

Ciminelli, Gabriele; D'Arcangelo, Filippo Maria; Pisu, Mauro; Tian, Shu

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## Climate laws and green finance: The value of legal commitment

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# CLIMATE LAWS AND GREEN FINANCE

THE VALUE OF LEGAL COMMITMENT

*Gabriele Ciminelli, Filippo Maria D’Arcangelo, Mauro Pisu, and Shu Tian*

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Gabriele Ciminelli ([gciminelli@adb.org](mailto:gciminelli@adb.org)) is an economist and Shu Tian ([stian@adb.org](mailto:stian@adb.org)) is a principal economist at the Economic Research and Development Impact Department, Asian Development Bank. Filippo Maria D’Arcangelo ([filippomaria.darcangelo@oecd.org](mailto:filippomaria.darcangelo@oecd.org)) is an economist and Mauro Pisu ([mauro.pisu@oecd.org](mailto:mauro.pisu@oecd.org)) is a senior economist at the Economics Department, Organisation for Economic Co-operation and Development.



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6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines  
Tel +63 2 8632 4444; Fax +63 2 8636 2444  
[www.adb.org](http://www.adb.org)

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## ABSTRACT

Using newly compiled cross-economy data on national climate legislation matched with mutual fund portfolio holdings, this paper finds that enshrining a climate commitment in law redirects capital toward green assets. A staggered difference-in-differences design reveals that legally binding climate commitments lead to a substantial increase in the share of environmental, social, and governance (ESG) holdings in total mutual fund assets. The effect is driven by laws setting net-zero emission reduction targets, which increase the ESG share by about 5 percentage points over 5 years. A simple back-of-the-envelope calculation suggests this corresponds to a rise in ESG mutual funds' holdings of about 1.8% of gross domestic product. The effect, which is strongest in bond and actively managed funds, is explained by tighter mitigation policies as well as reduced policy uncertainty and reflects an expansion in both the supply of and demand for green assets, rather than asset price changes. These findings underscore the role of legally binding commitments in anchoring expectations and mobilizing climate finance.

**Keywords:** climate laws, net-zero targets, sustainable finance, ESG investment, mutual funds, policy uncertainty, climate policy stringency

**JEL codes:** G11, G15, G18, Q54, Q58

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## I. INTRODUCTION

Most economies have introduced climate-related laws and policies to meet the Paris Agreement's climate change mitigation targets. This paper focuses on climate framework laws (hereafter "climate laws"), a type of climate-related legislation establishing legally binding commitments or institutional arrangements to reduce greenhouse gas emissions.

Climate laws codify national mitigation commitments. Many set quantitative emission reduction targets, such as net-zero emission targets or interim targets. Others define broader climate objectives, define responsibilities across government bodies, or mandate monitoring and reporting. By doing so, climate laws strengthen stakeholder engagement, signal credible government commitment, and create accountability mechanisms. More broadly, climate laws provide the legal basis for the formulation and execution of mitigation policies and offer firms and citizens legal recourse against inaction or reversal (Dubash et al. 2013; Iacobuta et al. 2018; Scotford and Minas 2018).

By making climate commitments legally binding, climate laws anchor expectations about the transition to a decarbonized economy. As expectations shift, financial markets reassess the attractiveness of different assets in light of anticipated climate policies. That is, climate laws can improve the expected risk return profile of climate-aligned investment by raising their relative expected returns, lowering their volatility, or both. On the supply side, this should encourage firms to align their operations with climate goals, potentially leading to an increased issuance of green assets and securities. On the demand side, a better risk return profile of sustainable investments should result in higher demand for green assets and securities. However, despite the rising importance of climate laws, evidence on their effects remains scant.

This paper is the first to investigate empirically how climate laws affect sustainable investment, as captured by environmental, social, and governance (ESG) mutual fund holdings. We use economy-level mutual fund holdings data sourced from Emerging Portfolio Fund Research (EPFR) and match it with a newly compiled dataset on climate laws. Employing a state-of-the-art difference-in-differences (DiD) design, we estimate the effects of adopting a climate law on the share of ESG fund holdings over total fund holdings, with economies without a climate law forming a control group.

We find evidence that the adoption of a climate law catalyzes sustainable investment by significantly increasing the share of ESG funds' holdings over all mutual funds' holdings. The effect is almost entirely driven by climate laws that set net-zero emission reduction targets (i.e., net-zero laws). In economies adopting such laws, the share of ESG fund assets rises by about 5 percentage points within 5 years of the climate law's adoption, relative to the control group. In contrast, climate laws that just set interim quantitative targets (i.e., emission reduction targets before mid-century) or establish institutional arrangements have smaller and statistically insignificant effects. These findings are robust to various modifications of the baseline regression. The absence of pre-treatment effects supports the assumptions of parallel trends and no anticipation effects.

The estimated effect of climate laws on ESG holdings is not only statistically significant but also economically large. A simple back-of-the-envelope calculation suggests that, for the average economy in our sample, the adoption of a net-zero law may have mobilized additional green finance equivalent to about 1.8% of gross domestic product (GDP) within 5 years from adoption through mutual fund portfolios alone. In extensions, we find that the effectiveness of climate laws depends critically on the economies' institutional capacity. While net-zero laws have gradual and large effects in economies with above-median government effectiveness, they have no discernible impact where government effectiveness is low, underscoring that climate laws are necessary but

not sufficient to mobilize sustainable finance. Heterogeneity tests across asset classes and funds' investment styles show that the effect is more than twice as large among actively managed funds than among passive funds, and four times larger for bond funds than for equity funds.

We then explore two different but non-mutually exclusive channels that could explain how the adoption of net-zero climate laws drives up sustainable investment: higher mitigation policy stringency and lower mitigation policy uncertainty. We find support for both channels. On the one hand, the passing of net-zero laws leads to more stringent mitigation policies, which improve the expected cash flows of green relative to brown assets. On the other hand, rising mitigation policy stringency does not fully explain the positive impact of net-zero laws on sustainable investment, lending support to the hypothesis that net-zero laws diminish uncertainty over future mitigation policies and the risks to ESG assets.

Additional evidence further corroborates the hypothesis that net-zero laws lower mitigation policy uncertainty. First, ESG investments do not decline following political turnover in economies that have adopted a net-zero law. This suggests that climate laws enhance the credibility and perceived stability of mitigation policies, as they are more difficult to repeal or ignore than those in strategies and other documents showing political intent but not setting legally binding commitments (Iacobuta et al. 2018). Second, we also find that the return volatility of global green bond funds declines relative to non-green funds following the adoption of a net-zero law.

As a final exercise, we assess the role of supply, demand, and valuation effects in explaining the positive impact of climate laws on sustainable investment. Focusing specifically on green bonds, we show that the supply of investable green assets expands following the adoption of net-zero laws. On the demand side, financial flows into green mutual funds rise markedly within weeks of the adoption of climate laws, suggesting that credible climate commitments trigger investors' portfolio reallocations toward green assets. In contrast, we find small and insignificant changes in assets' valuations, as captured by green bond funds' returns, after the adoption of climate laws. Taken together, these estimates suggest that volume rather than price effects explain the increase in the share of ESG funds in total mutual fund holdings owing to climate laws.

Overall, our findings suggest that climate laws anchor expectations about future mitigation policies. By doing so, they can bolster sustainable investment for the same level of mitigation policy stringency, thus enhancing the cost-effectiveness of mitigation policies. Moreover, they underscore the importance of complementing legally binding commitments to mitigation actions with efforts to improve the quality and availability of data on the environmental performance of assets and firms. Progress in this direction is essential to remove the risk of green washing, thus enhancing investor confidence and accelerating capital flows toward climate-aligned investments.

Our study contributes to two strands of literature. First, it extends current knowledge on the relationship between policy uncertainty and investment by focusing on the impact of climate laws on sustainable investment. Gulen and Ion (2016) show that policy uncertainty can depress and delay corporates' capital investment by increasing perceived risks to cash flows. Pástor and Veronesi (2012, 2013) show that financial markets reward policy certainty, reflecting it in price levels and volatility. In the context of climate policies, Olasehinde-Williams, Özkan, and Akadiri (2023) analyze the United States (US) weekly time series data and find that mitigation policy uncertainty affects both the returns and the volatility of sustainable investment, but more so the volatility. Hsu, Li, and Tsou (2023) find that uncertainty associated with the threat of stricter environmental regulation disproportionately impacts high-emission firms' stock prices, so investors receive a "pollution premium" as compensation for bearing this risk. This paper provides the first direct evidence on the positive impact of climate laws on sustainable investment in addition to identifying the channels—higher mitigation policy stringency and lower mitigation policy uncertainty—through which this effect comes about.

Second, this study provides new evidence on how financial markets respond to climate-related laws. Climate risk premia have been widely documented for stocks (Bolton and Kacperczyk 2023; Faccini, Matin, and Skiadopoulos 2023), government and corporate bonds (Huynh and Xia 2020; Beirne, Renzhi, and Volz 2021; Allman 2022), and bank loans (Javadi and Masum 2021; Ehlers, Packer, and de Greiff 2022). Zhang (2024) and D’Arcangelo et al. (2025) are among the few papers relating the price of green assets with climate policy stringency. We contribute to this literature by providing the first evidence that legally binding climate commitments mobilize green fund investment through increased issuance of ESG assets and portfolio reallocation.

The paper is structured as follows. Section II provides the definitions and institutional background on climate laws. Section III discusses the data. Section IV presents the empirical strategy. Section V presents the baseline results, robustness checks, and heterogeneities by investment type. Section 6 lays out the analysis of possible working channels. Section VII investigates the relative contribution of supply, demand, and valuation effects in explaining the observed increase in ESG investments. Section VIII concludes.

## **II. LEGAL BACKGROUND: CLIMATE LAWS AS DRIVERS OF POLICY CERTAINTY**

Climate framework laws (i.e., climate laws) establish an overarching, long-term legal basis for climate action. They typically set legally binding mitigation targets or institutional arrangements, and mechanisms for accountability and transparency that underpin the design and implementation of climate policies (World Bank 2020, Sridhar et al. 2022).

No universal definition of climate laws exists. However, they typically share some or all of the following characteristics: are passed by the legislative branch of government to determine the strategic direction of national climate change policy; establish national, long-term, and/or intermediate mitigation targets; set out institutional arrangements for climate governance at the national level; are multisectoral in scope; and involve mechanisms for transparency and accountability (World Bank 2020, Grantham Research Institute n.d.). Thus, climate laws are fundamentally different from climate mitigation policies, as the latter are the specific policy measures governments implement to lower emissions. The range of such specific mitigation policies is vast and includes carbon pricing mechanisms, renewable energy subsidies, efficiency standards, and regulations on industrial emissions, among many others (Blanchard, Gollier, and Tirole 2022; D’Arcangelo et al. 2022).

As legislative acts, climate laws possess formal legal force that distinguishes them from non-binding instruments—such as strategies, plans, declarations, guidelines, or recommendations. Non-binding instruments do not compel governments to undertake specific actions or follow predefined processes in the design and implementation of mitigation policies. In the fields of political science and law, these two categories of public policy instruments are commonly referred to as hard and soft laws (Shaffer and Pollack 2013, Vimha 2013), with the main distinction being the legally binding or non-binding commitments they impose.

Furthermore, climate laws subject government mitigation action (or the lack thereof) to judicial scrutiny, thereby providing people and firms with avenues for legal recourse. These laws can facilitate so-called “framework” (Setzer and Higham 2023) or “systemic” (Maxwell, Mead, and van Berkel 2022) litigation cases, as exemplified by landmark cases such as *Urgenda Foundation v. State of the Netherlands* (2019) and *Neubauer v. Germany* (2021). These cases can elevate the visibility of government action on mitigation issues and expose the inadequacy of actual mitigation policies in terms of meeting national emission reduction targets. In some cases, courts have

enforced statutory climate obligations, requiring governments to revise policies that fall short of legal targets (Higham, Setzer, and Bradeen 2022; Tigre and Barry 2025). Judicial scrutiny under climate laws also extends to environmental impact assessments, where courts may invalidate permits for infrastructure projects that fail, for instance, to account for greenhouse gas emissions (Tigre and Barry 2025). Furthermore, climate laws have been invoked in climate litigation against corporations, as seen in cases like *Notre Affaire à Tous v. Total* (2021), with sizable repercussions on firms' market value in the event of an adverse ruling (Sato et al. 2024).

Climate laws have the potential to mobilize green finance through two primary channels. First, by pushing legislative and administrative bodies to design and enforce mitigation measures, these laws foster more stringent mitigation policies. Furthermore, by delineating procedural requirements and allocating responsibilities (Shimshack and Ward 2008, Faure 2012), climate laws bolster coordination, thus improving policy effectiveness. More effective mitigation policy enhances the expected cash flows of green assets relative to brown ones. Investors might adjust their portfolios gradually, as the mandated institutional changes (such as establishing advisory bodies as well as coordination and accountability mechanisms) are implemented over time and enforcement mechanisms may take time to become effective and credible.

A second channel is via expectations. Legally binding emission reduction targets—extending over the medium to long term—shape expectations over future policy shifts, reducing policy uncertainty. This reduction in uncertainty enhances investor confidence by signaling a stable policy environment and improving the risk return profile of low-carbon investments. This contrasts with soft laws, such as non-binding targets, guidelines or strategies, as these indicate political intent but lack the credibility and enforceability to significantly shift risk perceptions and expected returns.

### III. DATA

#### A. Climate Laws

We collect information on climate laws worldwide from Higham et al. (2021), Jeudy-Hugo, Lo Re, and Falduto (2021), and Library of Congress (2022) and distinguish between two types of climate laws: qualitative and quantitative laws. Qualitative climate laws strengthen the institutional framework to achieve the climate transition, for instance by setting coordination mechanisms and establishing procedural requirements, such as public consultation, to inform the design and implementation of mitigation policies (World Bank 2022, Sridhar et al. 2022). They establish general principles, without setting quantitative emission reduction targets. In contrast, quantitative climate laws specify legally binding emission reduction targets on top of the general principles and may or may not strengthen the institutional framework.

We further divide quantitative laws into net-zero and intermediate target laws. We define net-zero laws as those that set a commitment to reach net-zero emissions (usually by around mid-century). Many economies have adopted these laws over the past 20 years, and especially since the 2015 Paris Agreement (Figure A1 in the Appendix shows a timetable of adoption). Some net-zero laws also define intermediate emission targets, typically by 2030 or 2040. In our definition, net-zero laws are those that set a net-zero target, regardless of whether they also contain an intermediate target. By contrast, intermediate target laws (i.e., interim laws) are those that set only interim emission reduction targets (and not net-zero targets). Table 1 provides a list of economies that have adopted different types of laws.

**Table 1: Economies with Climate Laws and Their Adoption Dates**

Climate Law Type				Climate Law Type			
Quantitative		Qualitative		Quantitative		Qualitative	
Economy	Net-Zero Law	Interim Law		Economy	Net-Zero Law	Interim Law	
Albania			Dec-20	Liechtenstein	Mar-22		Sep-12
Andorra		Sep-18		Luxembourg	Dec-20*		
Argentina			Dec-19	Maldives	May-21*		
Australia	Sep-22*			Malta			Jul-15
Austria	Jul-21	Nov-11		Mauritius			Nov-20
Bahamas			May-22	Mexico		Jun-12	
Benin			Jun-18	Micronesia			Nov-13
Brazil		Dec-09		Montenegro			Dec-19
Bulgaria		Mar-14		Mozambique			Jun-14
Canada	Jun-21*			Nauru			Oct-20
Chile	Jun-22*			Netherlands	Jul-19*		
Colombia	Dec-21	Jul-18		New Zealand	Nov-19*		Nov-02
Croatia			Dec-19	Nigeria	Nov-21		
Denmark	Jun-20*			Norway	Jun-21	Jun-17	
EU	Jun-21*			Pakistan			Mar-17
Fiji	Sep-21*			PNG			Nov-15
Finland	Mar-15*			Paraguay			Sep-17
France	Aug-15*			Peru			Apr-18
Gabon			Sep-21	Philippines			Jul-09
Germany	Dec-19*	Dec-19		Portugal	Dec-21*		
Greece	May-22*	May-22		Russia			Jul-21
Guatemala			Sep-13	Serbia			Nov-18
Honduras			Nov-14	Slovenia			Apr-06
Hungary	Jun-20*			Spain	May-21*		
Iceland	Jun-21*			Sweden	Jun-17*		
Ireland	Jul-21*		Dec-15	Switzerland	Sep-22	Jan-13	
Japan	Jun-21	May-16	Oct-98	Taipei,China	Feb-23*		Jul-15
Kenya			May-16	Uganda			Aug-21
ROK	Sep-21*			UK	Nov-08*		
Kosovo			Jan-24				

EU = European Union, PNG = Papua New Guinea, ROK = Republic of Korea, UK = United Kingdom.

Note: Dates indicate the month and year the climate law was passed. Dates of amendments are not reported. An asterisk (\*) denotes net-zero climate laws that also establish interim emission reduction targets. Not all economies listed in this table are included in the study, owing issues with data availability on mutual fund holdings.

Source: Authors based on Higham et al. (2021), Jeudy-Hugo, Lo Re, and Falduto (2021), and Library of Congress (2022).

## B. Funds Data

Fund data come from EPFR, a commercial data provider used by financial professionals to track trends in the investment fund industry and by academic researchers (e.g., Fratzcher 2012). EPFR receives data from individual funds and then aggregates them. The share of funds reporting to EPFR has grown steadily over time, reaching over \$24 trillion in 2017, or about half of the entire asset management industry at that time. Table 2 below presents some descriptive statistics of these data.

From EPFR, we source two sets of variables. The first focuses on fund holdings. For each economy  $i$  and time  $t$ , we collect data on the stock of equity and bond assets held by all mutual

funds reporting to EPFR. These variables capture investors' decisions to allocate funds in specific mutual funds as well as decisions of fund managers regarding which economies to allocate the funds' capital to. These variables also reflect market pricing. Fund holdings data are available from 2002 for equity funds and 2004 for bond funds and end in the first quarter of 2024. We source holding variables separately for ESG funds and other funds; for each of these two categories we distinguish between (i) bond and equity funds, (ii) retail and institutional funds, and (iii) actively and passively managed funds. We clean these data by censoring observations in which the overall sum of equity and bond holdings is below \$1 million and removing economies for which data are available for less than 10 years.

We use ESG fund holdings as a proxy for sustainable investment. While this is the most comprehensive cross-economy measure available, it has limitations. ESG classifications are broad and heterogeneous, often encompassing social and governance factors alongside environmental ones. EPFR identifies Socially Responsible Investing (SRI) and Environmental, Social, and Governance (ESG) funds based on their investment mandate. EPFR classifies actively managed funds as SRI/ESG if they indicate their investment focus to be SRI/ESG or following the relevant financial disclosure rules if applicable.<sup>1</sup>

As a result, ESG investment does not always equate to green or climate-aligned investment. This introduces attenuation bias in our estimates if only a subset of ESG funds is genuinely green and is likely to understate the true effect of climate laws on green investment. To address this issue, we complement the economy-level analysis with a fund-level investigation to isolate funds with an explicit climate-related mandate, as described below. Lepers and De Crescenzo (2024) adopt an alternative approach to estimate investments into green assets, which relies on security level data. Using detailed data on individual funds' holdings sourced from Morningstar, they classify individual funds' portfolio holdings as green or not green using based on a definition of "green" asset at the security level based on the share revenues in green sectors (renewable energy, green transport and building) of the issuing company.

We collect another set of variables at the fund level. One variable measures total net purchases of fund shares during period  $t$  made by both individual and institutional investors. We define this variable as net investor flows. To standardize flows among different funds, we source data on assets under management by each fund at the beginning of period  $t$ . Finally, we also collect data on period-on-period changes in net asset value (NAV), excluding changes resulting from new investors' allocations.

Fund-level data are available at a weekly frequency. Like for economy-level data, the fund-level data are available beginning in 2002 and 2004 for both equity and bond funds. Following Ciminelli, Rogers, and Wu (2022), we exclude funds that are in the sample for less than 1 year, as well as small funds, defined as those with less than \$10 million of assets on average, and censor abnormal flows, defined as observations having flows larger than one-third of assets in absolute value.<sup>2</sup> We isolate funds with an explicit climate-related investment focus by applying a screening procedure using a simple keyword search approach. Specifically, we identify funds having relevant keywords (e.g., climate, net-zero, green, transition) in the fund name. This procedure

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<sup>1</sup> For example, in Europe, the tag is assigned in compliance with the European Union Sustainable Finance Disclosure Regulation (SFDR) classifications in fund documents and prospectuses. In March 2022, following adoption of the SFDR, EPFR adjusted its classification of European funds to align with its classifications and Article 9 standards. Funds designated as Articles 6, 7, or 8 are not automatically considered SRI/ESG. However, funds with an Article 6, 7, or 8 designation may still be tagged as SRI/ESG if they track an SRI/ESG benchmark or are marketed primarily as an SRI/ESG fund, as indicated by their name or main investment objective. EPFR classifies passively managed funds as SRI/ESG if they track an SRI/ESG benchmark. For simplicity, throughout the paper we refer to ESG/SRI funds as ESG funds.

<sup>2</sup> This is equivalent to winsorizing less than the top and the bottom percentiles of observations.

allows us to focus on funds with a clear mandate aligned with climate objectives. Appendix Table A1 shows the list of used keywords

### C. Green Bond Issuance Data

We use green bond issuance data to investigate how climate laws affect the supply of green assets. We collect this data from Refinitiv (LSEG), which offers broad coverage of corporate green bond issuances. To investigate how the private sector forms expectations about climate policies, we focus on corporate issuers and exclude green sovereign bonds. Furthermore, we exclude eurobonds (about 2,000 bond issuances), whose economy-level reporting in Refinitiv is imprecise (e.g., many are classified as Luxembourg-listed regardless of the issuer’s actual domicile). We aggregate 4,900 bond issuances at the economy-quarter level, starting from 2013.

### D. Other Data

Robustness checks and sensitivity analyses rely on a set of macroeconomic and policy variables. Specifically, we use the World Uncertainty Index (WUI) from Ahir, Bloom, and Furceri (2022) as a measure of economy-specific economic uncertainty; annual data on GDP in constant US dollars and population are sourced from the World Bank World Development Indicators. Quarterly data on exchange rates and inflation are from Haver Analytics.

For some extensions, we draw from the Organisation for Economic Co-operation and Development (OECD) Climate Action and Policies Measurement Framework (CAPMF) (Nachtigall et al. 2024). This is a structured and harmonized climate mitigation policy inventory to collect and compare detailed information on a wide range of mitigation policies and their attributes across several economies. The database covers 130 policy variables, grouped into 56 policy instruments, and provides the basis for computing comparable measures of mitigation policy stringency across economies. The data covers 50 OECD and G20 economies yearly from 1990 to 2023. We follow Nachtigall et al. to construct an overall economy-year measure of mitigation policy stringency at the economy level, averaging the 56 policy instruments this policy inventory covers. To proxy for institutional quality, we source measures of government effectiveness and political stability and absence of terrorism from the World Bank’s Worldwide Governance Indicators database.

## IV. EMPIRICAL STRATEGY

This section describes the construction of the two outcome variables that are used in the baseline DiD model with staggered treatment, reviews the construction of the treatment indicator and the control group, and discusses the baseline econometric model.

### A. Construction of the Main Outcome Variable

The main outcome variable measures economy  $i$ ’s financial assets (i.e., equity and bond holdings) managed by ESG funds as a share of all investment funds’ financial assets of the same economy  $i$  (i.e. ESG and non-ESG funds):

$$Y_{i,t} = \frac{A_{i,t}^{ESG}}{A_{i,t}^{ESG} + A_{i,t}^{nESG}} \quad (1)$$

where  $A_{i,t}^j$  stands for the stock of economy  $i$ ’s equity and bond assets under management by mutual funds of type  $j$  at time  $t$ ; the superscript  $j$  denotes either ESG or non-ESG funds. The variable is measured at the quarterly frequency (end of period).  $Y_{i,t}$  thus measures the share of

economy  $i$ 's assets held by ESG-mandated funds as a share of total assets held by all mutual funds. This measure accounts for common factors that drive both ESG and non-ESG funds, such as macroeconomic development, market performance, and market sentiment.

To calculate  $Y_{i,t}$ , we use information from the universe of funds, irrespective of their economy of domicile. Hence,  $Y_{i,t}$  does not measure holdings of specific foreign or domestic investors but rather focuses on global holdings of ESG assets traded in economy  $i$ . It allows for investigating whether climate laws affect sustainable investment in the economy that has adopted a climate law, regardless of the nationality of the final investors.

The introduction of climate laws could affect the share of assets held by ESG funds—that is, the dependent variable—through three channels. First, investor demand: if a new climate law strengthens investor preference for ESG assets, ESG mutual funds will attract larger inflows and purchase more of the economy's securities they invest in, raising the ESG funds' share. Second, asset supply: if the introduction of a climate law leads more corporations to issue ESG securities (increasing the supply of ESG assets), this enables ESG funds to increase their holdings in that economy. Third, valuation effects: the adoption of a climate law could raise the price of ESG assets (for instance, owing to improved market sentiment or changes in investors' expectations); this will increase the mark-to-market value of ESG fund holdings in economy  $i$ , boosting their share of total holdings.

In Section VII, we disentangle the demand, supply, and valuation channels by examining green bond issuance (supply), ESG fund portfolio shifts (demand), and NAV changes (valuation) following the introduction of climate laws.

## **B. Construction of the Treatment Indicator and Control Group**

The treatment group comprises economies that introduce a climate law. We adopt three increasingly specific treatment definitions, according to the type of targets introduced by the climate law. The first definition includes all climate laws defined above (i.e., net-zero laws, interim laws, or qualitative targets). The second definition includes only quantitative climate laws (net-zero and interim laws). The third definition includes only net-zero climate laws. The latter treatment group then excludes economies that have also adopted either an intermediate target or a qualitative law. These treatment groups allow us to neatly isolate the effect of net-zero laws from the effect of qualitative or interim laws.

The estimation sample includes 43 economies that have passed a climate law (regardless of the type), 28 that have introduced quantitative climate laws (laws with net-zero or intermediate quantitative emission targets or both), and 16 that have adopted a net-zero law but not a qualitative or an intermediate target law.<sup>3</sup> In the first two definitions, when more than one law is passed, the treatment date is given by the first law. We consider an economy treated in the quarter in which the corresponding climate law is passed and disregard subsequent amendments or updates.

In a few cases, there is a difference between the adoption and the entry into force of climate laws. We focus on adoption. This is more conservative, as passed-but-not-yet-enforced laws could lead to lower estimates, especially if implementation is uncertain. Focusing on entry into force would also make it more likely to violate a “no anticipation” assumption as markets have time to adjust in the time span between the approval of the law and its entry into force. Below, we find statistically support for the no anticipation as well as parallel trends assumptions.

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<sup>3</sup> Relative to the economies listed in Table 1, we lose 14 economies for which mutual fund data are not available.

We construct a “clean” control group comprising exclusively economies that have not passed any climate law in the period of study or before (i.e., “never treated” economies). This implies that economies in any treatment group (net-zero, interim, or qualitative climate laws) are never in the control group.<sup>4</sup> Finally, we do not include in the control group the 11 economies of the European Union that did not have a national climate law at the time of writing.<sup>5</sup> This is because the European Union Climate Law of June 2021 sets climate objectives for all its members. The final control group consists of 51 economies.

Economies in the treated and control groups differ in many respects (Table 2). Treated economies tend to be more developed (higher GDP per capita), have deeper financial markets (higher amount of bond and equity assets detained by mutual funds as a share of GDP), and have lower inflation, and are more likely to be OECD and G20 economies. In light of these differences, the analysis carefully assesses and compares pre-treatment trends, accounts for macroeconomic differences by including control variables, and runs a robustness check including only OECD and G20 economies.

**Table 2: Descriptive Statistics of Economies in the Treated and Control Groups**

	A. Control			B. Treated: Any Climate Law		
	median	sd	# obs	median	sd	# obs
$Y_{i,t}$ (%)	0.53	3.02	2,878	1.03	4.61	2,057
Green bonds	0,00	0,11	2,787	0.00	0.61	1,964
CAPMF	1.71	0.58	112	2.7	1.01	362
GDP per capita (\$)	5 689	17 968	2,675	16 217	26 353	1,964
AUM over GDP (%)	0.03	0.12	2,675	0.07	0.13	1,964
Inflation rate (%)	3.65	8 079	2,204	2.41	10.78	1,854
WUI	0.15	0.21	2,724	0.22	0.21	1,895
OECD&G20 dummy	0.00	0.27	2,878	1.00	0.49	2,057
	C. Treated: Any Quantitative Law			D. Treated: Net-Zero Law Only		
$Y_{i,t}$ (%)	1.22	4.90	1,473	1.33	4.94	855
Green bonds	0.00	0.71	1,391	0.00	0.66	840
CAPMF	2.87	0.83	334	2.97	0.73	196
GDP per capita (\$)	42 961	24 610	1,391	40 973	18 260	840
AUM over GDP (%)	0.11	0.14	1,391	0.13	0.11	840
Inflation rate (%)	1.81	3.58	1,459	1.67	4.09	845
WUI	0.22	0.21	1,425	0.21	0.20	855
OECD&G20 dummy	1.00	0.32	1,473	1.00	0.25	855

AUM = assets under management, CAPMF = Climate Action and Policies Measurement Framework, G20 = Group of 20 economies, GDP = gross domestic product, OECD = Organisation for Economic Co-operation and Development, sd = standard deviation, WUI = World Uncertainty Index.

Note: See equation (1) for the definition of  $Y_{i,t}$ . “Green bonds” denotes the face value of green bond issuance per billion parts of US dollar GDP. The standard deviation of the inflation rate in the control group is very high owing to the inclusion of Venezuela.

Source: Authors’ calculations.

<sup>4</sup> Most of the economies used in the empirical analysis below are signatories of the 2015 Paris Agreement. Thus, even in the absence of domestic climate laws, these economies have likely undertaken non-legally binding mitigation commitments. This implies that the empirical analysis identifies the causal effects of legally binding mitigation commitments (i.e., climate laws) by comparing them with non-legally binding commitments rather than no commitments.

<sup>5</sup> Belgium, Cyprus, Czechia, Estonia, Italy, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

### C. Baseline Model and Identification

The main econometric analysis employs a DiD specification at the economy-quarter level. The identification strategy compares the before-and-after difference in the share of ESG fund holdings between economies that have passed a climate law and those that have never passed a climate law (during the sample period and before). A DiD strategy is appropriate here as it accounts for systematic differences between treatment and control group including time-invariant economy characteristics (such as the electorate’s underlying support for mitigation policy, baseline carbon intensity, depth and sophistication of domestic capital markets, investor risk tolerance, legal origin, and regulatory quality), as well as common global shocks (such as changes in global ESG demand and financial conditions).

We expect treatment effects to be heterogeneous, as economies adopt climate laws that differ in objectives, governance, and implementation agenda. Indeed, we document below that observable differences in the treatment are important drivers of the estimated treatment effects. To address treatment effect’s heterogeneity, we employ the estimator of Callaway and Sant’Anna (2021), who revisit and improve the traditional two-way fixed effects estimator. This estimator has two main advantages. First, it avoids the pitfalls of the traditional two-way fixed effects estimator, which delivers biased estimates of treatment effects because of “forbidden comparisons” between treated and already-treated units (Roth et al. 2023). Second, it offers estimates of cohort-time average treatment effects that can be aggregated in different ways to explore treatment heterogeneity.

All economies  $i$  that introduce a climate law for the first time (i.e., those economies that receive treatment) in quarter  $g$  form a treatment cohort, denoted with  $G_i = g$ . Control economies never introduce a climate law so that, for them,  $G_i = \infty$ . We are interested in the cohort-time average treatment effects on the treated for each cohort  $g$  and quarter  $t$  (with  $t > g$ ), defined as follows:

$$ATT(g, t) = \mathbb{E}[Y_{i,t}(g) - Y_{i,t}(\infty) | G_i = g] \quad (2)$$

where  $Y_{i,t}(g)$  is the potential outcome of economy  $i$  at time  $t$  from starting treatment at time  $g$  and  $Y_{i,t}(\infty)$  is the outcome for the same economy if it remained untreated. As an example,  $ATT(2021Q1, 2022Q1)$  is the treatment effect on ESG holdings in the first quarter of 2022 owing to the passing of a climate law in the first quarter of 2021. Let  $p = t - g$  denote the period between the post-treatment quarter  $t$  and the treatment quarter  $g$ . If climate laws increase an economy’s attractiveness for green investment, we expect the ATT estimates to be positive and statistically significant for at least some post-treatment period  $p$ .

As in all DiD studies,  $ATT(g, t)$  cannot be obtained from observational data because the counterfactual (i.e.,  $Y_{i,t}(\infty)$ ) is unobservable. However, the DiD estimator can be retrieved by invoking two identifying assumptions: parallel trends and no anticipation.

The parallel trend assumption is satisfied if, in the absence of a climate law, ESG funds’ holding shares would have evolved along parallel trends in treated and control economies. Because we use a clean control group that excludes not-yet-treated economies, the assumption needs to be satisfied only post-treatment, allowing for treatment and control groups to evolve differently in the early years of observation (Callaway and Sant’Anna 2021). The no anticipation assumption is satisfied if ESG fund holdings do not react to the expectation that a climate law will be introduced or if there are no such expectations. We draw support for both assumptions verifying that the estimated ATT is zero in periods before treatment.

In some specifications, we relax the unconditional parallel trend assumption by requiring that it be satisfied conditional on observable macroeconomic drivers of investment (inflation, GDP growth,

stock returns, and exchange rate). We introduce these controls using the method of Sant’Anna and Zhao (2020), which includes in the outcome regression the probability of being treated conditional on observables (i.e., the propensity score). This method is robust to misspecifications of both the outcome and the propensity score regressions, contrary to linear conditional DiD estimators.

If the parallel trend and no anticipation assumptions are satisfied, an estimate of the cohort-time average treatment effect ( $\widehat{ATT}(g, t)$ ) can be obtained from observational data, with the estimation repeated for each cohort  $g$ . This step resembles the standard “dynamic” DiD procedure, delivering estimates for each post-treatment period ( $p = t - g$ ) to create event studies.

It is impractical to show the  $\widehat{ATT}(g, t)$  for all  $g$  and  $t$  combinations for each specification. The baseline estimation yields thousands of them. We thus compute averages of the cohort-time average treatment effects as suggested by Callaway and Sant’Anna (2021). We form per-period averages considering the length of time from the treatment measured in quarters (i.e.,  $p = t - g$ ). Plotting these averages at  $p = 1, 2, \dots$  yields event study graphs showing how the average treatment effect evolves over time.

To retrieve aggregate ATTs, we average these estimates in three ways, differing in how they weight each estimate. First, we consider the difference between the post-treatment period ( $p > 0$ ) and pre-treatment period ( $p < 0$ ) averages of per-period outcomes across cohorts; we call this “difference of averages,” the  $ATT_{post}$ . Second, we consider the (unweighted) across-cohorts average of effects, calculated for each cohort as the difference between the post- and pre-treatment average outcomes; we call this “average of differences,” the  $ATT_{group}$ . Finally, we consider a weighted average of all the  $ATT(g, t)$  with weights chosen so that each economy and period has equal weight; we call this “weighted average,”  $ATT$ , as it is the closest to the traditional average treatment on the treated definition.

## V. MAIN RESULTS

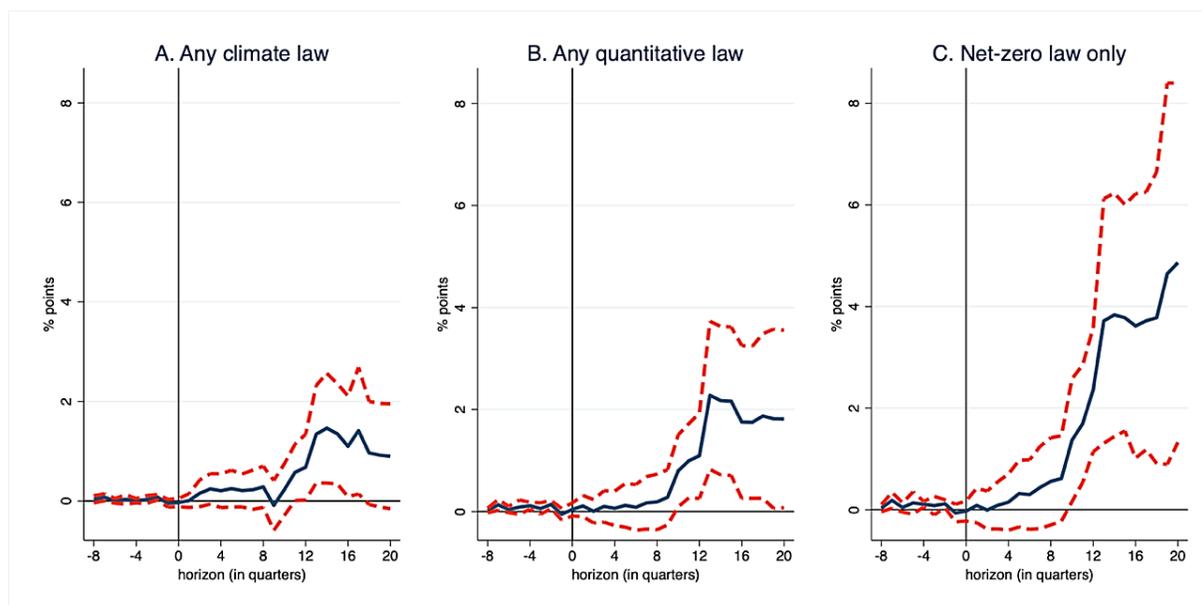
We estimate our baseline specification over the 2010Q1 to 2024Q1 period. Most of economies with a climate law adopted it starting from the second half of the 2010s (Table 1).<sup>6</sup> We exclude the years before 2010, to avoid the global financial crisis confounding results.

Figure 1 presents our main results on the dynamic effect of passing a climate law on the share of ESG fund holdings. We show estimates for a 29-quarter horizon, covering 8 quarters before approval of the climate law and 20 quarters after it. We compare three different treatments. The first treatment (Panel A) applies our most encompassing climate law definition; this includes all types of climate laws: net-zero, interim, and qualitative. The second (Panel B) focuses on the adoption of any quantitative climate law, be it net-zero or interim target; this estimation hence excludes economies with only a qualitative climate law from both the treatment and the control groups. The third (Panel C) includes economies that have exclusively adopted a net-zero law, meaning that economies with an interim or qualitative law are excluded from the treatment and control groups.

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<sup>6</sup> Most of economies that have adopted a climate law did so starting in the second half of the 2010s and only a few did so before 2010. These are Slovenia (June 2006, qualitative law), the Philippines (September 2009, qualitative law), the United Kingdom (December 2008, net-zero law), and Brazil (December 2009, interim law). In a sensitivity analysis, we show our results do not depend on the sample starting point and thereby on the exclusion of these four instances. Note that two cases of the adoption of a framework law, by Japan (December 1998) and by New Zealand (December 2002), are also lost, but this owes to equity fund data unavailability prior to 2004.

**Figure 1: Effect of Climate Laws on the Share of Mutual Fund Assets Managed by ESG Funds**



ESG = environmental, social, and governance.

Note: Estimates from a differences-in-differences regression model with staggered treatment. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

The results across the different types of treatment are qualitatively similar. First, in the pre-treatment periods, the effects are precisely estimated around zero, supporting the assumptions of parallel trends and no anticipation. Second, across the three types of treatment, we find an increase in the share of assets held by ESG funds in an economy following the climate law's adoption relative to the counterfactual (i.e., economies that do not adopt climate laws). However, for the two broad definitions of climate laws as defined above, any climate law (Panel A) and only quantitative laws (Panel B), the estimated treatment effects are statistically insignificant over most of the post-treatment period and tend to level off or reverse at the end of it.

Estimates in Panel C, focusing exclusively on net-zero laws, show instead a statistically significant and quantitatively large increase in the share of ESG fund holdings after the adoption of climate laws. This increase is not statistically significant in the first 8 quarters but rapidly gains pace and statistical significance over the rest of the post-treatment horizon. The point estimates suggest that, 3 years after adoption, the share of ESG funds is about 2 percentage points higher than what it would have been without the climate law; 4 years after adoption, the difference rises to about 3 percentage points, and it increases to nearly 5 percentage points 5 years after adoption. The 90% confidence interval of the estimated effect becomes larger over time because fewer economies are observed at longer post-treatment horizons. This compositional effect may also explain the increase in the estimated average effect.

These estimates underscore the importance of climate laws—and in particular net-zero laws—in driving sustainable finance but also raise questions regarding the timing of their impacts. The estimates become significant only after 10–12 quarters from adoption. As we discuss further below, this delayed response results from a mix of heterogeneous effects attributable to the level of government effectiveness and compositional effects across early and late adopters.

The estimated effects are large, particularly those of net-zero laws. A simple back-of-the-envelope calculation shows that the 5 percentage point increase in the share of ESG assets within 5 years following the adoption of a net-zero law may have resulted in the mobilization of additional sustainable finance equivalent to about 1.8% of GDP, on average, across the economies that had passed a net-zero law climate law and are considered in this study.<sup>7</sup> This figure captures the effect through mutual fund portfolios—including bond purchases where relevant—but abstracts from other channels of climate finance such as direct bank lending, private equity, or sovereign green bond issuance not held by mutual funds, which may also benefit from the climate law.

Next, we analyze the average treatments on the treated considering all estimation periods (not just the 20 quarters post-adoption shown above). Table 3 reports the three averaging methods suggested by Callaway and Sant’Anna (2021) and described above. The average effects broadly confirm the dynamic estimates reported in Figure 1, suggesting larger effects for climate laws setting net-zero targets. We confirm this by estimating the static effects of interim and framework laws in isolation in Appendix Table A2. We find weak and not statistically significant effects from the introduction of such laws.

**Table 3: Estimated Average Treatment Effects**

	(1) <i>ATT</i>	(2) <i>ATT<sub>post</sub></i>	(3) <i>ATT<sub>group</sub></i>
<b>A. Any climate law</b>	0.85** (0.34)	1.78*** (0.60)	0.66*** (0.21)
<b>B. Any quantitative law</b>	1.38*** (0.44)	2.60*** (0.67)	0.86*** (0.19)
<b>C. Net-zero law</b>	1.77*** (0.61)	3.30*** (0.73)	0.99*** (0.21)

Note: The first column reports the weighted average of all  $\overline{ATT}(g, t)$  across cohorts and periods, so that each economy and period are equally weighted; the second column reports the difference between post-treatment and pre-treatment averages across cohorts; the third column reports the average of post-treatment and pre-treatment differences. “Any climate law” refers to the treatment group with economies with any type of climate law (Row A)—i.e., net-zero, interim, and qualitative laws. “Any quantitative law” refers to the treatment group with economies with any quantitative climate target (Row B)—i.e., net-zero or interim targets. “Net-zero law” refers to the treatment group with economies that have adopted only a net-zero law (Row C).

Source: Authors’ calculations.

## A. Robustness Checks

Next, we present estimates from alternative specifications to assess the sensitivity of the baseline results. These robustness checks are performed on the specification in which the treatment group includes only net-zero laws (Figure 1, Panel C; Table 3, Row C); meaning that economies with other types of climate laws are excluded from both the treatment and the control groups. We perform three types of robustness checks: (i) checking if specific economies drive the result, (ii) checking if results are robust to changes in the estimation sample, and (iii) adding additional

<sup>7</sup> The baseline results imply that a net-zero law raises the ESG share of mutual fund holdings by about 5 percentage points within 5 years. To scale this, we use EPFR to compute mutual fund AUM as a share of GDP in economies at the time they adopted a net-zero law (average 18%). Because EPFR covers roughly half of the global mutual fund universe, we upscale by the inverse coverage ( $\times 2$ ), giving 36%. We then apply the estimated 5 percentage point effect—i.e., multiply by 0.05—to obtain  $0.36 \times 0.05 = 0.018$ , or 1.8% of GDP.

control variables in the DiD regression. Overall, these results point to the robustness of the baseline estimates.

### 1. Checking Whether Specific Economies Drive the Results

We divide the economies in our sample into 17 groups, each composed of four economies selected alphabetically, and we estimate 17 different specifications in which each group of economies is excluded one at a time. We plot the resulting point estimates together with the point estimate and confidence bands from the baseline specification in Appendix Figure A2. All estimates bar one fall within the baseline confidence bands and generally close to the baseline point estimates. This suggests that no specific economies or group of economies drive the baseline results. Only in one case (when Egypt, El Salvador, Finland, and France are excluded) does the point estimate rise briefly above the baseline confidence bands—and this is only at very long horizon.

### 2. Changing the Estimation Sample

Next, we extend the estimation backward in time. Our baseline sample starts in 2010, resulting in some economies being excluded from estimation. The United Kingdom, for instance, had already introduced a net-zero law in 2008 (the UK Climate Change Act). Hence, we run a specification with an extended sample starting in 2004 (earliest date in which mutual funds data are available). Second, we run a specification that includes only OECD and G20 economies. This further assuages the concern that, if economies passing climate laws are a selected sample, the parallel trend assumption might be violated. Third, given that the baseline specification excludes EU economies that do not have an economy-specific climate law—on the grounds that the EU has adopted its climate law setting a net-zero goal for 2050 for all EU member economies—we run two alternative specifications. One considers EU economies that do not have their own climate law as treated (i.e., part of the treated group); the other considers them as non-treated (i.e., part of the control group).

The average treatment effects from these robustness checks are reported in Table 4 (Columns 2–5). For simplicity, we also report only in Table 4 (Column 1) the *ATT* of the net-zero laws as estimated in our baseline specification (Table 3, Column 1). The robustness check estimates (Table 4, Column 2–5) are close to our baseline result and within its 95% confidence band.

**Table 4: Robustness Checks—Economy and Time Sample Stability**

(1) Baseline	(2) Start in 2004	(3) OECD&G20	(4) EU treated	(5) EU not treated
1.77*** (0.61)	1.52*** (0.55)	2.41*** (0.66)	1.18** (0.53)	1.51** (0.60)

EU = European Union, G20 = Group of 20 economies, OECD = Organisation for Economic Co-operation and Development.

Note: The table reports *ATT* estimates calculated with the equal weight method. The first column reports the baseline (net-zero laws) for comparison (Table 3, Column 1). In the other columns, the estimation sample changes as follows: Column (2) extends the sample back to 2004; Column (3) limits the estimation sample to OECD and G20 economies; Column 4 considers all EU economies treated from 2021 (the year of adoption of the European Climate Law); Column 5 considers all EU economies that do not have a national climate law in the control group.

Source: Authors' calculations.

### 3. Inclusion of Additional Control Variables in the Difference-in-Differences Regression

As additional regressors, we consider the log of GDP per capita (in US dollars), the log of the exchange rate against the US dollar, the inflation rate, and a measure of economy-specific uncertainty sourced from the WUI database (Ahir, Bloom, and Furceri 2022). Given limited coverage for some of these controls, we include them one at a time. The new estimates (Table 5) are again close to the baseline result and within its 95% confidence band.

**Table 5: Robustness Checks—Adding Control Variables**

(1) Baseline	(2) GDP	(3) Exchange rate	(4) Inflation	(5) WUI
1.77*** (0.61)	2.11*** (0.68)	1.72*** (0.61)	1.89*** (0.61)	1.79*** (0.61)

GDP = gross domestic product, WUI = World Uncertainty Index.

Note: The table reports *ATT* estimates calculated with the equal weight method. The first column reports the baseline (net-zero laws) for comparison (Table 3, Column 1), Columns (2) to (5) add a different control to the baseline regression.

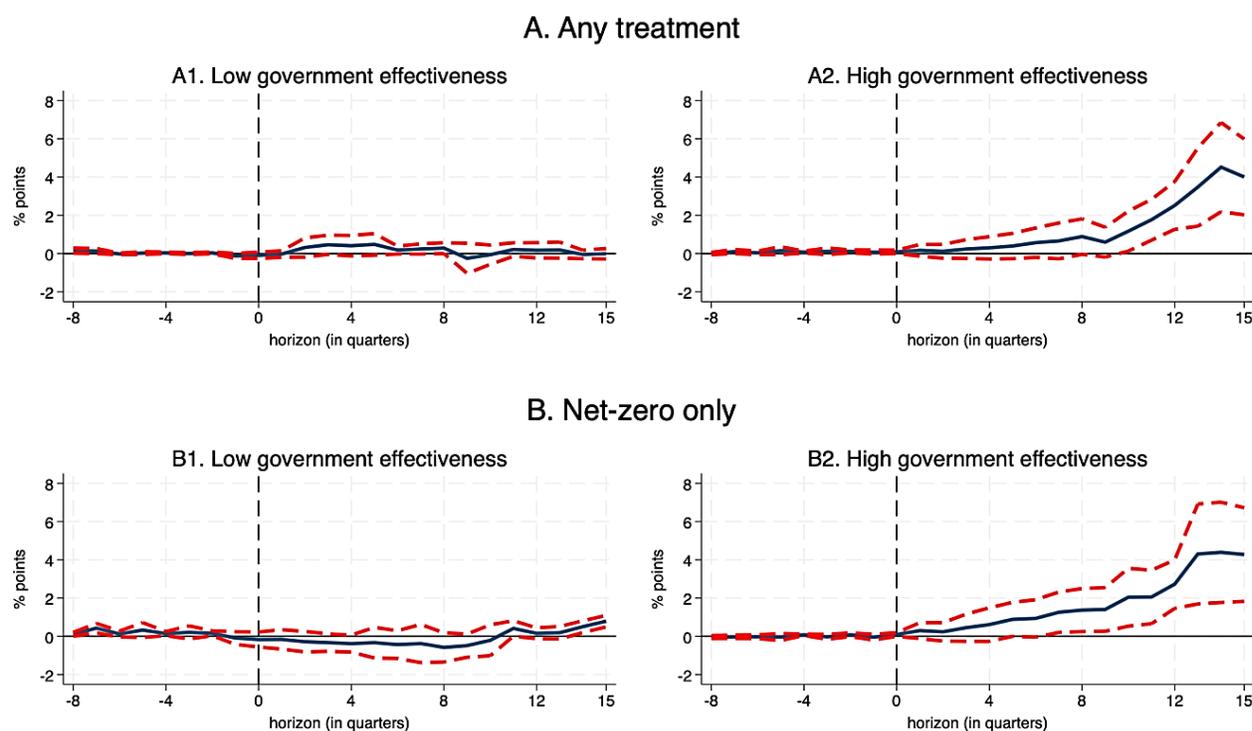
Source: Authors' calculations.

## B. The Role of Government Effectiveness

The impact of climate laws and its timing may depend on the institutional environment in which they are enacted. To test this, we split treated economies according to whether their mean government effectiveness (averaged over time) is above or below the median across all treated economies. The results are stark. In economies with below-median government effectiveness, climate laws have no discernible effect on ESG investment (Figure 2, Panels A1 and B1). By contrast, in economies with above-median effectiveness, the adoption of a climate law leads to a large and statistically significant increase in ESG fund holdings, in line with our baseline findings (Panels A2 and B2). This suggests climate laws are necessary but not sufficient to catalyze sustainable finance: they translate into investment only when governments have the capacity to implement and enforce them.

We ran the same exercise splitting economies by political stability and government effectiveness. While results are broadly consistent (estimates available upon request), government effectiveness displays the clearest differential effect. The policy implication is that, in economies with weaker institutions, the positive impact of climate laws on sustainable finance may be dependent on complementary measures to strengthen government effectiveness.

**Figure 2: Effect of Climate Laws on ESG Investment, by Government Effectiveness**



ESG = environmental, social, and governance.

Note: Estimates from a differences-in-differences regression model with staggered treatment. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands. Treated economies are split among low and high government effectiveness depending on whether their mean government effectiveness score is above/below the median of treated economies. Only a 15-quarter post-treatment horizon is considered owing to limited post-treatment data availability for net-zero law economies with low government effectiveness.

Source: Authors' calculations.

This exercise also sheds light on the reason for the delayed effect of climate laws estimated for the full sample of economies (Figure 1). With one exception, all economies with low government effectiveness passed net-zero laws in the last 3 years of our sample, meaning that we can estimate only short-run effects (up to 12 quarters post-adoption) for this set of economies.<sup>8</sup> Hence, our short-run estimates average the effects of net-zero laws in high- and low-government effectiveness economies, while longer-run estimates (from 12 quarters onward) reflect only effects in high government effectiveness. Indeed, when focusing exclusively on governments with high government effectiveness, the effect of net-zero laws is estimated to be equal to about 1 percentage point and statistically significant already 6 quarters after adoption (Figure 2, Panel D).

<sup>8</sup> The sample of high-government effectiveness economies includes Australia, Canada, Denmark, Finland, France, Germany, the Netherlands, and Sweden (mean government effectiveness score of 1.68). With the exception of Australia (September 2022) and Canada (June 2021), these economies all passed climate laws early in the sample (before 2021). The sample of low-government effectiveness economies includes Chile, Greece, Hungary, the Republic of Korea, Nigeria, Portugal, and Spain. With the exception of Hungary (June 2020), these economies all passed climate laws after 2021.

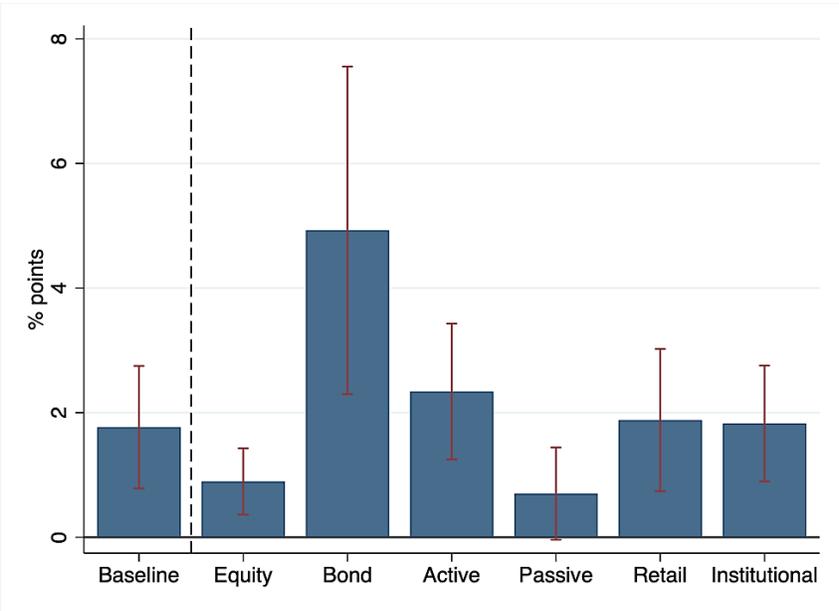
Still, even in the sample of high-government effectiveness economies, we find an acceleration in the estimated effect of net-zero laws at around quarter 12. This strengthening response could be because time is needed to implement the institutional changes mandated by climate laws (i.e., setting-up of advisory bodies and of coordination and accountability mechanisms) to become effective, credible, and visible to investors. As a result, investors may adjust their portfolios gradually.

### C. Heterogeneous Effects Across Mutual Fund Segments

Having established that climate laws matter only in effective institutional environments, we next explore how their impact differs across fund types. We categorize mutual funds across three dimensions: (i) equity vs. bond funds, (ii) actively managed vs. passively managed funds, and (iii) funds catering to retail investors vs. those catering to institutional investors. We estimate new *ATT*s separately for each category (Figure 3). We find a large difference between equity and bond funds, a small difference between active and passive funds, and virtually identical estimates for retail and institutional funds.

The coefficient estimate for bond funds is about five times larger than for equity funds in addition to being three times larger than the baseline estimate in Table 3 (Row C). The estimate for equity funds is lower than the baseline estimates but still statistically different from zero at the 90% confidence interval. The different estimates between equity and bond funds could be attributable to the high degree of development of green labels and external certificates for bonds meeting predefined criteria, making them easier to be identified and incorporated in ESG investment strategies when compared to equities. Moreover, green bonds allow companies and governments to fund specific projects without committing to a full-scale transformation of their activities. In contrast, ESG-compliant equity certification demands broader alignment with ESG principles by corporations. This is a far more challenging endeavor than funding specific green projects.

**Figure 3: Effect of Net-Zero Laws by Fund Type**

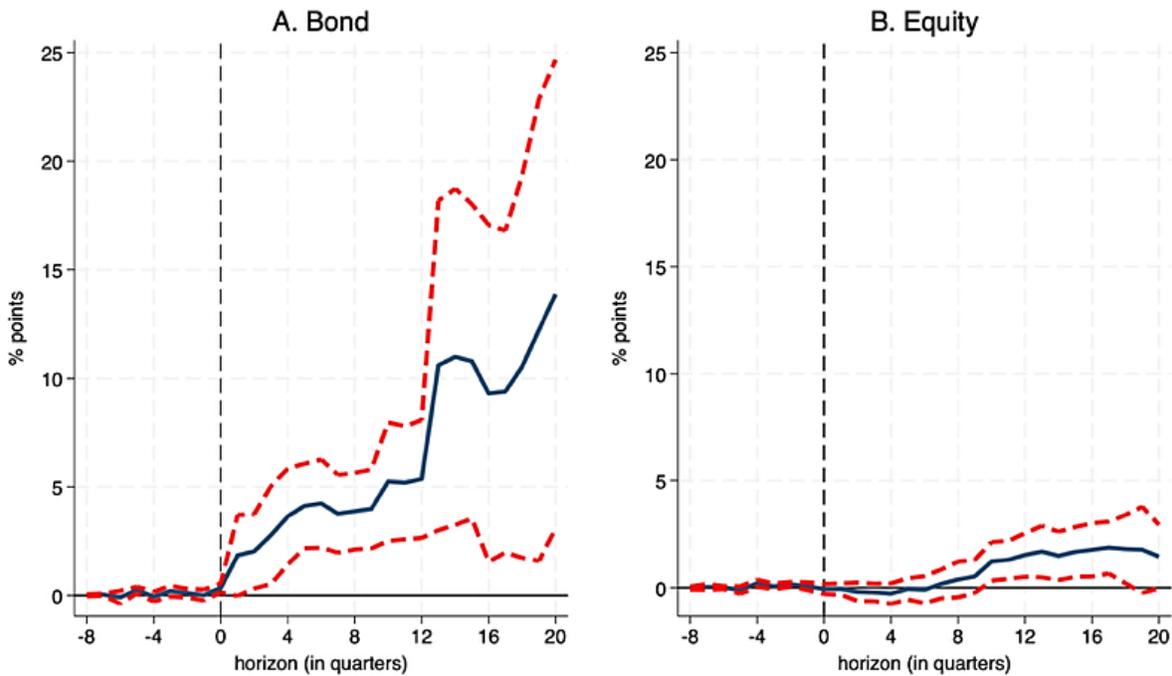


Note: *ATT* estimates from a differences-in-differences regression using the double-robust method of Sant’Anna and Zhao (2020). Blue bars denote point estimates, red whiskers are 90% confidence bands. Source: Authors’ calculations.

The weaker responsiveness of passive ESG funds may be attributable to the mandate of passive funds to track indexes. The development of ESG indexes requires sufficiently liquid markets for ESG-compliant securities, and such liquidity depends on the issuance and active trading of these securities by active investors.

In light of the large average effects of net-zero laws on bond funds, we estimate the dynamic effects for bond and equity ESG shares separately. The results for bond shares (Figure 4, Panel A) are qualitatively similar but quantitatively larger than the baseline estimates (Figure 1, Panel C). The estimated effect is statistically significant a few quarters from the climate law’s adoption and reaches almost 15 percentage points after 20 quarters. The estimated effects of equity (Figure 4, Panel B) are marginal.

**Figure 4: Effect of Climate Laws on the Share of Bond and Equity Assets Managed by ESG Funds**



ESG = environmental, social, and governance.

Note: Estimates from a differences-in-differences regression model with staggered treatment. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors’ calculations.

## VI. THE ROLE OF MITIGATION POLICY STRINGENCY AND UNCERTAINTY

In this section, we investigate two channels through which climate laws can impact ESG fund holdings. First, economies that have adopted a climate law may subsequently increase the stringency of climate change mitigation policies to meet the targets laid down by the law. Climate change mitigation policies work by shifting the fundamentals of green and brown assets,

increasing the expected cash flows or return on green assets relative to brown ones.<sup>9</sup> This, in turn, should lead to greater capital inflows into ESG assets, increasing their share in total mutual fund assets. We call this the mitigation policy stringency channel.

Second, climate laws reduce policy risks associated with ESG assets owing to a more predictable policy environment. By codifying mitigation targets into binding legal obligations and signaling government commitment, climate laws enhance the predictability and credibility of future mitigation policies. This can reduce policy uncertainty through mitigation policy “forward guidance,” expanding the scope for judicial review, and strengthening accountability mechanisms. Climate policies also make it more difficult for future governments to reverse mitigation policies. All this is expected to lower policy uncertainty and contribute to insulating sustainable investment decisions from political cycles.

From a risk management perspective, this lower policy uncertainty implies a decline in the volatility of expected returns.<sup>10</sup> In this view, climate laws not only act as enablers of future mitigation policies (which directly affects the relative profitability of sustainable investment projects and the return of the underlying assets) but also provide signals and legal obligations that reduce the risks of sustainable investment, further enhancing its attractiveness. We call this the policy uncertainty channel.

Below, we focus on bond assets, as these drive our baseline results, and provide evidence supporting both the mitigation policy stringency channel and the policy uncertainty channel. We do this in four steps. First, we find that net-zero laws are followed by increased mitigation policy stringency. Second, we estimate that they reduce the sensitivity of green investment to political turnover, supporting the policy uncertainty channel. Third, we estimate the effects of net-zero laws controlling for future changes in climate policy stringency and find a reduced but still statistically significant and economically meaningful effect, which further supports the importance of the reduced policy uncertainty channel. Fourth, we report evidence showing that the climate laws reduce the return volatility of green bond funds.

## **A. Evolution of Mitigation Policy Stringency and Uncertainty After the Adoption of Net-Zero Laws**

First, using the mitigation policy stringency index of Nachtigall et al. (2024) as the outcome variable of our DiD setting, results in the Appendix show that the stringency of climate mitigation policies increases more in economies that pass a net-zero law than in economies that do not (Figure A3).

Second, we examine whether political turnover affects ESG investment after the adoption of a net-zero law. This analysis draws from a large literature (predominantly focused on the US) showing that government cycles and the associated policy uncertainty affect returns and fund allocation (Białkowski, Gottschalk, and Wisniewski 2008; Pástor and Veronesi 2020), including for sustainable assets (Morales, Soler-Domínguez, and Hanly 2019; Cosma et al. 2025). We

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<sup>9</sup> In standard asset pricing models, expected returns reflect both expected cash flows and risk premia. When climate mitigation policies improve the growth prospects of green firms or the return of green projects, investors revise their cash flow expectations upward. This leads to higher current valuations. However, as prices adjust, the required return going forward declines—since part of the gain is realized immediately through revaluation, reducing future expected returns (Bolton and Kacperczyk 2023).

<sup>10</sup> Reduced mitigation policy uncertainty lowers the relative perceived risk associated with ESG investments, decreasing the risk premium investors require. In present value terms, this corresponds to a lower discount rate, which raises valuations without affecting expected cash flows. In equilibrium, this implies higher prices and lower expected returns. However, from a portfolio perspective, the improvement in the risk–return tradeoff—i.e., a higher Sharpe ratio—makes ESG assets more attractive even in the absence of return differentials. In equilibrium, this implies higher prices and lower forward-looking returns.

restrict the sample to economies that have adopted a net-zero climate law and to the years after its adoption. Economies that experience a change in government (after the adoption of the net-zero law) are assigned to the treatment group, whereas economies that do not experience a change in government fall in the control group. We capture the change in government by the change in the party affiliation of the head of government and use the timing of this change as the treatment date.<sup>11</sup>

The results show no statistically significant effect of government changes on ESG fund holdings (Figure A4). While political turnover is only an indirect proxy for policy uncertainty, the absence of a significant effect supports the interpretation that net-zero laws enhance policy credibility as they insulate ESG investment from political change.<sup>12</sup>

## **B. The Relative Contribution of Mitigation Policy Stringency and Uncertainty**

Next, we run variations of our baseline DiD regression specification, controlling or not for future changes in mitigation policy stringency. This attempts to net out the effect of mitigation policy stringency on sustainable investment. In other words, controlling for mitigation policy stringency helps us better distinguish the effect of climate laws on sustainable investment over and above that generated by stringency alone. Since investor expectations about future policy stringency likely embed beliefs about the credibility of climate policy, we cannot fully disentangle the policy stringency from the uncertainty channel. Despite this caveat, however, we view this approach as an informative test of whether the observed effect of climate laws on ESG investment can be fully attributed to expected increases in policy stringency or also to other factors that go beyond policy stringency.

First, we estimate our baseline DiD specification without controlling for policy stringency. This specification replicates the baseline results for the effect of net-zero laws shown above (Figure 4) for the subsample of economies for which we have mitigation policy stringency data. This specification yields a large and statistically significant increase in ESG bond fund holdings (Figure 5, Panel A), consistent with the result in Figure 3. Next, we add the cumulative 4-year ahead change in mitigation policy stringency as a control variable (Figure 5, Panel B). Doing this markedly lowers the estimated impact of climate laws on sustainable investment, which nevertheless remains statistically significant. The effect peaks at over 3 percentage points.

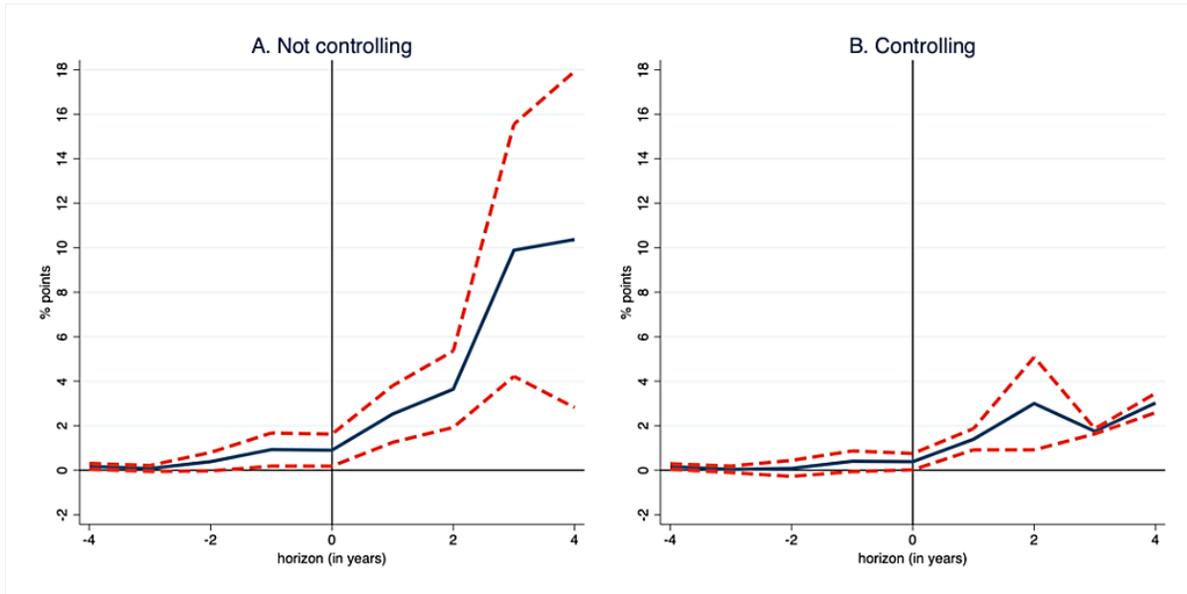
The considerably weaker effect estimated controlling for future changes in policy stringency suggests that most of the effect of net-zero laws reported above is attributable to the expected tightening of climate policies following the adoption of the net-zero law. However, the persistence of a statistically significant and economically meaningful effect after controlling for policy stringency supports the view that the impact of climate laws on the share of ESG mutual funds operates through other channels also. These results, in conjunction with those reported above on the absence of effects of government changes on sustainable investment in economies that have passed a net-zero laws, suggest that lower policy uncertainty and investors' risk perceptions are among the factors via which climate laws affect sustainable investment in addition to the expected increase in policy stringency.

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<sup>11</sup> These economies are Germany (December 2021), Finland (June 2019), France (June 2017), the Republic of Korea (May 2022), and Sweden (October 2022).

<sup>12</sup> Our test assesses whether, in economies with a net-zero climate law, a change in government—potentially from a pro-climate to a less climate-committed administration—affects ESG fund holdings. This directly captures whether climate laws reduce the risk of policy reversal. We do not extend the analysis to economies without a climate law as this would introduce significant ambiguity, as the climate stance of the outgoing and incoming governments is unknown, making any differential effect hard to interpret.

**Figure 5: Effect of Climate Laws on the Share of ESG Bond Assets (Not) Controlling for Forward Future Changes in Mitigation Policy Stringency**



ESG = environmental, social, and governance.

Note: Estimates from a differences-in-differences regression model with staggered treatment. Panel A: replicates the results from Figure 3, restricted to yearly data and the subsample of economies with available mitigation policy stringency data; Panel B: includes the 4-year forward change in mitigation policy stringency as control. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

### C. Green Funds Return Volatility After Net-Zero Laws

This subsection reports results from tests of whether net-zero laws lower the return volatility of funds with a climate-related mandate. Evidence in this direction would support the view that such laws enhance the risk profile of green assets, consistent with the findings reported above indicating that net-zero laws lower policy uncertainty.

This analysis uses fund-level data and distinguishes between green and non-green funds by looking at the fund name, as explained in Section III. Given that green funds investing in specific economies are few, we run the analysis on global funds—that is, funds that have the mandate to invest in any economy of the world. This means we are not able to compare treated with control economies. The identification relies on considering the adoption of each net-zero law as an event potentially affecting the investment decisions of global funds and testing whether these events affect green global funds differently from non-green global funds. This approach is similar in spirit to that used by Te Kaat, Raabe, and Tian (2024) to analyze the effect of the US Inflation Reduction Act on ESG mutual funds inflows, with the important difference that we focus on multiple events.

Given that economies differ in economic size, we give more weight to net-zero laws passed in larger economies by using GDP weights. We employ the local projections method as the empirical framework. This approach was pioneered by Jordà (2005) and has been widely used as a flexible alternative to autoregressive distributed lag specifications to derive impulse response functions (Auerbach and Gorodnichenko 2012, Jordà and Taylor 2016, Romer and Romer 2017, Ramey and Zubairy 2018). Specifically, for each horizon  $h$ , we estimate the following regression:

$$\begin{aligned} \sigma_{n_{j,t+h:t+h-11}} - \sigma_{n_{j,t-1:t-12}} &= \beta^h(x_t * Green_j) + \sum_{f=1}^h \vartheta^{h,f}(x_{t+f} * Green_j) \\ &+ \sum_{l=1}^4 \delta^{h,l} n_{j,t-l} + \sum_{l=1}^4 \gamma^{h,l} \frac{F_{j,t-l}}{a_{j,t-l}} + \tau_t + \mu_j + \varepsilon_{j,t} \end{aligned} \quad (3)$$

where subscripts  $j$  and  $t$  denote fund and time, respectively;  $\sigma_{n_{j,t:t-11}}$  is the 12-week lagging standard deviation of fund  $j$ 's returns at time  $t$  (the standard deviation of fund  $j$ 's return between week  $t-11$  and  $t$ ). The dependent variable then measures the change in the 12-month lagged volatility of fund returns over the  $t+h$  to  $t$  periods.

The main explanatory variable is  $x_t$ : an interaction between a dummy variable taking value 1 at the time in which a climate law is passed and the share in world GDP of the economy that has passed the climate law.  $Green_j$  is a dummy variable taking value 1 for green funds and 0 otherwise;  $F_{j,t}$  is investors' net purchase of shares of fund  $j$  at period  $t$  and  $a_{j,t}$  is the volume of assets under management by fund  $j$  at the beginning of period  $t$ ;  $\tau_t$  are time fixed effects included to account for all global shocks driving return volatility uniformly across green and non-green funds, such as, for instance, monetary policy shocks, increases in risk appetite, etc.;  $\mu_j$  are investment fund fixed effects that take into account time-invariant fund characteristics; and  $\varepsilon_{j,t}$  is the error term, assumed to be uncorrelated with the regressors.

The regression includes forward values of the explanatory variable interacted with the *Green* dummy,  $\sum_{f=1}^h \vartheta^{h,f}(x_{t+f} * Green_j)$ , to control for the passing of net-zero laws happening within the  $t + h$  horizon not captured by the explanatory variable at time  $t$ , and whose omission would lead to biased estimates (Teulings and Zubanov 2013). We also include four lags of one-period fund returns (captured by the term  $\sum_{l=0}^4 \delta^{h,l} n_{j,t-l}$ ) and four lags of one-period fund flows in the regression (captured by the term  $\sum_{l=1}^4 \gamma^{h,l} \frac{F_{j,t-l}}{A_{j,t-l}}$ ).

The  $\beta^h$ s are the coefficients of interest. They measure the mean cumulative additional effect on return volatility, in green funds relative to non-green funds over the  $t$  to  $t + h$  horizon, of the adoption of a net-zero law at time  $t$  in an economy with a world GDP share of 1%.

We carry out the analysis using weekly data. We consider a 25-week horizon, including the week of adoption, and the 24 following ones. We perform the estimation through Ordinary Least Squares (OLS) with two-way clustered standard errors (fund  $i$  and time  $t$ ). This clustering approach accounts for both autocorrelation in return volatility within the same fund and for cross-fund correlation within the same period. We plot impulse response functions (IRFs) using the estimated coefficients ( $\widehat{\beta}^h$ s) as point estimates and construct 90% confidence bands based on their associated standard errors.

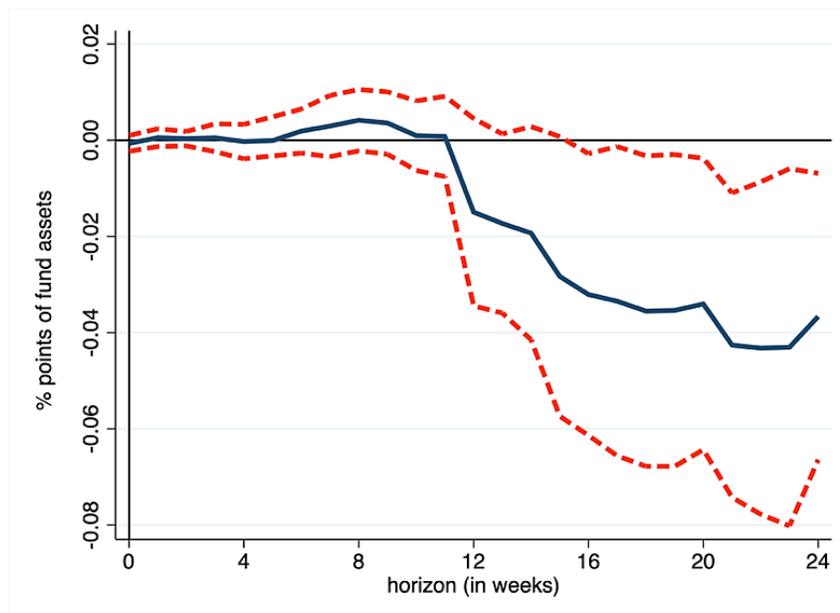
The results point to no meaningful change in the 12-week lagging return volatility in green funds relative non-green funds in the first few weeks after the passing of a net-zero law (Figure 6). However, the return volatility of green funds starts declining around week 10 and keeps doing so until week 20, when it levels off. The estimated effect is statistically significant from week 15 onward. At week 24, the effect is estimated to be almost equal to -0.04 percentage points of fund assets. This implies a return volatility reduction of about 7% in the median fund.<sup>13</sup>

These results align with theoretical and empirical findings in the literature on policy uncertainty and institutional signaling. Studies such as Pástor and Veronesi (2012, 2013) and Brogaard and Detzel (2015) show that markets gradually adjust to credible policy shifts, particularly when such

<sup>13</sup> The return volatility is about 0.60 and 0.56 percentage points of fund assets among, respectively, ESG and non-ESG funds.

shifts reduce long-term uncertainty. In this context, the results reported above suggest that net-zero climate laws function as credible commitment devices that lower the perceived risk of green assets by anchoring expectations about future mitigation policy.

**Figure 6: Differential Effect of Net-Zero Laws on Global Green Funds' Return Volatility Relative to Global Non-Green Funds**



Note: Estimates from a local projection model, measuring the mean cumulative additional effect of the adoption of a net-zero law at time  $t$  in an economy with a world gross domestic product share of 1% on the 12-week rolling standard deviation of returns, differentially in green funds relative to non-green funds over the  $t+h$  horizon. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

## VII. DECOMPOSING THE ROLE OF SUPPLY, DEMAND, AND ASSET PRICING

This section uses fund-level and bond issuance-level data to disentangle the role of supply, demand, and asset pricing in explaining our main result. First, climate laws may lead to an increase in the availability of investible green assets (through the issuance of new green bonds or equity capital by climate-aligned firms)—that is, the supply effect (supply of green assets). Second, climate laws may increase investors inflows into green mutual funds—that is, the demand effect (demand for green assets). Third, changes in the relative demand and supply of assets could alter the value of green assets relative to non-green assets—that is, the asset pricing effect.

As above, we focus this analysis on bonds as data on the supply of capital by ESG/green stocks are not available.

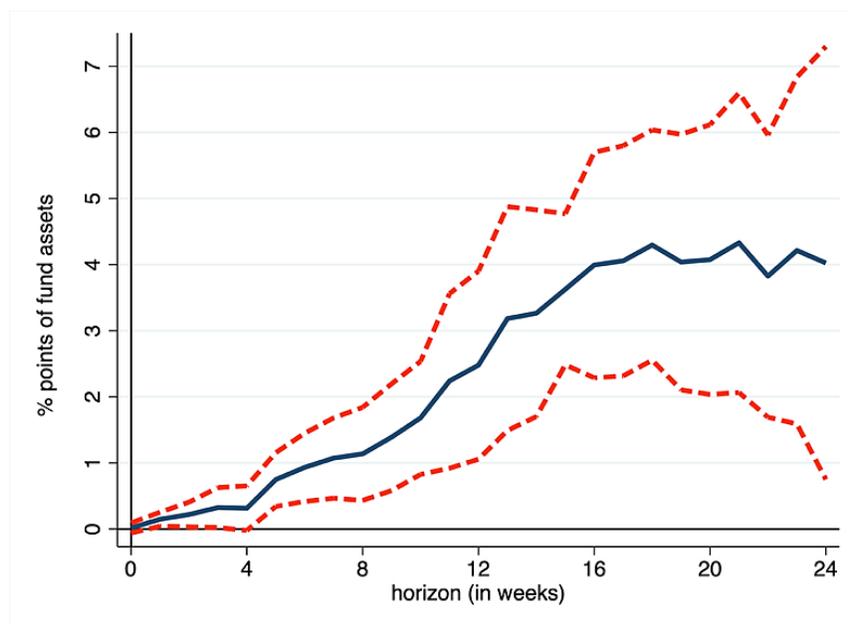
### A. Demand for Green Assets

We focus on the response of individual investors in the weeks after the passing of net-zero laws. The analysis is at the fund level and considers the differential effect of net-zero laws on inflows into green funds relative to similar non-green funds, using the empirical framework in equation (3). The only difference concerns the dependent variable, which here is given by the net

cumulative fund inflow over the  $t$  to  $t+h$  periods divided by fund assets at the beginning of the period. As above, estimates are shown in the form of IRFs.

Results indicate a positive and persistent effect of climate laws on the demand for green assets (Figure 7). Green fund inflows rise significantly in the weeks following the law, with cumulative effects at about 1 percentage point of fund assets by week 8 and about 4 percentage points by week 16, when the effect stabilizes. Importantly, the response begins to diverge from zero 4 weeks from the policy event.

**Figure 7: Differential Effect of Net-Zero Laws on Investors' Allocations into Global Green Bond Funds Relative to Global Non-Green Funds**



Note: Estimates from a local projection model, measuring the mean cumulative additional effect of the adoption of a net-zero law at time  $t$  in an economy with a world GDP share of 1% on new asset purchases (as % of total assets), differentially in green funds relative to non-green funds over the  $t$  to  $t+h$  horizon. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

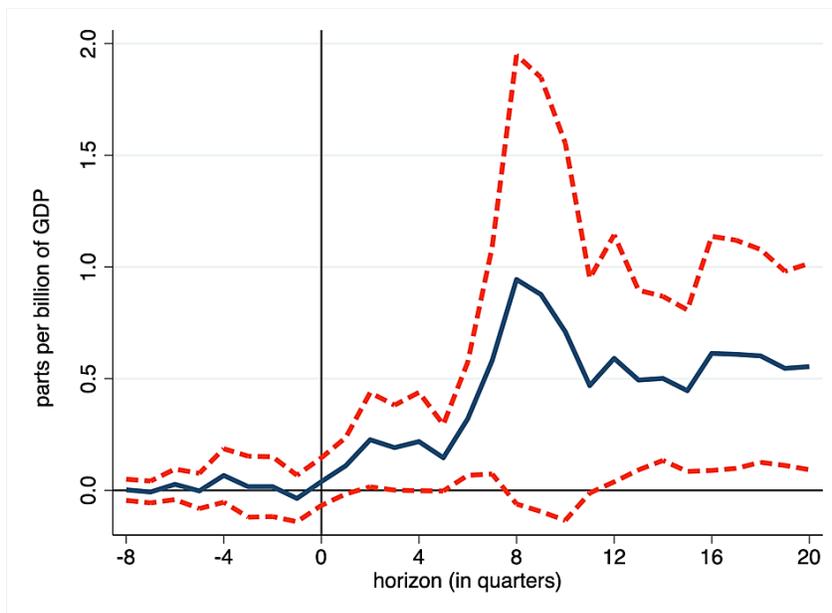
## B. Supply of Green Assets

To study supply effects, we turn to data on green bond issuance and revert to the DiD regression model with staggered treatment utilized in the baseline analysis, but changing the dependent variable. Specifically, the dependent variable here is given by the sum of the US dollar face value of all individual green bonds issued at the economy-quarter level, divided by nominal GDP in US dollars to rescale by the overall size of the economy. Given the relatively small size of green bond issuance in many economy-quarters, we express this variable in parts per billion (ppb) of GDP—that is, as the value of US dollars issued in green bonds per \$1 billion of GDP.

The event-study analysis presented in Figure 8 reveals a statistically and economically significant increase in green bond issuance following the adoption of climate laws. Reassuringly, in the quarters immediately preceding the enactment of a climate law, there is no discernible trend in issuance, suggesting the absence of strong pre-treatment dynamics. However, beginning around

2 quarters after the introduction of a climate law, issuance rises sharply, peaking approximately 8 quarters post-enactment at close to 1 ppb of GDP—an increase of about 1.7 standard deviations for treated economies. This surge appears persistent over the medium term, indicating that climate laws may play an important role in catalyzing the supply of green finance. The confidence bands exclude zero from approximately quarter 4 onward, supporting the interpretation that this pattern reflects a statistically robust treatment effect.

**Figure 8: Effect of Net-Zero Laws on Corporate Green Bond Issuance**



GDP = gross domestic product.

Note: Estimates from a differences-in-differences regression model with staggered treatment. Outcome variable: face value of green bonds issued divided by nominal GDP. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

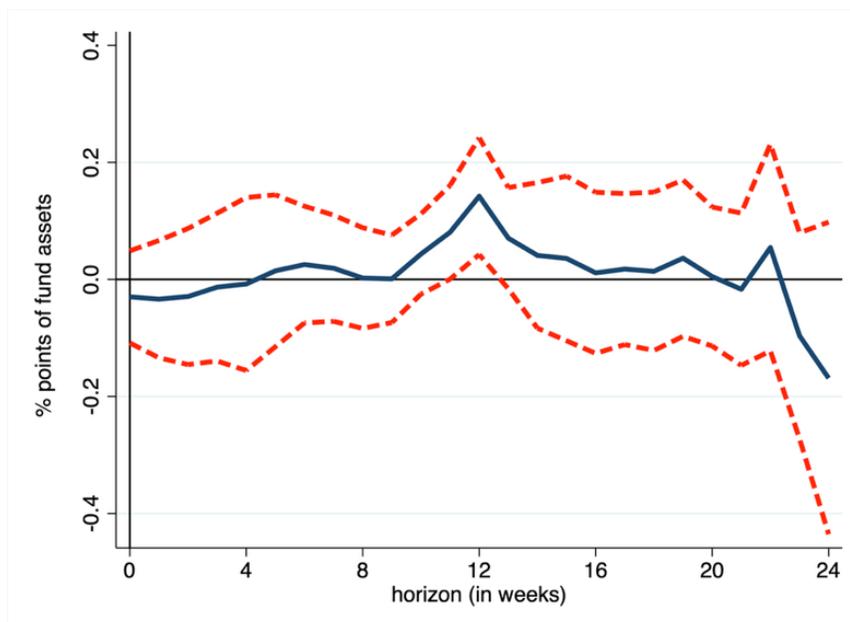
Before concluding, we note that the supply of green assets reacts slower than the demand of green assets to net-zero laws. This temporal difference is consistent with the notion that investors react faster than issuers, as reallocating capital typically involves fewer frictions than structuring and issuing green financial instruments. However, we cannot conclude a clear causal ordering between the two channels. Rather, the observed dynamics may instead reflect parallel responses to the passage of a climate law, which simultaneously shifts expectations and incentives for both sides of the market. Taken together, the findings suggest climate legislation acts as a coordinating device that mobilizes both issuers and investors, activating a two-sided market response that amplifies the flow of capital toward sustainable activities.

### C. Asset Pricing

We analyze whether the passing of climate laws induces an appreciation of the assets under management by green funds relative to non-green funds using the same framework as in equation (3). The dependent variable is fund return over the  $t$  and  $t+h$  period as a percentage of fund assets at the beginning of the period (i.e., at time  $t$ ).

Figure 9 presents the estimated impulse response of returns of green mutual funds relative to non-green funds following the adoption of net-zero laws. The response is close to zero over the projection periods and mostly not significantly different from zero. The point estimates of the asset pricing effect are about 90% smaller than the estimated demand effect.

**Figure 9: Differential Effect of Net-Zero Laws on Global Green Funds Returns Relative to Global Non-Green Funds**



Note: Estimates from a local projection model, measuring the mean cumulative additional effect of the adoption of a net-zero law at time  $t$  in an economy with a world gross domestic product share of 1% on net asset value not owing to new purchases, differentially in green funds relative to non-green funds over the  $t+h$  horizon. Blue solid lines denote point estimates, red dashed lines are 90% confidence bands.

Source: Authors' calculations.

## VIII. CONCLUSION

This study provides the first empirical evidence on the effects of climate laws on sustainable investment, focusing on ESG and green mutual funds. Using a novel dataset combining information on climate laws and mutual fund holdings across economies, and employing a robust DiD estimation design, we find that the adoption of climate laws significantly increases the share of ESG fund holdings in total mutual fund assets. The effects are stronger for climate laws setting net-zero emission reduction targets (i.e., net-zero laws). These laws lead to a gradual but steady rise in the share of ESG fund holdings, with the average effect reaching almost 5 percentage points 5 years after their adoption. A simple back-of-the-envelope calculation suggests that such an increase corresponds to additional ESG investment equivalent to 1.8% in the average economy that has passed a net-zero law in our sample.

The evidence points to two complementary channels in explaining these effects: increased mitigation policy stringency and reduced policy uncertainty. The impact of climate laws on diminishing policy uncertainty is further supported by a post-adoption decline in the return volatility of green funds and the absence of investment reversals following government political turnover.

Finally, the positive impact of climate laws on sustainable investing reflects both increased supply of green assets—through higher green bond issuance—and stronger demand for them, rather than valuation effects of green assets. These dynamics are most pronounced for bond funds and actively managed funds, which are better positioned to reallocate capital in response to credible policy signals.

From a policy perspective, our findings highlight that legally binding commitments arising from climate laws are a critical complement to mitigation policies. Climate laws credibly anchor expectations and can therefore significantly enhance sustainable investment for the same level of mitigation policy stringency. These findings highlight that climate laws and improving the financial ESG ecosystem, such as via sustainability ratings and certifications, can jointly support the large-scale reallocation of capital needed for the climate transition.

Future research could extend these findings by exploring the interaction between climate laws and other market or regulatory factors and examining the long-term implications for broader financial markets and the climate transition.

## APPENDIX

**Table A1: Keyword List for Identifying Climate-Related Funds**

Biodiversity	<u>Nachhaltigkeit</u>
Carbon neutral	Natural
Circular economy	Net zero
Clean	New energy
Climate	Renewable
Eco	Smart energy
Ecology	Solar
Environment	Sustainable
Environmental	Sustainability
Future energy	Transition
Green	Water
Hydrogen	Wind
Low carbon	Zero carbon

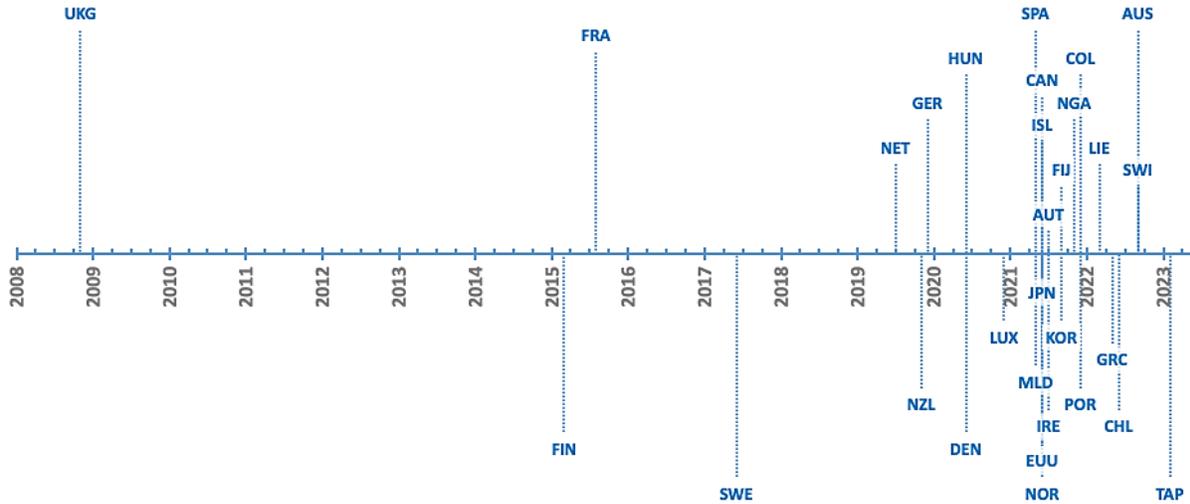
Note: *Nachhaltigkeit* means sustainability in German.  
Source: Authors.

**Table A2: Effect of Interim Target and Qualitative Climate Laws**

	(1) <i>ATT</i>	(2) <i>ATT<sub>post</sub></i>	(3) <i>ATT<sub>group</sub></i>
<b>A. Interim</b>	-0.16 (0.22)	-0.13 (0.22)	-0.17 (0.17)
<b>B. Qualitative</b>	0.31 (0.27)	0.23 (0.22)	0.45* (0.26)

Note: Estimates are obtained by including in the treatment group economies that have exclusively adopted an interim target law (Case A) and a qualitative law (Case B). Economies in the control group are as in the baseline specification (Table 3). Economies with multiple laws are excluded from the sample.  
Source: Authors.

**Figure A1: Date a Climate Law with Net-Zero Targets Is Passed, by Economy**

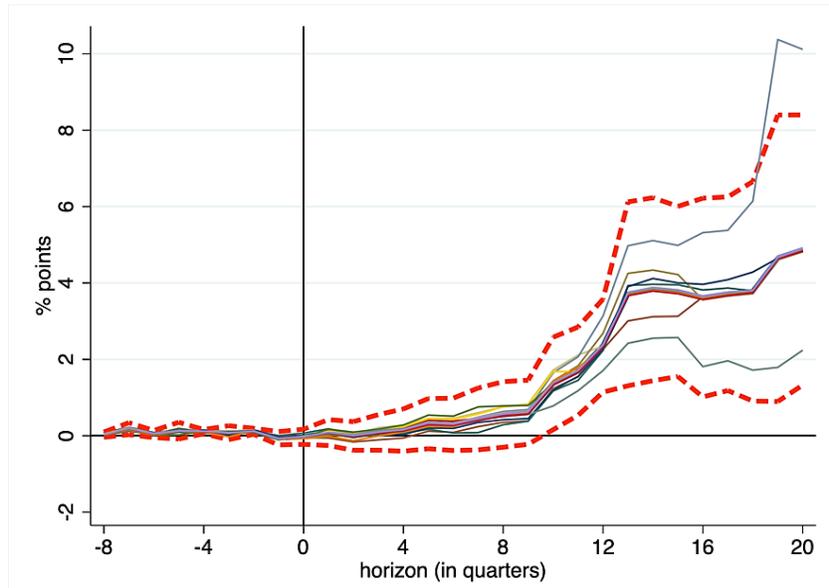


AUS = Australia, AUT = Austria, CAN = Canada, CHL = Chile, COL = Colombia, DEN = Denmark, EUU = European Union, FIJ = Fiji, FIN = Finland, FRA = France, GER = Germany, GRC = Greece, HUN = Hungary, IRE = Ireland, ISL = Iceland, JPN = Japan, KOR = Republic of Korea, LIE = Liechtenstein, LUX = Luxembourg, MAL = Maldives, NET = the Netherlands, NGA = Nigeria, NOR = Norway, NZL = New Zealand, POR = Portugal, SPA = Spain, SWE = Sweden, SWI = Switzerland, TAP = Taipei,China, UKG = United Kingdom.

Note: Amendments are not reported.

Source: Authors.

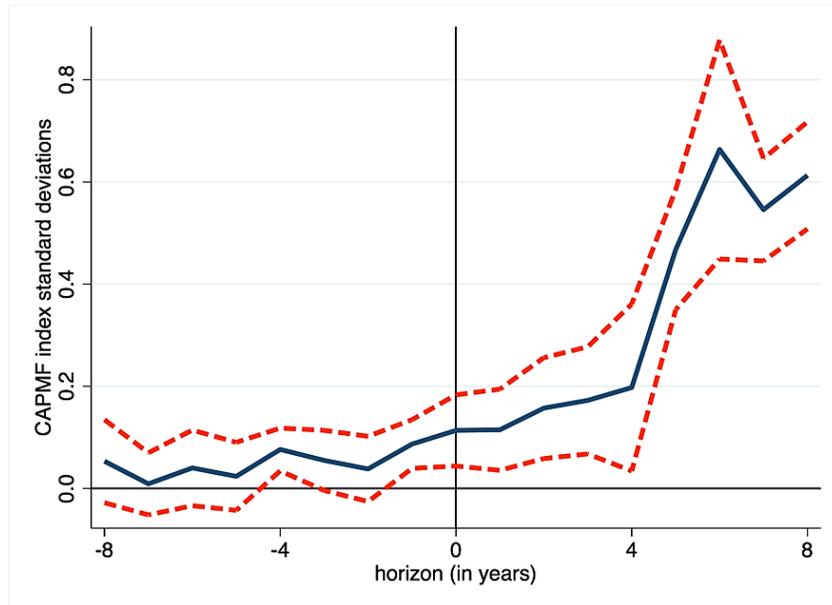
**Figure A2: Robustness Check on Economy Sample Stability**



Note: Each solid line reports estimates excluding four economies at a time (selected by alphabetical order). Dashed lines are 90% confidence bands from the baseline estimation.

Source: Authors.

**Figure A3: Effect of Net-Zero Laws on Stringency of Climate Mitigation Policies**

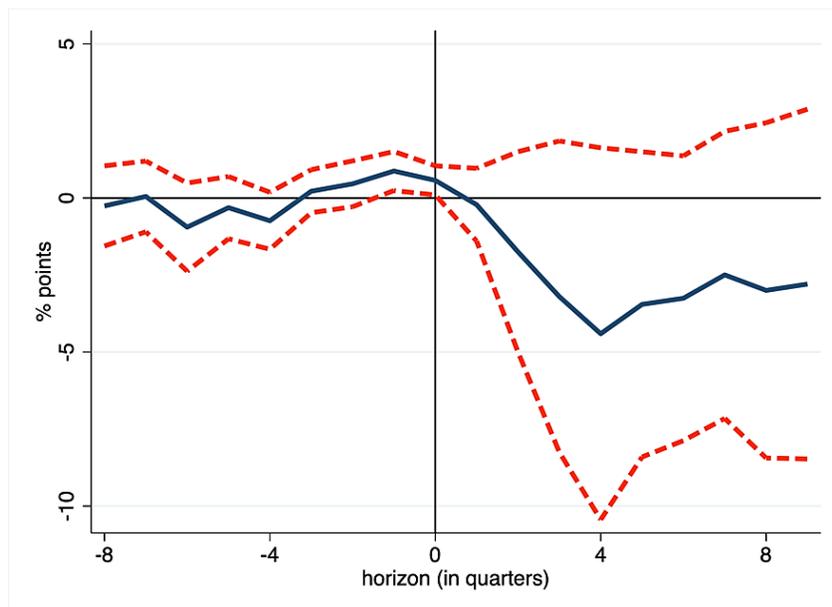


CAPMF = Organisation for Economic Co-operation and Development (OECD) Climate Action and Policies Measurement Framework.

Note: Dependent variable is CAPMF index.

Source: Authors.

**Figure A4: Effect of a Change in Government Following the Passing of a Net-Zero Law on the Share of ESG Bond Assets**



ESG = environmental, social, and governance.

Note: The sample includes only economies that have passed a net-zero law. Economies that did not see a change in government following the passing of the law form the control group.

Source: Authors.

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## **Climate Laws and Green Finance**

### *The Value of Legal Commitment*

This paper provides the first empirical evidence that legally binding climate commitments mobilize sustainable finance. Using a staggered difference-in-differences design, it finds that adopting net-zero climate laws raises the share of environmental, social, and governance fund assets by about 5 percentage points within five years. The effect operates through tighter mitigation policies and lower policy uncertainty. These findings highlight that credible legal commitments can anchor expectations and accelerate the flow of capital toward the climate transition.

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**ASIAN DEVELOPMENT BANK**

6 ADB Avenue, Mandaluyong City

1550 Metro Manila, Philippines

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