are the share of revenues classified as green by FTSE Russell (Green Revenues %), the midpoint estimate (Midpoint Green Revenues %), and revenues attributable to Tier 1 green activities (Tier 1 Green Revenues %). Green innovation is measured using an indicator equal to one if a firm filed at least one green patent prior to the Paris Agreement (GP Indicator). Post Paris is an indicator equal to one for years after 2015. Standard errors are clustered at the country-year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable	Green Revenues %	Midpoint Green Revenues %	Tier 1 Green Revenues %
Regressions	(1)	(2)	(3)
GP Indicator $\times$ Post Paris	1.558*** (0.107)	2.308*** (0.187)	1.209*** (0.116)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes
Observations	264,658	264,658	264,658
Adjusted R^2	0.856	0.845	0.852

Table 4. Heterogeneity of (Green) Patents

This table examines the relation between corporate green patent innovation and green revenues across different regions and sectors, as well as across various measures of innovation. In Panel A, we focus on heterogeneity across regions and zoom in on the Energy sector. In Panel B, we examine whether firms holding green product patents in the pre-Paris period translate these innovations into green revenues in the post-Paris period. In Panel C, we conduct a horse race between product and process patents, as many firms hold both types and thus overlap. Green innovation is measured by *GP Indicator*, which equals one if a firm had at least one green product or process patent, respectively, between 2008 and 2015. *Post Paris* is a dummy equal to 1 for years ≥ 2016 . The main dependent variable is the point estimate of *Green Revenues %*. In Panel B and C, we also use the midpoint between the minimum and maximum estimates of *Green Revenues %* and *Tier 1 % Green Revenues* (i.e., products and services with clear and significant environmental benefits). All specifications include firm, country $\times$ year, and sector $\times$ year fixed effects. Standard errors clustered at the country-year level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Regions & the Energy Sector

Dep. Variable	Green Revenues %			
Regressions	(1)	(2)	(3)	(4)
GP Indicator $\times$ Post Paris	1.476*** (0.208)	0.0109 (0.312)	1.862*** (0.176)	-1.002** (0.435)
Sample	USA	Europe	Asia-Pacific	Energy
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes	No
Country $\times$ Year FE	No	Yes	Yes	Yes
Observations	47,709	44,171	141,746	7,313
Adjusted R^2	0.911	0.840	0.838	0.673

Panel B: Product vs. Process Patents

Dep. Variable	Green Revenues %	Midpoint %	Tier 1 %
Regressions	(1)	(2)	(3)
GP Process $\times$ Post Paris	-0.999*** (0.181)	-0.316 (0.294)	-1.141*** (0.190)
GP Product $\times$ Post Paris	2.232*** (0.157)	2.534*** (0.224)	1.980*** (0.160)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes
Observations	264,658	264,658	264,658
Adjusted R^2	0.856	0.845	0.852

Table 4. Heterogeneity of (Green) Patents (continued)

Panel C: Placebo Test using All Patents

Dep. Variable	Green Revenues %	Midpoint Green Revenues %	Tier 1 Green Revenues %
Regressions	(1)	(2)	(3)
GP Indicator $\times$ Post Paris	2.052*** (0.128)	2.558*** (0.198)	1.702*** (0.134)
Any Patent Indicator $\times$ Post Paris	-0.601*** (0.0963)	-0.304*** (0.117)	-0.598*** (0.0659)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes
Observations	264,658	264,658	264,658
Adjusted R^2	0.856	0.845	0.852

Table 5. Green Revenues and CARs around the Paris Agreement

This table presents event study results examining cumulative abnormal returns (CARs) around the announcement of the Paris Agreement on December 12, 2015. For each firm, we calculate cumulative abnormal returns over 1-, 3-, 5-, and 10-day windows around the event. Each panel compares firms whose green revenues exceed the indicated threshold (0%, 20%, 50%, or 80%) with firms reporting no green revenues. “Low-green CAR” and “High-green CAR” denote the average cumulative abnormal returns for the respective portfolios. “High minus low” reports the difference in cumulative abnormal returns between the two portfolios, estimated using OLS regressions. Robust standard errors are reported in parentheses. Cumulative abnormal returns are expressed in percentage points. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Event window	[-1, +1]	[-3, +3]	[-5, +5]	[-10, +10]
Green revenue share > 0%				
Non-green CAR	-1.87*** (0.10)	-1.80*** (0.15)	-4.04*** (0.21)	-2.74*** (0.25)
High-green CAR	-1.61*** (0.23)	-1.47*** (0.36)	-3.90*** (0.51)	-1.10* (0.63)
High minus low	0.26 (0.25)	0.33 (0.39)	0.14 (0.56)	1.64** (0.68)
Green revenue share > 20%				
High-green CAR	-0.72* (0.44)	0.45 (0.75)	-1.02 (1.08)	1.87 (1.24)
High minus low	1.15** (0.45)	2.25*** (0.76)	3.02*** (1.10)	4.61*** (1.27)
Green revenue share > 50%				
High-green CAR	-0.08 (0.81)	2.46* (1.41)	1.73 (2.01)	4.03* (2.12)
High minus low	1.79** (0.82)	4.26*** (1.42)	5.77*** (2.02)	6.77*** (2.13)
Green revenue share > 80%				
High-green CAR	0.75 (1.04)	4.13** (1.78)	4.30* (2.53)	6.01** (2.71)
High minus low	2.63** (1.04)	5.93*** (1.79)	8.34*** (2.54)	8.75*** (2.72)

Table 6. Green Revenues, Green Patents, and CARs around the Paris Agreement

This table presents event study results examining cumulative abnormal returns (CARs) around the announcement of the Paris Agreement on December 12, 2015. For each firm, we calculate cumulative abnormal returns over 1-, 3-, 5-, and 10-day windows around the event. Each panel compares firms whose green revenues exceed the indicated threshold and that have at least one green patent during the 2008–2015 period with firms reporting no green revenues. “Low-green CAR” denotes the average cumulative abnormal return for firms without green revenues. “High-green CAR” denotes the average cumulative abnormal return for firms that exceed the indicated green-revenue threshold and have at least one green patent. “High minus low” reports the difference in cumulative abnormal returns between the two groups, estimated using OLS regressions. Robust standard errors are reported in parentheses. Cumulative abnormal returns are expressed in percentage points. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Event window	$[-1, +1]$	$[-3, +3]$	$[-5, +5]$	$[-10, +10]$
Green revenue share > 0% and green patent				
Non-green CAR	-1.87*** (0.10)	-1.80*** (0.15)	-4.04*** (0.21)	-2.74*** (0.25)
High-green + patent CAR	-1.61*** (0.29)	-1.91*** (0.54)	-4.41*** (0.69)	-1.77** (0.75)
High minus low	0.26 (0.31)	-0.10 (0.56)	-0.37 (0.72)	0.97 (0.79)
Green revenue share > 20% and green patent				
High-green + patent CAR	-0.63 (0.58)	0.57 (1.20)	-1.82 (1.57)	1.26 (1.61)
High minus low	1.25** (0.59)	2.37** (1.21)	2.22 (1.58)	4.00** (1.63)
Green revenue share > 50% and green patent				
High-green + patent CAR	-0.32 (1.12)	2.95 (2.34)	1.44 (3.04)	5.10* (3.01)
High minus low	1.56 (1.12)	4.76** (2.35)	5.48* (3.05)	7.84*** (3.02)
Green revenue share > 80% and green patent				
High-green + patent CAR	0.84 (1.56)	5.76* (3.23)	5.75 (4.11)	7.70* (4.25)
High minus low	2.71* (1.57)	7.56** (3.24)	9.79** (4.11)	10.44** (4.26)

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 long-short 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 I.A.13, 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 2023. In Panel B, revenues are classified based on the green revenue midpoint estimates. In Panel C, we apply a stricter definition of green revenues based on the GRCS tiering system, considering only Tier 1 green revenues. 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: Green Minus Legacy (GML)				
Portfolio	> 0%	> 20%	> 50%	> 80%
Alpha	-0.199** (0.0941)	-0.0219 (0.120)	0.135 (0.191)	0.595* (0.302)
Pre Paris	-0.409*** (0.129)	-0.292* (0.151)	-0.286 (0.192)	-0.0426 (0.283)
Post Paris	0.00602 (0.120)	0.242 (0.169)	0.546* (0.297)	1.218*** (0.463)
2008: Nr firms	1,462	493	221	129
Total USD trln	\$7.79	\$2.00	\$0.70	\$0.25
2023: Nr firms	2,687	985	496	290
Total USD trln	\$32.60	\$10.60	\$4.27	\$2.41
Panel B: Midpoint Green Minus Legacy (GML)				
Portfolio	> 0%	> 20%	> 50%	> 80%
Alpha	-0.191** (0.0928)	-0.165 (0.107)	0.289 (0.200)	0.679* (0.349)
Pre Paris	-0.382*** (0.125)	-0.394*** (0.146)	-0.148 (0.246)	0.125 (0.328)
Post Paris	-0.00333 (0.120)	0.0583 (0.142)	0.715** (0.299)	1.219** (0.550)
Panel C: Tier 1 Green Minus Legacy (GML)				
Portfolio	> 0%	> 20%	> 50%	> 80%
Alpha	-0.266** (0.103)	0.0844 (0.182)	0.446 (0.277)	1.082** (0.482)
Pre Paris	-0.503*** (0.142)	-0.279 (0.199)	-0.0204 (0.259)	0.202 (0.457)
Post Paris	-0.0355 (0.133)	0.439 (0.275)	0.901** (0.445)	1.942*** (0.743)

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). For more details on the specifications, refer to Tables I.A.13 and 7. By *, **, and *** we denote p -levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Variable	Green Revenue Threshold			
Regression	(1)	(2)	(3)	(4)
Portfolio	$> 0\%$	$> 20\%$	$> 50\%$	$> 80\%$
Sample	Panel A: United States			
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)	-	-

Table 9. GML Double-Sorted Portfolios: Sub-Sample Tests

This table reports the *Alpha* of the long-short green revenues minus legacy (GML) portfolio from double-sorted portfolios. Firms are first sorted based on whether they have a positive pre-Paris green patent indicator (GP Indicator) for the respective sub-sample and are then sorted according to minimum green revenue thresholds (0%, 20%, 50%, and 80%), as in Table 7. We report results for the different GP Indicator sub-samples. By *, **, and *** we denote *p*-levels below 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

Variable	Firms with Pre-Paris GP Indicator = 1			
	Green Revenue Threshold			
Portfolio	> 0%	> 20%	> 50%	> 80%
Panel A: Global				
Pre Paris	-0.428** (0.193)	-0.319 (0.219)	-0.195 (0.335)	0.0917 (0.542)
Post Paris	0.0986 (0.190)	0.399 (0.254)	1.026** (0.518)	2.177*** (0.797)
Panel B: United States				
Pre Paris	-0.311* (0.179)	-0.288 (0.204)	-0.180 (0.381)	0.221 (0.493)
Post Paris	0.181 (0.212)	0.477* (0.284)	1.596** (0.659)	2.014** (0.796)
Panel C: Europe				
Pre Paris	-0.491** (0.217)	-0.336 (0.232)	-0.230 (0.403)	0.118 (0.579)
Post Paris	-0.208 (0.153)	0.0447 (0.258)	0.403 (0.290)	0.302 (0.477)
Panel D: Asia-Pacific				
Pre Paris	-0.721** (0.335)	-0.443 (0.436)	-0.501 (0.458)	-2.270** (1.063)
Post Paris	-0.138 (0.338)	0.253 (0.522)	-0.000831 (0.647)	0.729 (0.739)
Panel E: Energy				
Pre Paris	-0.222 (0.351)	0.187 (0.640)	- -	- -
Post Paris	-0.494 (0.308)	0.557 (0.915)	- -	- -

Appendix 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.

EG - ENERGY GENERATION	EQ - ENERGY EQUIPMENT	EM - ENERGY MANAGEMENT	ER - ENVIRONMENTAL RESOURCES	ES - ENVIRONMENTAL SUPPORT
<i>Revenue generating activities from the generation of power from renewable and alternative energy sources.</i>	<i>Revenue generating activities from the renewable and alternative energy value chain, excluding power generation activities.</i>	<i>Revenue generating activities from products and services enabling more efficient methods of energy usage and management.</i>	<i>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</i>	<i>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</i>
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)
Cogeneration (Tier 1/2)	Cogeneration Equipment (Tier 1/2)	Controls (Tier 2)	Key Raw Minerals & Metals (Tier 3)	Finance & Investment (Tier 2)
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)
Geothermal (Tier 1)	Fuel Cells (Tier 2)	IT Processes (Tier1/2)		
Hydro (Tier 1/2)	Geothermal (Tier 1)	Lighting (Tier 1)		
Nuclear (Tier 3)	Hydro (Tier 1/2)	Power Storage (Tier 1)		
Ocean & Tidal (Tier 1)	Nuclear (Tier 3)	Smart & Efficient Grids (Tier 1)		
Solar (Tier 1)	Ocean & Tidal (Tier 1)	Sustainable Property Operator (Tier 2)		
Waste to Energy (Tier 1)	Solar (Tier 1)	Energy Management Logistics & Support (Tier 2)		
Wind (Tier 1)	Waste to Energy (Tier 1)			
	Wind (Tier 1)			
FA - FOOD & AGRICULTURE	TE - TRANSPORTATION EQUIPMENT	TS - TRANSPORTATION SOLUTIONS	WP - WASTE & POLLUTION CONTROL	WI - WATER INFRASTRUCTURE
<i>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</i>	<i>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</i>	<i>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</i>	<i>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 waste management, reuse and recycling</i>	<i>Revenue generating activities from technologies, infrastructure, products and services for the supply, management and treatment of water</i>
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 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)
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)

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 Firms in 2008	2008 Green Revenues (in US\$ trlns)	2008 Green Revenues (in %)	Nr of Firms in 2022	2022 Green Revenues (in US\$ trlns)	2022 Green Revenues (in %)	TOP 1 - 5 by country COMPANY NAME Green Revenues (in US\$ bln) % of Green Revenues (of which % in top FTSE GRCS sector & micro-sector)				
Europe	France	313	\$ 0.280	10.0	283	\$ 0.291	12.2	ELECTRICITE DE FRANCE \$ 97 bln 64% (52% in EG - Nuclear)	VEOLIA ENVIRONNEMENT \$ 42 bln 93% (33 % in WI - Water Utilities)	SCHNEIDER ELECTRIC \$ 26 bln 72% (23% in EM - Industrial Processes)	ENGIE \$ 19 bln 19% (3% in EG - Solar)	ALSTOM \$ 14 bln 85% (85% in TE - Trains Electric)
	Germany	289	\$ 0.150	5.1	285	\$ 0.274	9.8	MERCEDES-BENZ \$ 30 bln 19% (15% in TE - Electrified Road Vehicles & Devices)	UNIPER \$ 29 bln 10% (5% in EM - Power Storage)	E.ON \$ 28 bln 23% (22% in EM - Energy Management Logistics)	EnBW \$ 20 bln 35% (7% in EG - Wind)	BASF \$ 20 bln 22% (7% in ER - Recyclable Materials)
	U.K.	655	\$ 0.112	4.8	596	\$ 0.150	6.8	SHELL \$ 34 bln 9% (7% in TE - Electrified Road Vehicles & Devices)	JOHNSON MATTHEY \$ 21 bln 94% (76% in ER - Platinum)	BP \$ 9 bln 4% (4% in TE - Electrified Road Vehicles & Devices)	ANGLO AMERICAN \$ 9 bln 26% (26% in ER - Platinum)	BARRATT \$ 6 bln 97% (97% in EM - Buildings & Property (Integrated))
North America	U.S.	2,848	\$ 0.303	2.4	2,515	\$ 1.034	5.2	AMAZON \$ 104 bln 20% (15% in EM - Cloud Computing)	TESLA \$ 81 bln 100% (93% in TE - Electrified Road Vehicles & Devices)	MICROSOFT \$ 57 bln 29% (29 % in EM - Cloud Computing)	BERKSHIRE HATHAWAY \$ 28 bln 10% (7% in TS - Railways Operator)	FORD MOTOR \$ 21 bln 13% (13 % in TE - Electrified Road Vehicles & Devices)
	Canada	450	\$ 0.026	2.3	457	\$ 0.073	4.7	CN RAILWAY \$ 12 bln 91 % (91 % in TS - General Railways)	WEST FRASER TIMBER \$ 9 bln 92% (92% in FA - Sustainable Forestry)	CANADIAN SOLAR \$ 7 bln 100% (83% in EQ - Solar)	WASTE CONNECTIONS \$ 7 bln 100% (50% in WP - Waste Management & Recycling)	CANFOR \$ 5 bln 85% (85% in FA - Sustainable Forestry)
Asia Pacific	China	1,409	\$ 0.047	2.7	3,383	\$ 0.648	6.2	CHINA RAILWAY \$ 60 bln 35% (35% in TE - Railway)	CHINA RAILWAY CONSTRUCTION \$ 34 bln 21% (20% in TE - Railway)	POWER CHINA \$ 25 bln 30% (8% in EQ - Hydro)	BYD \$ 24 bln 38% (14% in TE - Electrified Road Vehicles & Devices)	ENERGY CHINA \$ 23 bln 43% (5% in EQ - Solar)
	Japan	1,808	\$ 0.370	5.7	1,956	\$ 0.526	8.4	TOYOTA MOTOR \$ 71 bln 30% (30% in TE - Electrified Road Vehicles & Devices)	ENEOS \$ 25 bln 30% (20% in EG - Solar)	BRIDGESTONE \$ 24 bln 76% (75% in TE - Energy Use Reduction Devices)	DAIKIN \$ 21 bln 91% (91% in EM - Buildings & Property)	TEL \$ 14 bln 94% (94% in EM - Industrial Processes)
	South Korea	345	\$ 0.049	3.4	892	\$ 0.123	4.9	KIA \$ 17 bln 25% (25% in TE - Electrified Road Vehicles & Devices)	HYUNDAI MOTOR \$ 12 bln 11% (11% in TE - Electrified Road Vehicles & Devices)	SK HYNIX \$ 10 bln 28% (28% in EM - Efficient IT)	HANWHA \$ 7 bln 15% (7% in EQ - Solar)	SK INNOVATION \$ 8 bln 10% (5% in EM - Power Storage)
Rest of the World	Brazil	169	\$ 0.047	6.4	138	\$ 0.052	6.2	MARFRIG \$ 15 bln 58% (58% in FA - Meat & Dairy Alternatives)	GERDAU \$ 14 bln 83% (85% in ER - Recyclable Materials)	SABESP \$ 4 bln 88% (66% in WI - Water Utilities)	ELETROBRAS \$ 4 bln 56% (53% in EG - Hydro)	METALURGICA GERDAU \$ 3 bln 20% (20% in WP - Recycling Services)
	Chile	165	\$ 0.011	6.8	160	\$ 0.020	9.2	SQM \$ 4 bln 41% (33% in ER - Lithium)	EMPRESAS COPEC \$ 4 bln 12% (12% in EA - Sustainable Forestry)	ENEL AMERICAS \$ 3 bln 17% (10% in EG - Hydro)	ENEL CHILE \$ 2 bln 48% (36% in EG - Hydro)	CMPC \$ 2 bln 25% (15% in ER - Recyclable & Reusable Products)

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.

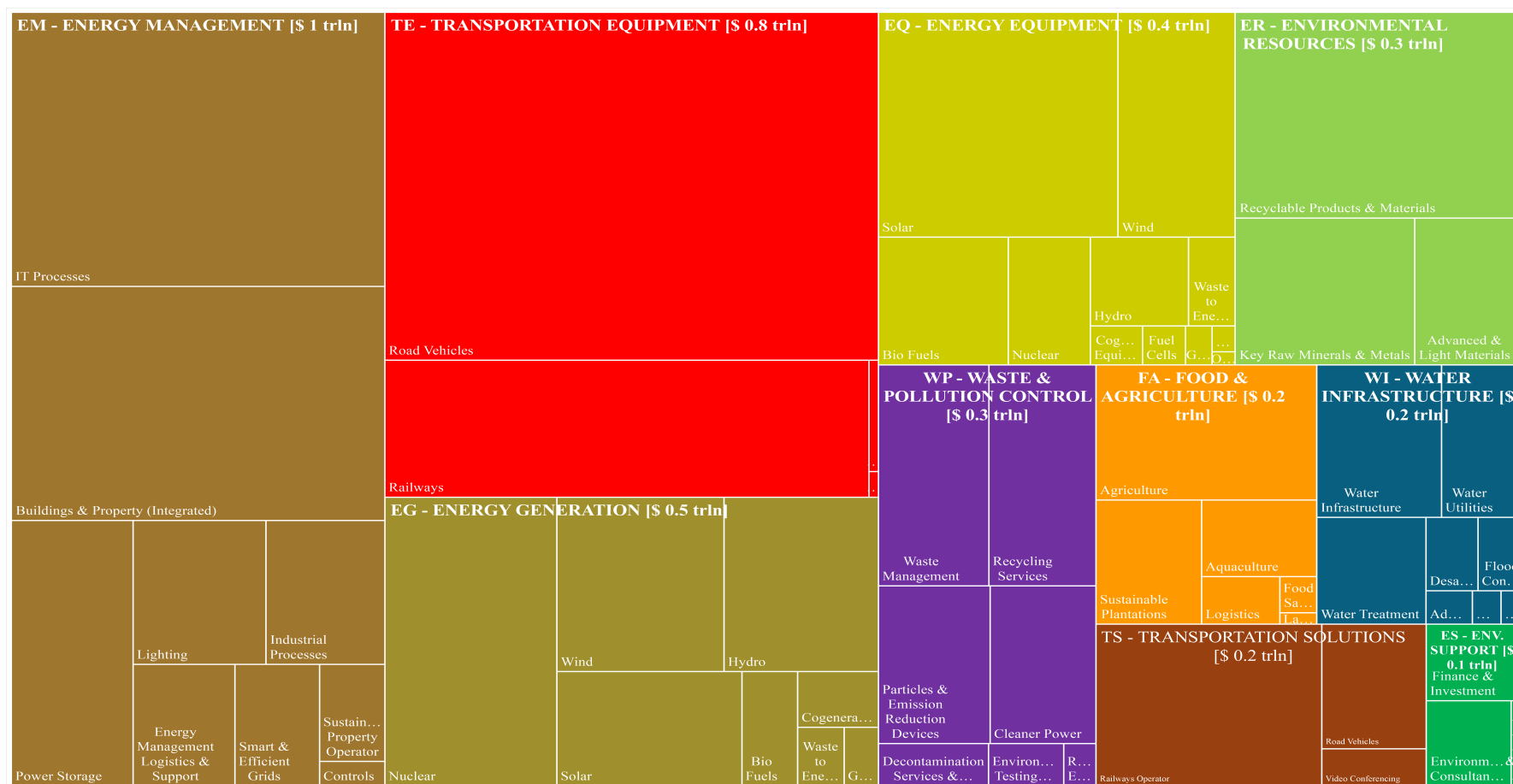


Figure A-1.2. Decomposition of Green Revenues by Tiers of “Greenness” of GRCS Business Activities

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 net-positive 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.

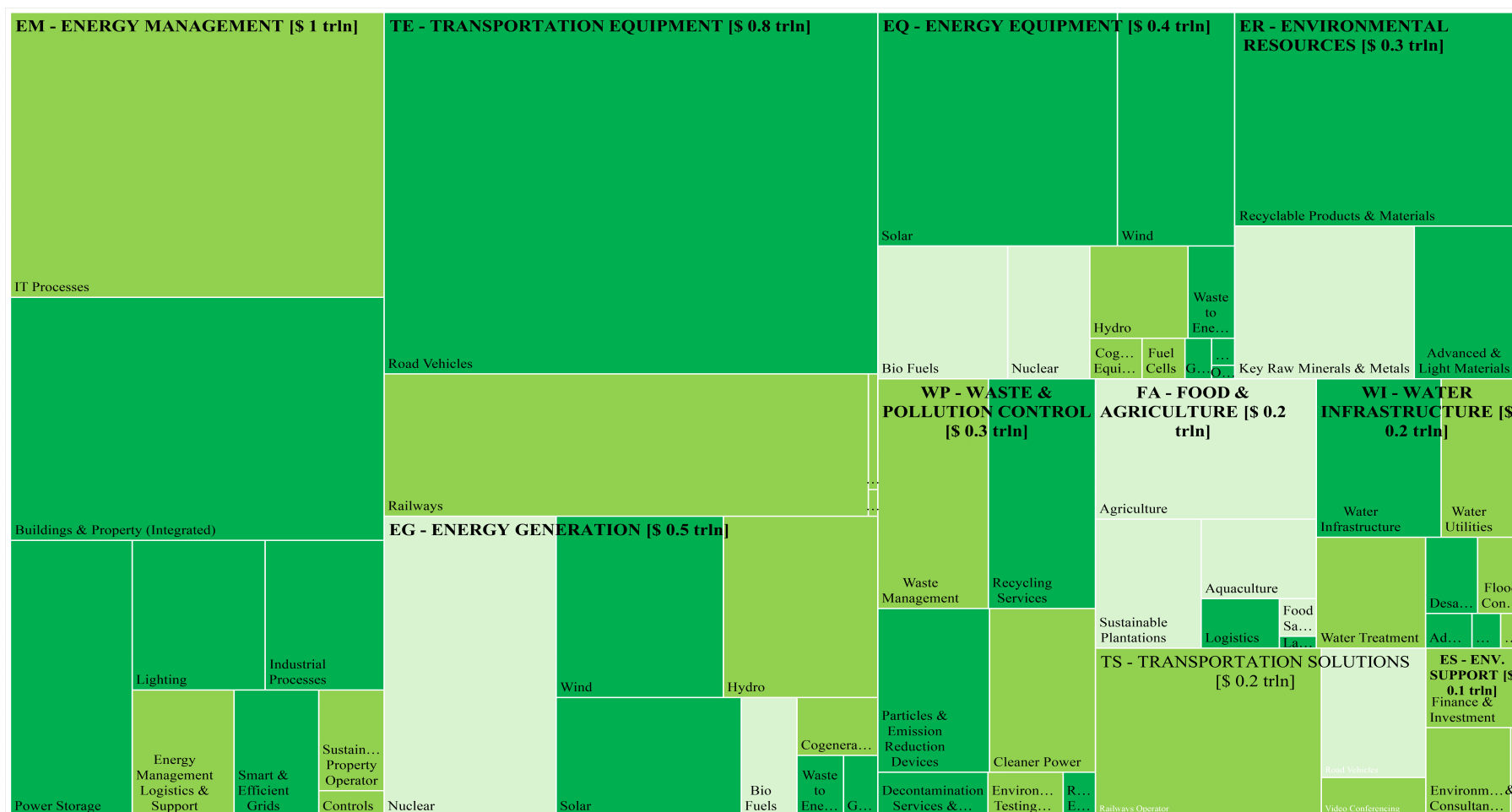


Table A-1.3. Top Green Patents Firms by Region

This table presents the leading firms in terms of green patent activity for selected countries. Green patents are identified using the CPC green technology classification and are measured using granted patents before the Paris Agreement from 2008 to 2015. For each country, firms are ranked according to their total number of green patents. The table highlights the firms that account for a large share of green innovation within their respective countries.

Region	Country	Company	# GP	% GP
Europe	France	SNECMA SA	487	41.95
		ALSTOM SA	455	38.40
		AIR LIQUIDE SA	274	38.11
		COMPAGNIE DE SAINT GOBAIN SA	166	11.61
		RENAULT SA	146	38.22
	Germany	SIEMENS AG	1261	13.19
		BASF SE	866	19.64
		MERCEDES BENZ GROUP AG	757	58.01
		BAYERISCHE MOTOREN WERKE AG	609	51.83
		CONTINENTAL AG	515	40.91
North America	Unites States	GENERAL MOTORS CO	3911	39.31
		GENERAL ELECTRIC CO	3423	28.27
		FORD MOTOR CO	2211	43.81
		IBM CORP	1662	3.32
		INTEL CORP	1300	9.78
	Canada	BLACKBERRY LTD	441	6.86
		MOSAID TECHNOLOGIES INC	55	9.96
		ATI TECHNOLOGIES ULC	47	8.39
		BALLARD POWER SYSTEMS INC	32	100.00
		NOVA CHEMICALS CORP	31	24.03
Asia Pacific	Japan	TOYOTA MOTOR CORP	5484	43.77
		HONDA MOTOR CO LTD	2125	23.85
		PANASONIC HOLDINGS CORP	2100	10.05
		DENSO CORP	1669	21.99
		HITACHI LTD	1589	9.85
	Korea	SAMSUNG SDI CO LTD	2635	69.45
		SAMSUNG ELECTRONICS CO LTD	1925	4.23
		HYUNDAI MOTOR CO LTD	1316	31.21
		KIA CORP	723	33.33
		SAMSUNG ELECTRO MECHANICS CO LT	249	8.72

Table A-1.4. Variable Definitions and Data Sources

Variable	Definition
<i>Green Revenues %</i>	Percentage of green revenues relative to total annual company revenues, with missing values filled in as zeros (source: FTSE Russell GRCS). The data identifies products and services that positively impact climate change mitigation and adaptation, water management, resource use, pollution reduction, and agricultural efficiency.
<i>Tier 1 Green Revenues %</i>	Percentage of green revenues relative to total annual company revenues according to the tiering definition of the FTSE Russell classification system ¹⁸ , with missing values filled in as zeros (source: FTSE Russell GRCS). Tier 1 covers business activities with significant and clear environmental benefits.
<i>Tier 2 Green Revenues %</i>	Tier 2 covers business activities with more limited but net positive environmental benefits.
<i>Tier 3 Green Revenues %</i>	Tier 3 covers business activities which have some environmental benefits but are overall net neutral or negative (e.g. nuclear).
<i>EUTSF Green Revenues %</i>	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. ¹⁹ Missing values are filled in as zeros (source: FTSE Russell GRCS).

¹⁸LSEG FTSE Russell (2024) “Green Revenues Data Model - Methodology”.

¹⁹LSEG FTSE Russell (2020) “Sizing the Green Economy - Green Revenues and the EU taxonomy”.

Table A-1.4 (continued): Variable Definitions

Variable	Definition
<i>Midpoint Green Revenues %</i>	Share of green revenues, defined as the midpoint between the most optimistic and most conservative estimates of a firm's green revenue share provided by FTSE Russell.
<i>Post Paris</i>	Dummy = 1 if the year ≥ 2016 , which captures the period after the Paris Agreement.
<i>Post TEG</i>	Dummy = 1 if the year ≥ 2018 , which captures the creation of the Technical Expert Group commissioned to create a taxonomy for green investing (TEG).
<i>Post EUTSF</i>	Dummy = 1 if the year ≥ 2020 , which captures the roll out of the EU Taxonomy on Sustainable Finance (EUTSF).
<i>Europe</i>	Dummy = 1 if the company is headquartered in Europe (source: FactSet).
<i>North America</i>	Dummy = 1 if the company is headquartered in North America (source: FactSet).
<i>Asia Pacific</i>	Dummy = 1 if the company is headquartered in the Asia-Pacific region (source: FactSet).
<i>Rest of World</i>	Dummy = 1 if the company is headquartered in another region (source: FactSet).
<i>GP Ratio</i>	Average annual ratio of green patents to total patents between 2008 and 2015. Patent data is from the Global Corporate Patent Dataset ²⁰ and green patents are classified using the OECD Environmental-related technology mapping developed by Hascic and Migotto (2015) and updated in 2020 ²¹ .
<i>GP Indicator</i>	Dummy = 1 if the company had at least one green patent between 2008 and 2015.

²⁰UVA Darden Global Corporate Patent Dataset.

²¹OECD Green Patents Classification.

Table A-1.4 (continued): Variable Definitions

Variable	Definition
<i>IO Pre-Paris</i>	Holdings by institutional investors as a fraction of market capitalization at the end of 2015 (source: FactSet Ownership).
<i>IO PRI Pre Paris</i>	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)).
<i>IO CDP Pre Paris</i>	Holdings by institutional investors that are participants of the Carbon Disclosure Project (CDP) as a fraction of market capitalization at the end of 2015 (sources: FactSet Ownership and CDP).
<i>Turnover Pre Paris</i>	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).
<i>Total Assets</i>	Total assets in millions of US dollars (FactSet item <i>FF_ASSETS</i>).
<i>Total Sales</i>	Total sales in millions of US dollars (FactSet item <i>FF_SALES</i>).
<i>Domestic Sales</i>	Percentage revenue 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 <i>FF_FOR_SALES_PCT</i>).
<i>Market Value</i>	Market capitalization in millions of U.S. dollars (FactSet item <i>FF_MKT_VAL</i>).
<i>Tobin's Q</i>	Total assets (FactSet item <i>FF_ASSETS</i>) plus market value of equity (FactSet item <i>FF_MKT_VAL</i>) minus book value of equity (FactSet item <i>FF_COM_EQ</i>) divided by total assets.

Table A-1.4 (continued): Variable Definitions

Variable	Definition
<i>Leverage</i>	Total debt (FactSet item <i>FF_DEBT</i>) divided by total assets (FactSet item <i>FF_ASSETS</i>).
<i>ROA</i>	Operating income (FactSet item <i>FF_OPER_INC</i>) plus interest expenses (FactSet item <i>FF_INT_EXP_DEBT</i>) divided by total assets (FactSet item <i>FF_ASSETS</i>).
<i>Cash</i>	Cash and short-term investments (FactSet item <i>FF_CASH_ST</i>) divided by total assets (FactSet item <i>FF_ASSETS</i>).
<i>Capex</i>	Capital expenditures (FactSet item <i>FF_CAPEX_FIX</i>) divided by total assets (FactSet item <i>FF_ASSETS</i>).
<i>R&D</i>	Research and development expenditures (FactSet item <i>FF_RD_EXP</i>) divided by total assets (FactSet item <i>FF_ASSETS</i>).
<i>Returns</i>	Monthly gross returns are calculated using stock prices from Factset (item <i>ADJ_PRICE</i>). This variable is right-winsorized at the 99.95% level.
<i>Market - R_f</i>	Value-weighted returns of all firms in our sample using prices from Factset (item <i>ADJ_PRICE</i>) minus the one-month Treasury bill rate from Kenneth French's website.
<i>Size</i>	Global size factor from Jensen et al. (2023) (source: https://jkpfactors.com/) and regional factors from Kenneth French's website.
<i>Value</i>	Global value factor from Jensen et al. (2023) (source: https://jkpfactors.com/) and regional factors from Kenneth French's website.

Table A-1.4 (continued): Variable Definitions

Variable	Definition
<i>Momentum</i>	Global momentum factor from Jensen et al. (2023) (source: https://jkpfactors.com/) and regional factors from Kenneth French's website.
<i>Profitability</i>	Global profitability factor from Jensen et al. (2023) (source: https://jkpfactors.com/) and regional factors from Kenneth French's website.
<i>Investment</i>	Global investment factor from Jensen et al. (2023) (source: https://jkpfactors.com/) and regional factors from Kenneth French's website.
<i>GMB</i>	Global green-minus-brown factor provided by the authors of the study Karolyi et al. (2023).
<i>Earnings surprises</i>	The difference between 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.
<i>MCCC</i>	Media Climate Change Concerns Index provided by the authors of Ardia et al. (2023).
<i>EPI</i>	The Environmental Performance Index (EPI) provides a country-year summary of the state of sustainability around the world using 58 performance indicators.
<i>IVS</i>	IVS E-Norms is a survey-based index of the environmental awareness in a country-year.

Appendix 2

Validating the Paris Agreement Regime Shift

This appendix provides additional evidence on the economic forces underlying our interpretation of the Paris Agreement as a regime shift that increased the value of commercializing green products and services. We organize the analysis around complementary shifts in supply and demand. On the supply side, heightened expectations of future environmental regulation can increase firms' incentives to develop and commercialize green products. On the demand side, Paris can increase both consumer demand for green products and capital-market demand for firms positioned to supply them, particularly among environmentally oriented institutional investors. We examine each of these three channels. Because green revenues reflect equilibrium outcomes, these tests are not intended to separately identify supply and demand or quantify the causal contribution of each channel. Rather, they provide evidence on whether the post-Paris increase in green revenues is systematically stronger where each underlying force is expected to be more pronounced.

A2.1 Regulatory supply incentives: the EU-level rollout of a green taxonomy policy

We first examine the multi-stage policy process leading to the EU Taxonomy for Sustainable Activities (EUTSF). The EUTSF was the first large-scale framework to establish common criteria for environmentally sustainable economic activities and made the post-Paris regulatory shift especially visible in Europe. An activity is considered environmentally sustainable when it contributes substantially to at least one of six EU environmental objectives without significantly harming the others. The objectives cover climate-change mitigation, climate-change adaptation, water and marine resources, the circular economy, pollution prevention and control, and biodiversity and ecosystems.

We use three milestones through which the prospective regulation became progressively more concrete. In 2016, following Paris, the European Commission initiated the

process of forming an expert group to develop a sustainable-finance taxonomy. In 2018, the Technical Expert Group on Sustainable Finance (TEG) began its work. In 2020, the EUTSF was formally enacted. This staggered roll-out allows us to test whether firms began adjusting in anticipation of its formal implementation.

For each milestone m , we estimate:

$$GR_{i,t} = \beta_m (\text{Europe}_i \times \text{PostMilestone}_{m,t}) + \gamma X_{i,t} + \mu_s + \lambda_c + \tau_t + \varepsilon_{i,t}, \quad (4)$$

where Europe_i identifies firms headquartered in Europe and $\text{PostMilestone}_{m,t}$ equals one after the relevant policy milestone. The regressions include firm controls and sector, country, and year fixed effects. In the joint specification, we include the interactions for the Paris, TEG, and EUTSF milestones simultaneously. Standard errors are clustered by country-year.

Table A-2.1 presents the results. In Panel A, European firms' baseline green-revenue shares rise by 0.983 percentage points relative to firms outside Europe after Paris, by 1.063 percentage points after the creation of the TEG, and by 1.042 percentage points after formal enactment of the EUTSF when the milestones are entered separately. All three estimates are statistically significant at the 1 percent level. When the three milestones are included jointly, the interaction coefficients are 0.477, 0.459, and 0.355 percentage points, respectively; the first two are significant at the 1 percent level and the final coefficient at the 10 percent level. The pattern indicates that the relative expansion of European green revenues began before formal implementation and strengthened as the taxonomy process advanced, consistent with anticipatory responses to increasingly concrete regulatory signals.

Panels B and C show that the result is not specific to the baseline FTSE Russell point estimate. Using midpoint green revenues, the separate post-Paris, post-TEG, and post-EUTSF interactions are 1.106, 1.134, and 1.052 percentage points, respectively, and are all significant at the 1 percent level. Using the more restrictive Tier 1 green revenues, the corresponding estimates are 0.674, 0.730, and 0.755 percentage points. In the joint Tier 1 specification, all three milestone interactions remain positive and significant. The

results are also robust to excluding non-EU European countries and, as reported in the Internet Appendix, to measuring green activity in dollar revenues and to propensity-score matching. These findings support a regulatory supply channel: firms exposed to the clearest post-Paris regulatory progression expanded environmentally beneficial commercial activity more rapidly. They do not, however, isolate regulation from other contemporaneous differences between Europe and the rest of the world.

Table A-2.1. European 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 ≥ 2016 . *Post TEG* is equal to 1 if the year ≥ 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 ≥ 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 green revenue midpoint estimates as the dependent variable. Panel C shows results for the GRCS Tier 1 green revenues as the dependent variable. 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: Green Revenues %

Regressions	(1)	(2)	(3)	(4)
Green Revenues %				
Europe $\times$ Post Paris	0.983*** (0.128)			0.477*** (0.138)
Europe $\times$ Post TEG		1.063*** (0.141)		0.459*** (0.154)
Europe $\times$ Post EUTSF			1.042*** (0.184)	0.355* (0.201)
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	0.072	0.072	0.072	0.072

Panel B: Midpoint Green Revenues %

Regressions	(1)	(2)	(3)	(4)
Green Revenues Midpoint				
Europe $\times$ Post Paris	1.106*** (0.131)			0.643*** (0.130)
Europe $\times$ Post TEG		1.134*** (0.148)		0.470*** (0.141)
Europe $\times$ Post EUTSF			1.052*** (0.198)	0.249 (0.211)
Sample	Full	Full	Full	Full
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Observations	267,576	267,576	267,576	267,576
Adjusted R^2	0.117	0.117	0.117	0.117

Panel C: Tier 1 Green Revenues %

Regressions	(1)	(2)	(3)	(4)
Tier 1 Green Revenues %				
Europe $\times$ Post Paris	0.674*** (0.0763)			0.326*** (0.0922)
Europe $\times$ Post TEG		0.730*** (0.0855)		0.262*** (0.0979)
Europe $\times$ Post EUTSF			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^2	0.044	0.044	0.044	0.044

A2.2 Cross-country environmental policy and consumer demand

We next use time-varying country characteristics to examine whether the post-Paris increase in green revenues is stronger where environmental policy and consumer demand are more supportive. Distinguishing supply from demand is inherently difficult because we observe equilibrium revenues rather than separate prices and quantities. We therefore interpret these tests as evidence about where the post-Paris expansion is concentrated, not as a structural decomposition.

We proxy for the policy environment using Yale’s Environmental Performance Index (EPI). The EPI summarizes countries’ environmental outcomes, regulatory frameworks, institutional capacity, enforcement, and policy performance. It therefore captures the constraints and incentives firms face to supply environmentally beneficial products and services. We proxy for consumer environmental preferences using the environmental awareness measure from the Integrated Values Survey (IVS), which aggregates individual attitudes and norms concerning environmental stewardship. Because IVS is measured in the firm’s headquarters country, it should be most relevant when a larger share of the firm’s sales is generated domestically.

Table A-2.2 reports regressions spanning 2008–2020 including firm-level controls, sector, country, and year fixed effects. Columns (1) and (2) examine the policy channel. Green-revenue shares are higher when the EPI is higher, and the positive association strengthens after Paris: the coefficient on $\text{EPI} \times \text{PostParis}$ is 0.0186 and is significant at the 1 percent level. Because the regressions include country fixed effects, this result is identified from changes in countries’ policy environments over time. It complements the European taxonomy evidence by showing that the post-Paris expansion is larger where environmental policy and institutional capacity strengthen.

Columns (3)–(5) examine consumer demand. IVS alone is not significantly associated with green-revenue shares in column (3). This null average relation is unsurprising if headquarters-country preferences are a noisy measure of the demand faced by firms that sell globally. Consistent with this interpretation, column (4) shows that the interaction between IVS and the domestic-sales share is positive and statistically significant: con-

sumer environmental preferences are more strongly associated with green revenues when firms depend more heavily on their home market. Column (5) adds the full set of interactions with the post-Paris indicator. The coefficient on $IVS \times DomesticSales \times PostParis$ is 0.0777 and significant at the 1 percent level. Thus, after Paris, the incremental association between local environmental preferences and green revenues becomes more positive as firms' domestic exposure rises. We do not interpret the coefficients on the lower-order IVS terms in isolation, because in the interacted specification their economic meaning depends on both domestic exposure and the post-Paris period.

Together, the EPI and IVS results point to two complementary forces. Green revenues expand more where public policy provides stronger incentives to supply green products, and consumer environmental preferences matter more when firms are more exposed to those consumers. The evidence is therefore inconsistent with a purely supply-driven or purely demand-driven account of the post-Paris transition.

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. The sample period ranges from 2008 to 2020. *Post Paris* is a binary variable equal to 1 if the year is ≥ 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	216,232	216,232	233,171	227,420	227,420
Adjusted R^2	0.069	0.069	0.069	0.070	0.070

A2.3 Investor demand

Finally, we examine capital-market demand using firms' institutional ownership before Paris. Environmentally oriented institutions may allocate capital toward firms expected to benefit from the green transition, encourage portfolio firms to develop and commercialize green products, or both. We measure institutional ownership using FactSet/LionShares. We identify responsible and climate-focused investors through membership in the United Nations-supported Principles for Responsible Investment (PRI) and CDP, respectively, using the mappings developed in the prior literature. We also measure the investment horizon of a firm's owners using holdings-weighted portfolio turnover; higher turnover indicates a shorter horizon.

To preserve temporal ordering, all ownership measures are observed in 2015 and held fixed throughout the sample. This design prevents post-Paris portfolio reallocations in response to realized green-revenue growth from mechanically generating the estimates. It does not eliminate selection based on information or expectations available before Paris, nor does it distinguish investor influence from investor selection. Accordingly, we interpret the results as evidence of a capital-market demand channel, not as causal effects of institutional ownership.

Table A-2.3 reports specifications with firm fixed effects, sector-by-year fixed effects, country-by-year fixed effects, and controls. Panel A uses the baseline green-revenue share. The interactions of post-Paris with total institutional ownership, PRI ownership, and CDP ownership are 2.334, 3.706, and 4.237, respectively, and all are significant at the 1 percent level. The larger coefficients for PRI and CDP ownership show that the relation is especially strong when pre-Paris owners have an explicit environmental orientation. The interaction with investor turnover is -2.235 and statistically significant, implying that firms held by lower-turnover, more patient investors experience larger post-Paris increases in green revenues.

Panels B and C confirm the same pattern using midpoint and Tier 1 green-revenue shares. For midpoint revenues, the post-Paris interactions with total, PRI, and CDP ownership are 3.229, 5.766, and 5.923, and the turnover interaction is -3.160. For Tier

1 revenues, the corresponding coefficients are 1.481, 2.423, 2.937, and -1.133. All are statistically significant at the 1 percent level. The robustness of the results to the more restrictive Tier 1 definition reduces the concern that environmentally oriented institutions are associated only with activities whose green classification is ambiguous.

Overall, firms entered the post-Paris period with different capital-market environments. Those with greater ownership by sustainability-oriented and longer-horizon institutions subsequently expanded green revenues more strongly. Alongside the consumer-preference evidence, these findings indicate that demand for green corporate output operates through both product and capital markets. Combined with the EUTSF and EPI evidence, the results support our central interpretation: the Paris Agreement accelerated the green transition through mutually reinforcing regulatory supply incentives and market demand. In Section 5, we provide further evidence from a short-window event study that investors revalue green stocks relative to brown stocks following Paris, consistent with an increase in the NPV of future green revenues.

Our results contribute to research on sustainable investing and the real effects of capital allocation. The association between post-Paris green commercialization and ownership by sustainability-oriented, long-horizon institutions complements evidence on investor engagement, exit, and corporate environmental behavior (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 outcome differs from those typically studied in this literature. Rather than measuring commitments, emissions, or environmental scores, we examine whether firms expand sales of environmentally beneficial products. The results suggest that the capital-market environment may matter not only for reducing harmful production but also for supporting the commercialization of beneficial output, while leaving open the extent to which the ownership relations reflect influence or selection.

Table A-2.3. The Role of Institutional Ownership

In this table, we explore the role of institutional shareholders in the green transition. In Panel A, the dependent variable is *Green Revenues %* and the main explanatory variables are the total share of institutional ownership (*IO*), the share of responsible institutional ownership (*IO PRI*) and climate-focused institutional ownership (*IO CDP*) in the year 2015, which we keep constant over the sample period in our main regression setup to explore how institutional ownership pre-Paris influenced firm green revenues post Paris. *Post Paris* is a dummy equal to 1 if the year ≥ 2016 . Institutional ownership is considered green when institutional investors are signatories of the Principles of Responsible Investment (*IO PRI*) and climate-related when the institutional owner is part of the Carbon Disclosure Project (*IO CDP*). *IO Turnover* measures the holdings-weighted Churn ratio of institutional owners by firm. In Panel B, we employ the midpoint green revenue % measure as the dependent variable. In Panel C, we only consider GRCS tier 1 green revenues as the dependent variable. 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: Green Revenues %

Dep. Variable	Green Revenues %			
Regressions	(1)	(2)	(3)	(4)
IO Total Pre Paris $\times$ Post Paris	2.334*** (0.254)			
IO PRI Pre Paris $\times$ Post Paris		3.706*** (0.437)		
IO CDP Pre Paris $\times$ Post Paris			4.237*** (0.534)	
Turnover Pre Paris $\times$ Post Paris				-2.235*** (0.343)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes	Yes
Observations	202,930	202,930	202,930	208,992
Adjusted R^2	0.860	0.860	0.860	0.853

Panel B: Midpoint Green Revenues %

Dep. Variable	Midpoint Green Revenues %			
Regressions	(1)	(2)	(3)	(4)
IO Total Pre Paris $\times$ Post Paris	3.229*** (0.331)			
IO PRI Pre Paris $\times$ Post Paris		5.766*** (0.578)		
IO CDP Pre Paris $\times$ Post Paris			5.923*** (0.621)	
Turnover Pre Paris $\times$ Post Paris				-3.160*** (0.355)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes	Yes
Observations	202,930	202,930	202,930	208,992
Adjusted R^2	0.847	0.847	0.847	0.842

Panel C: Tier 1 Green Revenues %

Dep. Variable	Tier 1 Green Revenues %			
Regressions	(1)	(2)	(3)	(4)
IO Total Pre Paris × Post Paris	1.481*** (0.211)			
IO PRI Pre Paris × Post Paris		2.423*** (0.363)		
IO CDP Pre Paris × Post Paris			2.937*** (0.479)	
Turnover Pre Paris × Post Paris				-1.133*** (0.266)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sector x Year FE	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes
Observations	202,930	202,930	202,930	208,992
Adjusted R^2	0.852	0.852	0.852	0.851

Internet Appendix

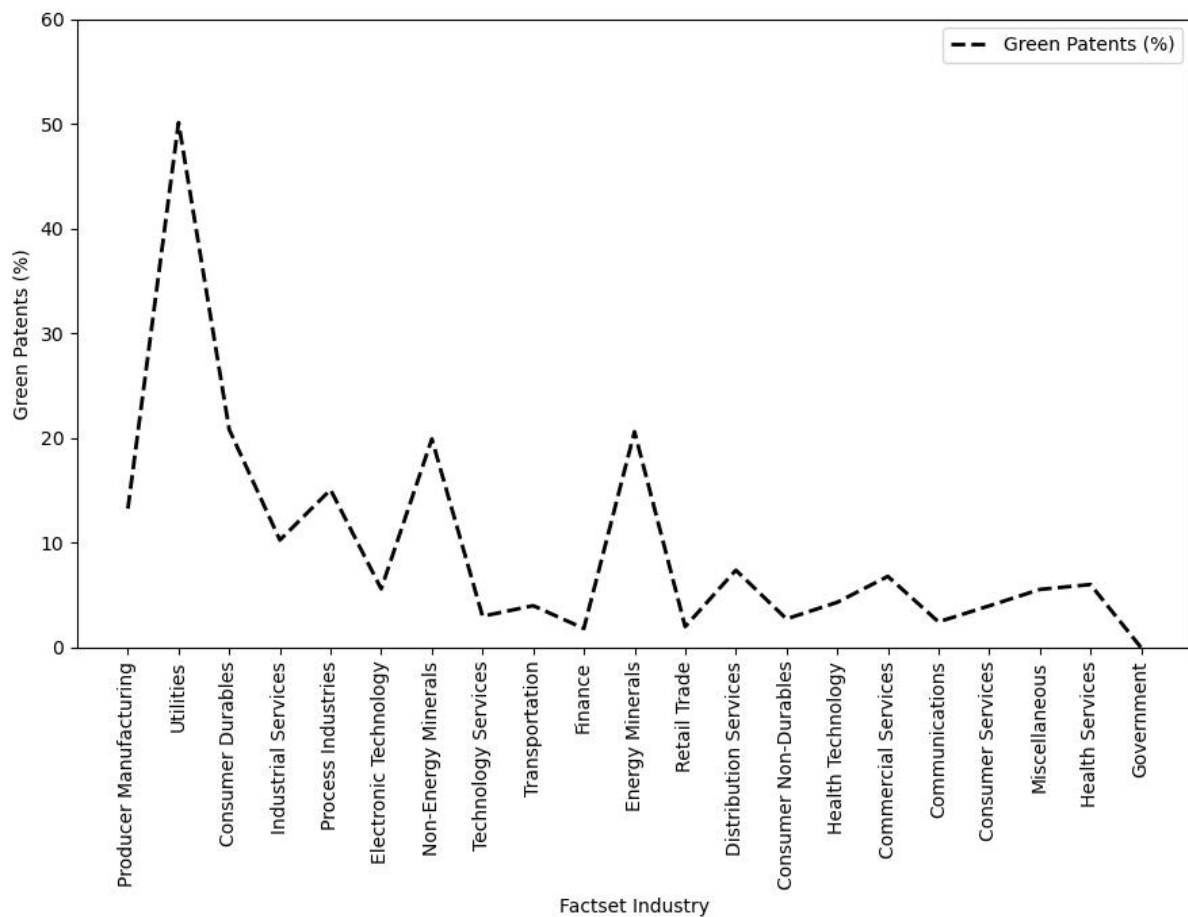
The Green Transition:

Evidence from Corporate Green Revenues

Figures

Figure I.A.1. Green Patents Pre Paris by Industry

The figure maps green patents into different traditional industries based on a company's FactSet sector classification. The green bar chart shows total green patents and the black dashed line plots green patents relative to total patents for companies in each FactSet sector from 2008 to 2015.



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, % midpoint green revenues, % tier 1 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 *Adj. 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) Midpoint Green Revenues %	0.718***	1						
(3) Tier 1 Green Revenues %	0.776***	0.530***	1					
(4) CO2 Int. Scope 1	-0.0542***	-0.0442**	-0.0845***	1				
(5) CO2 Int. Scope 2	0.00975	0.00599	-0.00417	0.0919***	1			
(6) CO2 Int. Scope 3	-0.0348*	-0.0353*	0.0657***	0.326***	0.0787***	1		
(7) E-Score PST	-0.00421	-0.0103	0.0510**	-0.416***	-0.117***	-0.439***	1	
(8) Adj. ESG Score	0.0118	-0.0267	0.0509**	-0.179***	-0.0364*	-0.154***	0.386***	1

Table I.A.2. Determinants of Green Revenues

This table shows firm-level determinants of green revenues. 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 level are in parentheses.

Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Sales)	0.820*** (0.0324)	0.818*** (0.0311)	0.816*** (0.0313)	0.787*** (0.0330)	0.736*** (0.0375)	0.794*** (0.0315)	0.744*** (0.0359)	0.253*** (0.0574)
Tobin's Q		0.176*** (0.0241)	0.131*** (0.0250)	0.167*** (0.0258)	0.196*** (0.0227)	0.118*** (0.0239)	0.142*** (0.0235)	0.0494*** (0.0137)
Leverage		2.214*** (0.216)	2.044*** (0.212)	0.933*** (0.158)	0.975*** (0.167)	2.070*** (0.221)	0.894*** (0.161)	0.0643 (0.127)
ROA		-2.542*** (0.331)	-2.592*** (0.341)	-2.644*** (0.376)	-2.882*** (0.367)	-2.462*** (0.346)	-2.574*** (0.360)	0.524*** (0.234)
Cash		-1.737*** (0.186)	-1.737*** (0.189)	-1.252*** (0.173)	-1.009*** (0.220)	-1.518*** (0.194)	-0.846*** (0.188)	0.234* (0.125)
CAPEX			9.786*** (1.153)	9.826*** (1.064)	11.37*** (1.093)	10.17*** (1.144)	10.48*** (1.099)	0.374 (0.559)
R&D			4.660*** (0.966)	6.481*** (1.159)	1.091 (1.226)	3.089*** (1.042)	3.121** (1.239)	-0.565 (0.964)
Europe						2.160*** (0.193)	2.414*** (0.138)	
Asia-Pacific						1.211*** (0.150)	1.078*** (0.104)	
North America						1.500*** (0.227)	2.018*** (0.0940)	
Number of Green Patents								
Year FE	No	No	No	Yes	Yes	No	Yes	No
Sector FE	No	No	No	Yes	Yes	No	Yes	No
Country FE	No	No	No	No	Yes	No	No	No
Firm FE	No	No	No	No	No	No	No	Yes
Sector x Year FE	No	No	No	No	No	No	No	Yes
Country x Year FE	No	No	No	No	No	No	No	Yes
Observations	267,576	267,576	267,576	267,576	267,576	267,576	267,576	264,658
Adjusted R^2	0.013	0.015	0.016	0.065	0.072	0.018	0.068	0.856

Table I.A.3. Green Patents and Green Revenues: Intensive Margin

This table reports difference-in-differences estimates relating pre-Paris green innovation to changes in green revenues after the Paris Agreement. The sample is restricted to the intensive margin and therefore includes only firm-year observations with positive green revenues. The dependent variables are the share of revenues classified as green by FTSE Russell (Green Revenues %), the midpoint estimate (Midpoint Green Revenues %), and revenues attributable to Tier 1 green activities (Tier 1 Green Revenues %). Green innovation is measured using an indicator equal to one if a firm granted at least one green patent prior to the Paris Agreement (GP Indicator). Post Paris is an indicator equal to one for years after 2015. Standard errors are clustered at the country-year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable	Green Revenues %	Midpoint Green Revenues %	Tier 1 Green Revenues %
Regressions	(1)	(2)	(3)
GP Indicator $\times$ Post Paris	1.686*** (0.239)	2.051*** (0.391)	0.912*** (0.241)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes
Country $\times$ Year FE	Yes	Yes	Yes
Observations	36,646	36,646	36,646
Adjusted R^2	0.914	0.808	0.915

Table I.A.4. MSCI Green Revenues %

This table examines the relation between corporate green patent innovation and MSCI % 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 2015) is associated with more green revenues as estimated by MSCI (columns 1 & 2) and FTSE green revenues (columns 3 & 4). Alternatively, we use *GP Ratio* which measures average annual green patents relative to all patents created by a company between 2008 and 2015. *Post Paris* is a dummy equal to 1 if the year ≥ 2016 . In Panel B, we fill missing values within the MSCI ACWI universe with zeros. 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: MSCI Green Revenues

Regressions	(1)	(2)	(3)	(4)
	MSCI Green Revenues		FTSE Green Revenues	
GP Indicator	1.800*** (0.358)		5.402*** (0.676)	
GP Ratio		13.76*** (2.160)		23.33*** (4.578)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	8,821	8,821	8,821	8,821
Adjusted R^2	0.091	0.095	0.144	0.142

Panel B: MSCI Green Revenues (Filled Zeros)

Regressions	(1)	(2)	(3)	(4)
	MSCI Green Revenues		FTSE Green Revenues	
GP Indicator	1.964*** (0.276)		6.154*** (0.570)	
GP Ratio		19.44*** (1.809)		47.48*** (4.016)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	125,772	125,772	125,772	125,772
Adjusted R^2	0.047	0.052	0.089	0.096

Table I.A.5. Are FTSE and MSCI Estimates Correlated?

This table examines the relation between FTSE and MSCI % green revenue estimates. We test whether MSCI estimates predict FTSE green revenue estimates. In Panel A, we used a sample that consists of firms with non-zero green revenues. In Panel B, we fill missing values within the MSCI ACWI universe with zeros. 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: Conditional Sample

Regressions	(1)	(2)	(3)
	FTSE Green Revenues %	FTSE Midpoint Green Revenues %	FTSE Tier 1 Green Revenues %
MSCI Green Revenues %	0.594*** (0.0383)	0.379*** (0.0347)	0.546*** (0.0372)
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	8,821	8,821	8,821
Adjusted R^2	0.255	0.214	0.310

Panel B: MSCI ACWI Universe

Regressions	(1)	(2)	(3)
	FTSE Green Revenues %	FTSE Midpoint Green Revenues %	FTSE Tier 1 Green Revenues %
MSCI Green Revenues %	0.631*** (0.0205)	0.446*** (0.0238)	0.609*** (0.0199)
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	125,772	125,772	125,772
Adjusted R^2	0.205	0.159	0.218

Table I.A.6. Green Innovation and EU Taxonomy Outcomes

This table examines the relation between green innovation and firms' EU Taxonomy outcomes in 2022 and 2023. Specifically, we test whether firms that owned at least one green patent prior to the Paris Agreement (*GP Indicator*) exhibit higher shares of green revenues, green capital expenditures, and green operating expenditures as reported under the EU Taxonomy framework. Columns (1)–(3) report Taxonomy-eligible revenues, capital expenditures, and operating expenditures, respectively. Columns (4)–(6) report the corresponding Taxonomy-aligned measures. For each outcome, we distinguish between Taxonomy-eligible and Taxonomy-aligned revenues or expenditures. 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	Eligible			Aligned		
	Revenues	CAPEX	OPEX	Revenues	CAPEX	OPEX
Regressions	(1)	(2)	(3)	(4)	(5)	(6)
GP Indicator	12.43*** (2.367)	5.159** (2.190)	12.66*** (3.673)	4.158*** (1.392)	4.345** (1.746)	4.705*** (1.178)
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	1,396	1,408	1,337	1,289	1,316	1,248
Adjusted R^2	0.218	0.207	0.198	0.210	0.323	0.296

Table I.A.7. Alternative Measures of Green Patenting

This table examines whether the relation between green innovation and green revenues depends on how green innovation is measured. The dependent variables are the percentage of revenues classified as green by FTSE Russell (Green Revenues %), the midpoint estimate (Midpoint %), and revenues attributable to Tier 1 green activities (Tier 1 %). Green innovation is measured either as the logarithm of one plus the number of green patents granted prior to the Paris Agreement ($\ln(\text{GP Count})$) or as the ratio of green patents to total patents (GP Ratio). Post Paris is an indicator equal to one for years after 2015. All specifications include firm fixed effects, sector-by-year fixed effects, country-by-year fixed effects, and the full set of firm-level controls used throughout the paper. Standard errors are clustered at the country-year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable	Green Revenues %		Midpoint %		Tier 1 %	
	(1)	(2)	(3)	(4)	(5)	(6)
Regression						
$\ln(\text{GP Count}) \times \text{Post Paris}$	0.643*** (0.0645)		0.777*** (0.120)		0.474*** (0.0706)	
$\text{GP Ratio} \times \text{Post Paris}$		3.220*** (0.732)		4.572*** (1.189)		1.930*** (0.451)
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	0.844	0.844	0.852	0.851

Table I.A.8. The Role of Influential Green Patents

This table examines whether the results in Table 3 are driven by more influential patents, as measured by citation counts. The dependent variable is the point estimate of *Green Revenues %*. In column (1), the main independent variable is the natural logarithm of the number of green patent citations prior to the Paris Agreement. Column (2) scales this measure by the firm's total patent citations in the pre-Paris period. Column (3) uses the natural logarithm of the ratio of firm-level green patent citations to the corresponding industry average. 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	Green Revenues %		
Regressions	(1)	(2)	(3)
Log Green Citations $\times$ Post Paris	0.282*** (0.0217)		
Green Citation Ratio $\times$ Post Paris		3.018*** (0.639)	
Green Sector Citation Ratio $\times$ Post Paris			0.485*** (0.0484)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sector x Year FE	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes
Observations	264,658	264,658	264,658
Adjusted R^2	0.856	0.856	0.856

Table I.A.9. The Impact of Influential Individual Green Patents

This table examines the relation between highly influential green patents and green revenues. We test whether ownership of a green patent in the top 5% or top 1% of the pre-Paris citation distribution predicts higher green revenues after Paris. *Post Paris* is a dummy equal to 1 if the year ≥ 2016 . In columns (3) & (4), we consider green revenues that are the midpoint between the minimum and the maximum green revenue estimates. In columns (5) & (6), we only consider Tier 1 green revenues (green products and services with significant and clear environmental benefits) as the dependent variable. 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	Green Revenues %		Midpoint Green Revenues %		Tier 1 Green Revenues %	
Regressions	(1)	(2)	(3)	(4)	(5)	(6)
95th Percentile $\times$ Post Paris	1.246*** (0.228)		1.536*** (0.362)		0.823*** (0.252)	
99th Percentile $\times$ Post Paris		0.714*** (0.183)		1.256*** (0.334)		0.294 (0.216)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country $\times$ 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	0.844	0.844	0.851	0.851

Table I.A.10. 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 $USD\ Green\ Revenues = (Green\ Revenues\ \%/100) \times USD\ Total\ Sales$. 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-year level (except in column (3)) are in parentheses.

Dep. Variable	USD Green Revenues		USD Brown Revenues	
Regression	(1)	(2)	(3)	(4)
GP Indicator $\times$ Post Paris	460.9*** (60.75)		1069.5*** (366.7)	
GP Ratio $\times$ Post Paris		1041.0*** (199.4)		-424.9 (693.6)
Firm FE	Yes	Yes	Yes	Yes
Sector x Year FE	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes
Observations	264,658	264,658	264,658	264,658
Adjusted R^2	0.717	0.716	0.893	0.893

Table I.A.11. 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 A-2.3. 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 Total Pre Paris × Post Paris	204.5*** (34.53)				
IO Total High Pre Paris × Post Paris		59.71*** (11.89)			
IO PRI Pre Paris × Post Paris			669.0*** (72.14)		
IO CDP Pre Paris × Post Paris				845.8*** (88.46)	
Turnover Pre Paris × Post Paris					-539.0*** (78.57)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Sector x Year FE	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	202,930	202,930	202,930	202,930	208,992
Adjusted R^2	0.722	0.722	0.722	0.722	0.722
Panel B: USD Brown Revenues					
Regression	(1)	(2)	(3)	(4)	(5)
IO Total Pre Paris × Post Paris	1181.1*** (221.6)				
IO Total High Pre Paris × Post Paris		110.2* (62.12)			
IO PRI Pre Paris × Post Paris			4517.4*** (747.0)		
IO CDP Pre Paris × Post Paris				5842.5*** (1037.8)	
Turnover Pre Paris × Post Paris					-5333.4*** (994.0)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Sector x Year FE	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	202,930	202,930	202,930	202,930	208,992
Adjusted R^2	0.898	0.898	0.898	0.898	0.898

Table I.A.12. 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: Tesla Weight in Global Green Revenues Portfolios (%)				
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: Tesla Weight in US Green Revenues Portfolios (%)				
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.13. 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* ≥ 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.

Panel A: Long Green Revenues Portfolio

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

Panel B: Long-Short Green Revenues Minus Legacy (GML) Portfolio

Portfolio	Green Revenues ≥ 20% Minus Legacy (GML)							
Regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market - Rf			0.0596** (0.0253)	0.120*** (0.0243)	0.108*** (0.0242)	0.0756*** (0.0252)	0.0733*** (0.0246)	0.126*** (0.0368)
Size				-0.0444 (0.0737)	-0.0538 (0.0737)	-0.118 (0.0961)	-0.119 (0.0963)	-0.0810 (0.143)
Value				-0.254*** (0.0453)	-0.322*** (0.0570)	-0.128* (0.0690)	-0.183** (0.0882)	-0.113 (0.140)
Momentum					-0.0909** (0.0440)		-0.0524 (0.0472)	-0.0573 (0.0877)
Profitability						-0.0337 (0.113)	-0.0411 (0.113)	0.0204 (0.145)
Investment						-0.290** (0.114)	-0.257** (0.120)	-0.292 (0.197)
GMB								-0.0797 (0.0793)
Alpha	-0.0041 (0.119)	-0.0426 (0.0681)	-0.0568 (0.114)	-0.106 (0.103)	-0.0797 (0.102)	-0.0337 (0.119)	-0.0219 (0.120)	0.113 (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 I.A.14. Green Revenues, Earnings Surprises, and Firms' Cost of Capital

This table reports linear regressions examining the relationship between firms' green revenues and earnings surprises and measures of the cost of capital. Columns (1) and (2) use the median earnings surprise as the dependent variable. Columns (3) and (4) use the implied cost of capital, while Columns (5) and (6) use an alternative implied cost of capital measure. Odd-numbered columns use the global sample, while even-numbered columns restrict the sample to firms incorporated in the United States. The sample covers the years from 2008 to 2023. Variables are defined as in Appendix Table A-1.4. All regressions include firm, country-by-year, and sector-by-year fixed effects. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate that the parameter estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. Variable	Earnings Surprise		Implied Cost of Capital		Alternative ICC	
	Global	US	Global	US	Global	US
Regression	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Green Revenues %	-0.0139 (0.00863)	-0.0168** (0.00743)	-0.108 (0.685)	0.223 (0.622)	-0.149 (0.525)	-0.0969 (0.569)
Lagged Green Revenues % $\times$ Post Paris	0.0147** (0.00678)	0.0136*** (0.00523)	-0.0894 (0.277)	-0.301 (0.341)	-0.0980 (0.258)	-0.303 (0.330)
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	24375	15628	16485	11327	24375	15628
Adjusted R^2	0.196	0.176	0.586	0.593	0.545	0.546

Table I.A.15. Unexpected Changes in Climate Concerns

We estimate monthly time-series regressions using data from January 2008 to December 2023. The dependent variable is the return on a long-short portfolio constructed as each value-weighted green portfolio return minus the legacy portfolio return (GML). Green portfolios are formed using different thresholds of *Green Revenues %*, as in Tables I.A.13 and 7. 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 reported in parentheses.

Variable	Green Minus 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	192	192	192	192
Adjusted R^2	0.029	0.038	0.074	0.063

Table I.A.16. 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*** (0.125)	-0.302** (0.139)	-0.323** (0.160)	-0.126 (0.227)
Alpha (Post Paris)	-0.0746 (0.108)	0.00995 (0.126)	0.00794 (0.172)	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)	0.192 (0.205)	0.454* (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)	-0.0406 (0.125)	0.0839 (0.162)	0.310 (0.205)
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.17. GML Loadings on GMB Before and After 2016 (United States)

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 Pastor et al. (2022). The dependent variables are the returns on long-short portfolios constructed as each value-weighted green portfolio return minus the legacy portfolio return. The regressions control for the Fama–French six-factor asset-pricing model. Pre-2016 and Post-2016 are period-specific intercepts that capture average GML returns before and after 2016, respectively. By *, **, and *** we denote p -levels below 10%, 5%, and 1%, respectively. Robust standard errors are reported in parentheses.

Variable	Green Minus Legacy (GML)			
Regression	(1)	(2)	(3)	(4)
Portfolio	> 0%	> 20%	> 50%	> 80%
Panel A: GML Loadings on GMB in the Six-Factor Model				
Market – Rf	0.131*** (0.0296)	0.0676 (0.0511)	0.343*** (0.116)	0.397*** (0.151)
Size	-0.216*** (0.0681)	-0.0753 (0.0908)	0.116 (0.180)	0.216 (0.232)
Value	-0.149*** (0.0573)	-0.301*** (0.0915)	-0.412** (0.172)	-0.515** (0.223)
Momentum	0.0152 (0.0327)	0.0281 (0.0482)	0.00274 (0.0851)	-0.0636 (0.107)
Investment	-0.0777 (0.110)	-0.0406 (0.137)	-0.139 (0.274)	-0.275 (0.363)
Profitability	-0.0856 (0.0789)	-0.0178 (0.109)	-0.249 (0.275)	-0.249 (0.376)
GMB	-0.0675 (0.0740)	-0.100 (0.100)	-0.0537 (0.196)	0.0713 (0.263)
Pre-2016 Alpha	-0.297* (0.170)	-0.378* (0.207)	-0.581 (0.360)	-0.396 (0.490)
Post-2016 Alpha	0.152 (0.184)	0.423* (0.251)	1.314** (0.522)	1.824*** (0.696)
Fama–French 6 Factors	Yes	Yes	Yes	Yes
Observations	180	180	180	180
Adjusted R^2	0.225	0.183	0.188	0.196

Table I.A.18. 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 $USD\ Green\ Revenues = (Green\ Revenues\ \%/100) \times USD\ Total\ Sales$. 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 (12.97)			-54.36*** (14.47)
Europe $\times$ Post TEG		15.80 (14.22)		29.68** (14.32)
Europe $\times$ Post EUTSF			33.33* (18.58)	43.87** (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 R^2	0.058	0.058	0.058	0.058
Panel B: USD Brown Revenues				
Regression	(1)	(2)	(3)	(4)
Europe $\times$ Post Paris	-471.1*** (101.1)			-404.5*** (118.8)
Europe $\times$ Post TEG		-406.9*** (108.0)		-77.64 (112.6)
Europe $\times$ Post EUTSF			-345.6** (138.7)	-20.53 (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 R^2	0.234	0.234	0.234	0.234

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