



## On the origin of green finance policies

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### ABSTRACT

Despite the rising number of green finance policies, the socioeconomic determinants shaping them remain largely unexamined. Drawing from the literature analysing the relationship between regulation, market development and institutional economics, we contend that green finance policy adoption is driven by both market-based and institutional factors. Using a survival analysis approach to understand the levers influencing green finance policy adoption across 188 countries from 2000 to 2019, we find that exposure to the fossil fuel industry predominantly drives the initial issuance of green finance policies. The positive effect of fossil fuel commercial financing on the adoption of green finance policies exists in countries with high and medium climate change awareness levels. Meanwhile, in countries with a low climate change awareness level, fossil fuel government subsidies drive green finance policy adoption. Our study also highlights the role of the financial industry as one of the key actors in the policy cycle of green finance policies via two pathways: (i) affecting financial stability through financing oil and gas companies on primary financial markets and (ii) developing a market for sustainable finance products.

### 1. Introduction

The financial sector, and in particular private finance, is being increasingly recognised as a key player in achieving the 2015 Paris Agreement's central aim of limiting global temperature rise. Considerable investments are rapidly required to align the planet's greenhouse gas (GHG) emissions pathway with the net zero goal by 2050, (Klaaßen and Steffen, 2023; Peake and Ekins, 2017; Polzin, 2017; Zhu et al., 2012). These investments are necessary in both developing and developed countries (Ameli et al., 2020; Gençsü et al., 2020; McCollum et al., 2018). According to an estimate based on a meta-analysis of 56 studies, the European Union (EU) needs to invest EUR302 billion between 2021

and 2025 to improve its energy and transport infrastructure in order to reach net zero (Klaaßen and Steffen, 2023). The Paris Agreement explicitly emphasises the role of financing flows into low-carbon infrastructure and climate-resilient projects (UNFCCC, 2015) so policies specifically aimed at financial actors could be crucial to redirect financing flows from carbon-intensive sectors to low-carbon ones.

Several governments and central banks have issued innovative types of climate policies that aim to change the behaviour of financial actors such as investors, banks, and insurers (Steffen, 2021). Green finance measures, as defined by the Green Growth Knowledge Partnership (GGKP), are policies aimed at financing investments that generate environmental benefits in the context of the United Nations' (UN's)

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Sustainable Development Goals (SDGs).<sup>1</sup> One notable example of a green finance measure is guidelines on the issuance of green bonds. Market-led voluntary guidelines of green bond principles (GBPs) established in 2014 by the Climate Bonds Initiative (CBI) predated regulatory efforts by governments and central banks to improve transparency in tracking funding to environmentally sustainable projects. Other examples of green finance policies are climate-related disclosures and bank lending guidelines for energy sectors.

Despite the growth of this newer type of climate policy relative to traditional policies such as carbon taxes and emission trading system, little is known about the socioeconomic drivers or processes that shape their introduction. Climate policy research has so far focused on conventional environmental policies such as carbon taxes and emissions trading schemes (Nordhaus, 1993), along with just transition policies for climate financing in developing countries (Steffen, 2021). An emerging literature on green finance policies focuses almost exclusively on their effects on the financial system (Dafermos and Nikolaidi, 2021; Lamperti et al., 2021; Wang and Li, 2022). As a result, a research gap emerges regarding what drives governments and central banks to issue green finance policies, along with how these policies may interact with traditional environmental policies, green bond financing and government fossil fuel subsidies.

In this paper we aim to address this gap by exploring the motivations for green finance policies, in other words what processes and/or factors drive governments and central banks to issue green finance policies? We hypothesize that four factors drive the issuance of green finance policies. Firstly, an exponentially growing green finance market, which has gradually formed a coherent and distinct identity as an industry, has led to a natural need for increased regulation. Secondly, there are increased financial stability concerns for central banks regarding climate change and other related risks. Such risks are composed of physical risk and transition risk and have been comprehensively discussed in a seminal article by (Campiglio et al., 2018). Thirdly, green finance measures may fill the so-called ‘carbon pricing gap’, which is left by the slow progress of traditional environmental policies in effectively facilitating a transition to a net-zero emissions world (Campiglio, 2016), and an existing regulative institution of fossil fuel subsidies. Next, strong pressure from divestment campaigns demand that central banks and financial authorities must act more proactively to address climate change issues by utilising their regulatory toolkit. To empirically test our hypotheses, we employ survivorship modelling and analyse a novel dataset from the GGKP spanning from 2000 to 2019. We find that exposure to the fossil fuel industry, proxied by the amount of financing raised on financial markets, is the main driver behind the initial issuance of green finance policies. Divestment commitments, a form of social pressure, have a different effect on the likelihood of green finance policy adoption depending on the level of compliance of these policies. The effect of fossil fuel financing exists in countries with high and medium climate change awareness levels whereas, in countries with a low climate change awareness level, fossil fuel subsidies from governments drive green finance policies adoption.

Although Steffen (2021) calls for research to study the socioeconomic drivers of green finance measures, little research has shed light on those policy drivers. Investigating potential motivations for green finance policies enables us to explain country-level differences in policy density. In addition, although external shocks such as the Paris

<sup>1</sup> No poverty (SDG 1), Zero hunger (SDG 2), Good health and well-being (SDG 3), Quality education (SDG 4), Gender equality (SDG 5), Clean water and sanitation (SDG 6), Affordable and clean energy (SDG 7), Decent work and economic growth (SDG 8), Industry, innovation and infrastructure (SDG 9), Reduced inequalities (SDG 10), Sustainable cities and communities (SDG 11), Responsible consumption and production (SDG 12), Climate action (SDG 13), Life below water (SDG 14), Life on land (SDG 15), Peace, justice, and strong institutions (SDG 16), and Partnerships for the goals (SDG 17).

Agreement and the global COVID-19 pandemic could lead to temporary policy change focusing more on green growth (Sabatier and Jenkins-Smith, 1993), variegated systemic and institutional factors may be much more important and sustained factors driving policy changes across countries. Finally, our study highlights the role of the financial industry as one of the key actors in the policy cycle of green finance policies via two pathways: (i) affecting financial stability through financing oil and gas companies on primary financial markets and (ii) developing a market for sustainable finance products such as green bonds. Our research makes a conceptual contribution by combining relevant strands of literature on financial instability concerns related to climate change risk (Battiston et al., 2021; Campiglio et al., 2018; Chabot and Bertrand, 2023), coherent market developments (Georgallis et al., 2019; Navis and Glynn, 2010), and institutional theory (North, 1990; Scott, 1995). This work conceptualises the issuance and formation of green finance policies under the theoretical backdrop of market-based determinants of policy outputs and institutional economics. This is important as extant literature (e.g. (Lamperti et al., 2021; Roncoroni et al., 2021)) mainly examines policy outputs as well as the effects of those outputs on financial markets, but does not investigate policy drivers or the factors driving policy issuances. In addition, we implement a survivorship model to empirically study the socioeconomic drivers of the adoption of green finance policies.

The remainder of the paper is organised as follows. Section 2 summarises relevant literature and extensively formulates hypotheses. Section 3 outlines the data and econometric methodology. Section 4 reports and discusses results. Finally, Section 5 contains concluding remarks.

## 2. Literature review and hypothesis development

### 2.1. Literature review

Literature that systematically classifies the drivers of green finance policies is scarce. We summarise directly and indirectly related literature strands using the more recent articles in Table 1. Literature analysing the implications of climate-related risks on the financial system and on financial regulations to tackle climate change is growing. Campiglio et al. (2018) is perhaps the first research to suggest that central banks and financial regulators can be more involved in addressing climate change risks through a set of policies. Specifically, in addition to requiring disclosure of climate risks, central banks could in principle adopt regulations that take into consideration climate-related risks. (Chabot and Bertrand, 2023), following the theoretical framework of physical risk and transition risk and using data for EU financial institutions, empirically prove that at an individual institutional level and financial system level, scope 3 emissions<sup>2</sup> and climate risks lead to negative effects on financial stability.

The growth of an emerging green bond markets could also call for policy interventions to scale up investment in environmentally sustainable projects. Based on management science, there is a literature strand that directly explains policies are adopted to accommodate the scaling up of an emerging industry with coherent developments and a clear identity from incumbent and established actors. With the theory on state support for emerging industries, Georgallis et al. (2019) interview industry insiders and stakeholders to find that government policy support for an emerging industry increases when the industry gathers enough producers and has a coherent identity. This could be applicable to our study in that policies and regulations set out a harmonised framework and understanding of “green” and “environmentally sustainable” projects, without which financing flows might have targeted economic activities or projects that do not contribute to the net-emissions goal. In addition, it is argued that green bond markets, or more broadly sustainable finance markets, have been breaking through

<sup>2</sup> Scope 3 emissions arise from the reporting organisation’s value chain.

**Table 1**  
Related studies highlighting relevant socioeconomic factors and green finance policies.

	Market-based drivers			Institutional theory			This paper
	Financial stability concerns			Coherent market			
	Regulatory pillar	Normative pillar	Related	Regulatory pillar	Normative pillar	Related	
Research objective	Campiglio et al. (2018) – Indirectly related Discusses the implications of climate change and the low-carbon transition for financial regulation/ policies	Chabot and Bertrand (2023) – Indirectly related Quantifies the impact of climate-related risks on the European financial system	Georgallis et al. (2019) – Directly related Empirically tests whether government policy support for an emergent industry is decided by the industry’s internal coherent developments	Geels (2014) – Indirectly related Examines the resistance of current actors to the transition	Cojoianu et al. (2021) – Indirectly related Investigates whether country-level divestment commitments affect the financing of fossil fuel companies	Studies socioeconomic factors driving the adoption of green finance policies, weaving together strands of literature on climate risks and low-carbon transition	
Theoretical framework	Central banks’ mandates in relation to monetary policies and financial stability	Transmission channels of climate-related risks to financial system	State support for emergent industries	Multi-level perspective in the context of low-carbon transition	Institutional theory	Climate-related risks’ implications for financial stability & Institutional theory	
Sample period (Region) Model/ method	N/A	130 financial institutions between 2001 and 2021 (EU including the UK)	Feed-in-tariff policies of 28 countries between 1987 and 2012 (EU)	Case study of the UK’s electricity generation from 1980 to 2012 (UK)	33 countries between 2000 and 2015	383 green finance policies from 2000 to 2019 (188 countries)	
Summary of key findings	Critical review of 4 potential types of financial policies A comprehensive set of policies is required for the transition, and central banks can play an instrumental role in the process.	3-step regression using panel data models At individual institutional level and financial system level, scope 3 emissions and climate risks lead to negative effects on financial stability	Interviews with industry insiders and other stakeholders Government policy support for an emergent industry increases when the industry gathers enough number of producers and has a coherent identity	Coal, gas and nuclear electricity producers’ resistance negates renewable energy production deployment	Panel-corrected standard error regression model Divestment pledges result in lower capital flows into domestic fossil fuel companies, the effect of which is stronger in countries with more stringent environmental policy regime	Survival analysis Financing deals raised on primary financial markets mainly drives the initial issuance of green finance policies. In countries with low climate change awareness, fossil fuel subsidies from governments are the driving factor.	

to become embedded in the mainstream financial system (Urban and Wójcik (2019), and as such could promote top-down policies to accelerate the transition to a low-carbon economy (Ghisellini et al., 2016).

Furthermore, institutional theory, which has been adopted in climate finance research, provides a theoretical background for the discussion on green finance policies. As highlighted by Steffen (2021), institutional settings could be crucial in shaping green finance policies; hence, institutional theory, which formulates that the emergence of an institution is shaped by normative, regulatory, and cognitive settings, could be a useful lens to study green finance policies. We can argue that green finance policies are an emerging institution/ construct that is affected by the norms and regulatory environment. Specifically, state fossil fuel subsidies and state support for renewables could represent a regulatory pillar that long predates green finance policies. Those two factors have entirely opposite effects on sustainability transitions. While government supports for renewable energy projects via feed-in tariff or other research grants accelerate the transitions, fossil fuel subsidies hinder progress, creating a carbon pricing gap (Campiglio, 2016). This situation is well explained by Geels (2014). The research highlights a case study of the United Kingdom’s (UK’s) electricity generation to emphasise how incumbent fossil fuel electricity producers can hold back renewable energy deployment. As a result, additional policy interventions in the forms of green finance policies may be needed to break the tie between fossil fuel subsidies and renewables supports.

Under the normative pillar, divestment commitments also have a role to play in the low-carbon transition (Cojoianu et al., 2021), which may create a new moral norm to shift investments away from the fossil fuel industry. The stigmatisation from divestment campaigns raises uncertainties in fossil fuel companies’ cash flows (Ansar et al., 2013), which may result in a huge amount of stranded assets and a disorderly transition<sup>3</sup> as explained in Campiglio et al. (2018). In summary, the previous literature has not synthesised perspectives from different relevant drivers which can allow for comprehensive understanding of the socioeconomic motivations of green finance policies. As far as we are aware, our study is the first to empirically examine socioeconomic factors driving the adoption of green finance policies by countries, integrating relevant strands of literature from finance (climate-related risks and financial stability), and management science (market developments and state support, and institutional theory).

## 2.2. Hypothesis development

### 2.2.1. Financial stability concerns

From a theoretical perspective, traditional economics considers environmental issues as negative externalities. As such, the first-best policy intervention would be carbon pricing in the form of a Pigouvian tax equal to the external damage imposed (Pigato, 2019), thereby internalising the negative externality. Therefore, in the first-best world of traditional economics, the financial sector would have no role to play. However, to solve “greatest market failure that the world has ever seen” (Stern et al., 2017), empirical evidence suggests that carbon pricing alone is not sufficient. Consequently, green finance measures can be deemed as second-best policies, which can supplement carbon pricing. From a practical perspective, insofar as climate change affects financial stability, it “falls squarely within the mandates of central banks and supervisors to ensure the financial system is resilient to these risks” (Network for Greening the Financial System, 2019, page 1). Indeed, the Network for Greening the Financial System (NGFS), consisting of more than 140 central banks and financial regulators, has made attempts to tackle financial stability concerns caused by climate change (Hadji-Lazaro et al., 2024) by developing transition pathway scenarios for climate risk management and monitoring. Campiglio et al. (2018)

<sup>3</sup> A disorderly transition results in significantly adverse repercussions on the economy and financial stability through stranded physical and financial assets.

suggest that financial regulations and policies should reflect the growing evidence of the link between climate-related risks and financial stability.

The literature on the link between climate change risks and financial instability has been gaining traction. Chabot and Bertrand (2023) provide an in-depth framework on how climate change risks, consisting of physical and transition risks, are translated into financial instability via several transmission channels. Physical risks are caused by chronic and acute climate events in temperatures which can adversely affect household consumption of many types of products (Chabot and Bertrand, 2023). In terms of the effects of climate variability on corporates, many studies have found a material drop in sales and cash-flows (Parnaudeau and Bertrand, 2018), increases in operating costs in the agri-food industry (Kumar et al., 2022), and in the construction sector (Schuldt et al., 2021), along with lower productivity, which could cause financial distress to these entities (Agnew and Palutikof, 2006; Bertrand and Parnaudeau, 2019; Dell et al., 2012). Acute climate events such as flooding, tornados, and heat waves can also cause declines in residential assets' value, resulting in reduced household wealth and credit capacity (Bin and Polasky, 2004; Ortega and Taspınar, 2018). Moreover, there exists a literature strand documenting the negative effects of extreme weather events on corporates' performances. (Abe and Ye, 2013) find that natural disasters disrupt global supply chains whereas (Barrot and Sauvagnat, 2016) document a drop of 1 per cent in corporate equity value following a natural disaster. According to (Gu and Hale, 2023), corporate investments are negatively impacted following an extreme climate event, which could lead to non-performing assets.

Transition risks stem from unexpected changes in carbon-intensive assets due to the introduction of policies or regulations that financial actors do not anticipate (Chabot and Bertrand, 2023; Monasterolo, 2020). Firms have faced higher levels of carbon tax, decreasing profitability and debt payments following the Paris Agreement (Bernardini et al., 2021) along with increasing costs of credit for carbon-intensive companies (Battiston et al., 2021). This can, in turn, impede corporates' investments in technologies and equipment required for the net-zero transition. The above effects on household and corporates are transmitted to the financial system in the forms of financial contracts, portfolios, insurance contracts, bank loans, pension funds, stocks and bonds, which has been empirically investigated in various studies. (Cortés and Strahan, 2017; Ivanov et al., 2022) find that banks decrease credit lines to affected areas after natural disasters to mitigate their loan portfolios exposure to credit risk. In addition, (Dunz et al., 2021) study the risk transmission from banks to the real economy that can cause cascading effects, thereby further destabilising banks' financial performance. (Klomp, 2017) highlights how climate change risks are priced in sovereign debt. Studying the United States (US) insurance and banking sectors, (Curcio et al., 2023) find that climate change exacerbates financial systemic risk. Finally, through indirect emissions via investment and lending activities, financial institutions also carry the risk of asset value losses, reduction of earnings/profitability, higher costs of capital, and stranded assets<sup>4</sup> (see for example (Ehlers et al., 2022; Reghezza et al., 2022; Roncoroni et al., 2021). Furthermore, a study by (Kanas et al., 2023) finds a positive relationship between (carbon dioxide) CO<sub>2</sub> emissions and systemic risk in US financial institutions.

Empirical findings corroborate both the need for policy interventions and how those policies could help the financial system align with a low-carbon economy. Dafermos and Nikolaidi (2021) analyse climate-related financial risks using a stock-flow consistent model, demonstrating that increased credit provisions for green industries decrease the pace of global warming and the associated physical risks. Lamperti et al. (2021) differentiate three types of green finance policies (green capital requirement, carbon risk adjustment, and green public guarantees) to evaluate their effectiveness in mitigating financial

instability. Using an agent-based macro-financial model, the paper suggests that a policy mix of the three types would help curb emissions from economic activities as well as stabilise the financial sector. Chabot and Bertrand (2023) call for mandatory corporate climate risk disclosure to assist financial institutions and investors in evaluating the exposure of their lending and investment portfolios. Although carbon taxes are necessary for the low-carbon transition, green finance policies present a complementary toolkit to accelerate the transition (Dunz et al., 2021). In case a disorderly transition cannot be avoided, stepping up policy interventions and increasing climate policies' credibility could minimise financial losses (Roncoroni et al., 2021) and align investments with the low-carbon transition (Gourdel et al., 2024).

The theoretical and empirical literature on financial stability concerns indicates a need for a policy mix of green finance policies to deal with the challenges of climate change. Green finance policies, especially those issued by central banks and financial supervisors, could be a useful supplementary tool. We therefore hypothesize that financial stability concerns could positively affect the probability of the first issuance of green finance policy (Hypothesis 1).

### 2.2.2. Coherent developments of green finance markets

The theoretical framework of the emergence of policies to support new industries is grounded in market category research which explains how new market industries emerge, succeed, and attain legitimacy (Durand and Paoletta, 2013; Lee et al., 2017; Navis and Glynn, 2010). As there are more firms participating in the new industry, they can raise the cognitive recognition (Hannan et al., 2012), demonstrate feasibility and practicality (Kennedy, 2008), and, more importantly, the industry becomes more acceptable to key audiences such as governments (Hargrave and Van De Ven, 2006; Lee et al., 2017; Navis and Glynn, 2010). This allows the new industry, via increasing collective resources and networks, to persuade and induce governments to issue policies favourable to it (Ozcan and Gurses, 2018). Moreover, having an identity coherence means that the new industry distinguishes itself from incumbent industries, whereby governments are more likely to view the emerging industry as a distinct one (McKendrick et al., 2003), which is a positive sign that the emerging industry can be recognised on its own. Finally, a high level of concentration of rivals means that a new industry is less likely to be deemed as unthreatening and, at the same time, as a feasible alternative (Benford and Snow, 2000). Georgallis et al. (2019) build upon the literature to argue that policy support for emerging industries is conditioned upon the number of sub-industry categories, industry coherence, and concentration of rival groups. Empirically, studying the solar photovoltaics (PV) industry in European countries from 1987 to 2012, the paper demonstrates that in countries with a greater number of PV producers, the likelihood of policy interventions in the form of feed-in tariffs is also higher.

According to Urban and Wójcik, (2019), the green finance industry is forming a coherent identity through an exponential growth in the market for sustainable finance products and is increasingly embedded in the mainstream financial system. Despite that, a clear definition of green finance and how to quantify its impact are still under debate. A report by the (Climate Policy Initiative, 2022) documents a decade of climate finance activities around the world, recording a doubling of climate finance amounts from 2011 to 2020 and deeper involvement of the private sector in the field. This growing market has considerable demand for green finance products, particularly among long-term investors (Andersson et al., 2016); and green finance is becoming increasingly mainstream in the financial industry (Urban and Wójcik, 2019). Such growth can be explained by a well-grounded literature analysing how consideration of environmental, social and governance (ESG) factors would not hurt stock market portfolio and even positively affects business performances (see (Revelli and Viviani, 2015; van Beurden and Gössling, 2008) and a shift in investors' preferences towards more sustainable sectors (Richardson, 2009).

Despite, or perhaps due to, the increasing popularity of green assets,

<sup>4</sup> Stranded assets are those that are converted to liabilities due to unexpected and premature write-offs or devaluation.

a consistent definition of green or sustainable activities does not yet exist, which can undermine the reliability of green finance instruments such as green bonds. (Flammer, 2020) finds that green bonds are effective in reducing companies' environmental footprint, but this is only significant for green bonds that have been certified. The same findings are also applicable to municipal green bonds in the US. According to (Flammer, 2023), following an issuance of green bonds, the issuing states' emissions are documented to decrease by 0.9–1.4 per cent. This result is of larger magnitude if the bonds are certified by an independent third party. These two studies suggest that on the grounds of a lack of public governance, certification of “greenness” plays an important role as a private governance mechanism in the green bond market. However, Park (2018) argues that both public and private governance would be optimal for green bonds with respect to financial and environmental impacts. Relatedly, a lack of regulation in climate risk disclosure can lead to companies with a high level of exposure to climate risks not publicly disclosing this type of information. This would deprive companies and investors of the long-term financial benefits of mitigating climate risks (Cheng et al., 2014; Dhaliwal et al., 2011; Sharfman and Fernando, 2008).

To increase transparency regarding what actually constitutes sustainable securities, several jurisdictions have begun to legislate to develop official definitions and taxonomies, such as China, Japan, South Africa, and the EU (OECD, 2020). Indeed, in December 2021 the EU legislated the first part of its green finance taxonomy to define what exactly constitutes ‘sustainable’ in an effort to ‘...tackle greenwashing and steer investment into activities that make the biggest contribution towards meeting its environmental objectives’. As of December 2024, the EU has developed criteria for all the climate and environmental objectives set out in the EU Taxonomy. The publication of recent green taxonomies and related reporting requirements in different jurisdictions reflects not only an urgent need for a common understanding of sustainable economic activities. These taxonomies also signal regulatory pressure to improve information transparency and to tackle the persistent challenges caused by a lack of public governance in green finance markets.

Thus, we hypothesize that green finance industry development can positively affect the probability of the first issuance of green finance policy (Hypothesis 2).

### 2.2.3. Institutional drivers

Green finance measures are also influenced by factors encompassing the social and regulatory environments in which they are designed, thus requiring an explanation based on institutional economics. According to (North, 1990), institutions are “humanly devised constraints that shape human interaction”, providing “rules of the game in society” (p. 3). In sociology and organisational theory, (Scott, 1995) formulates the three institutional pillars of normative, regulative, and cognitive structures that shape an organisation's behaviour through external pressures.

While the first pillar embodies social norms and values that delineate the boundaries of acceptable behaviour in alignment with the prescribed goals, the second pillar defines acceptable behaviour through the setting of regulations, the monitoring of compliance, and the penalising of non-compliance. The final pillar, the cognitive pillar, is defined by Scott, (1995) as the wider belief system built upon a common understanding and shared by individual organisations and persons. We rely on the first two pillars to provide institutional rationale for issuing green finance measures.

Institutional economics in general and institutional theory in particular have recently been used as a theoretical framework in climate and sustainable finance. (Liu et al., 2024) adopt the theory to examine how corporate green innovation is shaped by climate exposure. (Chortareas et al., 2024), grounding their work in institutional theory, associate corporate reputational risk with corporate pollution. In the context of Chinese mixed-ownership (private and state-owned) firms, (Cao et al., 2022) investigate whether a reform in regulatory institution

increases the adoption rate of ESG practices. In addition, the theory is useful in studying factors driving the adoption of sustainable practices (Glover et al., 2014), the diffusion of corporate environmental practices in China (Zhu et al., 2012), and the effectiveness of environmental system management (Daddi et al., 2016).

Moreover, previous studies have adopted institutional theory to explore how variations in formal and informal institutional settings drive diverging behaviours of a specific organisation across countries. (Makrychoriti and Pasiouras, 2021) reveal a negative relationship between national culture of secrecy and central bank transparency in its policymaking using a sample of 79 countries. (Harjoto et al., 2021) find that corporate social irresponsibility negatively affects stock returns based on their empirical study of more than 7000 non-financial companies from 42 countries. The reactions of governments during the global COVID-19 pandemic also affect emerging capital markets differently than developed ones (Aharon and Siev, 2021). Finally, (Levänen et al., 2018) use institutional theory to explain the interplay between institutional settings and circular economy models in Finland and Chile.

*2.2.3.1. Regulative pillar: fossil fuel subsidies & renewables supports.* This is an example of the regulative pillar in Scott's institutional theory. From an economic perspective, green finance measures can be deemed as second-best policies, supplementing carbon pricing. However, to date, the issue of how much the cost of carbon should be as a base for tax policies remains unanswered and without definitive answers in foreseeable future, which impedes the effectiveness of carbon taxes as a mechanism to tackle climate change. Since Nordhaus (1993), economists interested in climate change policies have not been able to concur on the cost of carbon, providing a wide range of values with estimates as low as USD10 per ton of CO<sub>2</sub> and as high as USD200 per ton of CO<sub>2</sub> (Pindyck, 2013).

Furthermore, in the context of relatively ineffective carbon pricing policies, government fossil fuel subsidies attenuate the expected benefits of traditional environmental policies (Böhringer, 1996; Eichner and Pethig, 2015; Geels, 2014; Smink et al., 2015; Zietsma et al., 2018). The Effective Carbon Rates report by the OECD highlights a carbon pricing gap in cutting down GHG emissions goal (OECD, 2023). In 2023, 72 countries analysed in the report, which are responsible for about 80 % of energy related global CO<sub>2</sub> emissions, had a Carbon Pricing Score of 7 at the EUR 60 benchmark (CPS60). This means that, together, they reached 7 % of the goal of pricing all emissions at EUR 60 or more per tonne of CO<sub>2</sub>, which is a significant step back given that the same metric in 2020 was 19 % (OECD, 2020). Eichner and Pethig (2015) further demonstrate that, in the presence of allowances for fossil fuel trades, the cap-and-trade policy fails to achieve any reduction in climate damage. Another theoretical contribution to this literature strand is presented by Geels (2014), which argues, based on institutional theory, that the resistance from fossil fuel production stalls the progress of renewables deployment. Conducting case studies in the Netherlands and Canada, respectively, Smink et al. (2015) and Zietsma et al. (2018) arrive at the conclusion that clean and disruptive technology proves difficult to implement due to resistance from incumbent institutional infrastructure of fossil fuel producers. Thus, state fossil fuel subsidies further the carbon pricing gap, which adds to heightened pressure to resort to another regulatory tool than carbon taxes.

We therefore hypothesize that countries which are ineffective at phasing out fossil fuel subsidies have financial regulators that are more prone to intervene in their complementary but limited green finance mandates. Equally, countries which enjoy more renewables support would require less the intervention of financial supervisors through green finance policies (Hypothesis 3).

*2.2.3.2. Normative pillar: divestment commitments.* Divestment movements are considered as an emerging normative institution in which the divestment pledges push for new norms in defunding fossil fuels. The

rationale for divestment commitments is rooted in the stranded asset hypothesis which argues that financing for new fossil fuel-related assets should be stopped (Pfeiffer et al., 2018). In the context of responsible investing strategy, divestment is a primary choice for investors due to its proven effectiveness. The normative pillar's influence on the financing activities is demonstrated in great detail by (Cojoianu et al., 2021). The paper suggests that the fossil fuel divestment campaign, one of the explicit enactments of the normative pillar, negatively affects the level of fundraising for the oil and gas sector. Banks that are engaged in underwriting oil and gas companies risk being ostracised and stigmatised by the fossil fuel divestment movement (Le Billon and Kristoffersen, 2020). As a result, banks are increasingly aware of reputational risk from financing oil and gas sector, and thus would be expected to decrease their exposure to the sector (Cojoianu et al., 2021). The divestment movement has also led to the creation of new green finance products such as green indices that exclude fossil fuel companies (Ayling and Gunningham, 2017).

There is a literature on how environmental movements, through their inherent social norms, confer legitimacy on a transition to a low-carbon economy; this legitimacy, in turn, garners support from governments in the form of favourable policies (Pacheco et al., 2014; Sine and Lee, 2009; Vedula et al., 2019; York and Lenox, 2014). In other words, the normative pillar's effects can spill over to inform regulation. A concrete example is the passing of the Fossil Fuel Divestment Act 2018 by the Republic of Ireland. This act requires the country's sovereign fund to divest from fossil fuel holdings. Social norms and government policies can create a virtuous circle in which the norms gain legitimacy when governments publish supportive policies, and by means of those policies governments reinforce/encourage desirable actions or penalise undesirable ones (Kinzig et al., 2013). In addition, divestment campaigns could potentially create heightened level of uncertainties in the cash flows of fossil fuel companies due to the stigmatisation, which might result in stranded physical assets (Ansar et al., 2013). This, in turn, could spill over to stranded financial assets, thereby materialising in an abrupt transition scenario with severe consequences on the economy and financial system (Campiglio et al., 2018). Thus, this circles back to the financial instability concerns requiring interventions by financial regulators.

Hence, we hypothesize that divestment commitments positively affect the probability of the first issuance of green finance policy (Hypothesis 4).

### 3. Data and methodology

This section describes the data used to proxy for market-based and institutional drivers and our empirical approach. While most of the data are from the World Bank and OECD, the data on green bond markets and fossil fuel financing are from Dealogic. The study has certain limitations in terms of data analysed. First, since green finance policies are a new policy tool, a comprehensive and definitive database used in the literature is not yet available. Hence, the GGKP may differ from other green finance regulation databases, as demonstrated by (Steffen, 2021). Second, in our effort to cover as many countries as possible, we opt for proxies that have a broad coverage, whereby we may have overlooked proxies that cover only specific groups of countries such as the OECD, G20, and G7, the members of which are early adopters of green finance measures.

#### 3.1. Sample construction

The list of green finance measures is obtained directly from the Green Growth Knowledge Partnership (GGKP) for policies issued up until 2019. On the grounds of limited data availability for several key independent variables, we limit the study period from 2000 to 2019. In addition, although the database contains green finance policies issued before 2000, upon close reading, they do not match with the definition

of this type of policies; hence, these are removed from our sample. Moreover, the period of twenty years should be sufficiently long to capture the first instance of green finance measures across countries. To the best of our knowledge, we are the first study to employ the GGKP database to empirically analyse the socioeconomic factors driving the adoption of green finance policies. From 2000–2019 383 policies were issued by 75 countries.<sup>5</sup> We take the list of 195 countries and territories from the International Monetary Fund (IMF) and eliminate countries lacking values for any of the explanatory and control variables.

The resulting sample comprises 188 countries, of which 75 countries have issued at least one green finance measure as at the end of our sample period. Table 2 provides a correlation matrix.

Table 2 illustrates that correlations among explanatory and control variables are generally low and that multicollinearity does not negatively affect our statistical results (i.e. the highest correlation is 0.472). Descriptive statistics<sup>6</sup> for all country-level variables illustrate that the sample for issuing countries ends at the year when a country issued its first green finance policy. For non-issuing countries, their observations conclude at the end of the sample period of 2019. As a result, for the baseline regression of our study period, we document a total of 3227 observations. The highest observation for time to the first issuance is 20 years, which happens in non-issuing countries at the end of the period. At the same time, some countries such as the US, the UK, and Sweden issued their first green finance measure in 2000, the first year in the period, so their time to the event is 0.

#### 3.2. Dependent variable

We use the survival model, outlined in 3.5, to estimate the effects of several factors on a country's first issuance of green finance policies. The dependent variable in the model is determined by two parts: *an event indicator* (that is whether a country issues its first green finance policy) and *a measure of time* from baseline to the event or censoring. In our study, right censoring applies since there are countries in the sample that have never issued a green finance policy at the end of the observation period.<sup>7</sup>

#### 3.3. Explanatory variables

All of the independent and control variables are lagged one year compared with the dependent variable in order to alleviate reverse causation concerns, which are discussed in detail later.

##### 3.3.1. Market-based factors

**3.3.1.1. Fossil fuel financing.** Financial stability concerns involve the risk of stranded assets, which is triggered by historical and current financing of fossil fuel projects. According to (Welsby et al., 2021), an estimated 60% of oil and fossil methane gas and 90% of coal would need to be left unextracted in the ground to keep a global temperature rise well below 2 degrees Celsius above pre-industry levels. In such a scenario, fossil fuel resources and infrastructure that are no longer utilised would become liabilities or stranded assets before their end of economic life cycle. As far as exposure to climate risks is involved, there are several strands of literature on the methodology, ranging from stock-flow consistent techniques (Dafermos and Nikolaidi, 2021), assets devaluation due to default (Allen et al., 2020) to financial system contagion or second-round effects (Battiston et al., 2017). However,

<sup>5</sup> The full data collection steps from the GGKP database are described in detail in Appendix 3.

<sup>6</sup> Appendix 2 presents summary descriptive statistics of all the variables used in the baseline model.

<sup>7</sup> A more detailed definition of the variables employed is provided in Appendix 1.

**Table 2**  
Correlation matrix between the variables used in the baseline model.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Green bond issuance	1.000														
(2) Fossil fuel financing	0.119	1.000													
(3) Fossil fuel subsidies per capita	0.030	0.387	1.000												
(4) Divestment commitments	0.110	0.061	0.063	1.000											
(5) EPI	0.000	0.000	0.000	0.000	1.000										
(6) GDP per capita	0.088	0.426	0.266	0.077	0.219	1.000									
(7) Green innovation	0.120	0.245	0.213	-0.001	0.000	0.139	1.000								
(8) Renewable energy use	-0.027	-0.188	-0.031	0.016	0.058	-0.346	-0.068	1.000							
(9) Feed-in tariff	0.049	0.155	0.128	0.016	0.130	0.191	0.098	-0.036	1.000						
(10) Environmentally-related taxes	0.024	0.279	0.400	0.081	0.305	0.412	0.148	0.041	0.257	1.000					
(11) Public expenditure	-0.006	0.040	0.105	0.030	0.127	0.121	0.018	-0.034	0.059	0.181	1.000				
(12) Public employment	-0.014	0.127	0.215	-0.001	0.201	0.095	-0.004	0.038	0.128	0.344	0.110	1.000			
(13) Government effectiveness index	0.009	0.118	0.120	0.003	0.051	0.000	0.029	-0.009	-0.009	0.125	0.057	0.037	1.000		
(14) Regulatory quality index	0.006	0.094	0.105	-0.002	0.082	0.000	0.015	0.038	0.001	0.166	0.002	0.100	0.472	1.000	
(15) Voice and accountability index	0.050	0.099	0.228	0.058	0.155	0.404	0.090	-0.080	0.125	0.360	0.097	0.089	0.270	0.111	1.000

these studies apply the methodology to a limited number of countries (for example 28 countries or regions in (Dafermos and Nikolaidi, 2021) France in (Allen et al., 2020) and the EU in (Battiston et al., 2017)). Our study, on the other hand, aims to cover as many countries as possible on the aforementioned IMF list. Given such coverage, financing deals data on secondary markets may not be as reliable as the data on primary markets (Pazitka et al., 2021). On the grounds of the above rationale, we employ fossil fuel financing (via bond issuances, syndicated loan issuances, and equity issuances) as a proxy for financial stability concerns.

Total fossil fuel financing per country is aggregated from raw data on investment deals provided by Dealogic, covering three groups of deals: (i) issuance of equity, (ii) issuance of debt (corporate and government bonds), and (iii) syndicated loans. We use the Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) company codes on Dealogic to identify deals related to the fossil fuel sector. In total, there are 32,545 deals, of which 9247 relate to equity issuance, 8447 are debt issuance, and 14,851 are syndicated loans. As with the green bond variables, the scope of transactions focusses on the primary capital market.

Total value of each deal is divided equally among investment banks as we do not have specific information on the actual deal amount by individual banks. We aggregate fossil fuel financing amount in USD by year and by the brokering bank parent country. Finally, we divide the fossil fuel financing amount by total financing amount (including equity, debt, and syndicated loan) to arrive at the variable as a proportion of fossil fuel financing over total financing on primary markets.

**3.3.1.2. Green bond markets.** Among green finance products, green bonds experienced the earliest growth and have since attracted the most attention to date, from both investors' and regulators' perspectives. Moreover, green bond markets have been well researched and have become generally standardised with guidelines from independent verifiers such as the Climate Bonds Initiative and the Green Bond Principles (GBPs). We therefore use the amount of green bond financing underwritten by investment banks headquartered in a country to proxy for that country's green finance industry. This reflects more market-based dynamics than green bonds issued by national governments and governmental bodies.

We analyse data on green bonds from the Dealogic database, a platform providing financial market information on thousands of transactions from investment banks and other financial service providers. The data span from 2000 to 2019 and cover 2861 green bond deals. Dealogic defines green bonds as a type of bond instrument whose proceeds will exclusively finance or refinance, partly or fully, new and/or existing green projects that are aligned with the core four components that issuers must disclose to comply with the GBPs. The GBPs are voluntary guidelines for green bond issuers and the four components are use of proceeds, process for project evaluation and selection, management of proceeds, and reporting.

The scope of the data is limited to primary markets; as a result, trading, securitisation, and other secondary transactions of bond markets are not covered. We use the nationality of the parent bank to classify green bond deals brokered by investment banks headquartered in a specific country. Total value (in USD) of each deal is divided equally among investment banks involved in the deal since we do not have specific information on the actual deal amount by individual bank. We then aggregate the deal amount in USD by year and by the brokering bank parent country. Finally, we divide the green bond financing amount by the total debt financing amount to arrive at the variable as a proportion of green bond issuance over total debt issuance on primary markets.

### 3.3.2. Institutional factors and their proxies

#### 3.3.2.1. Regulative pillar: fossil fuel subsidies from governments. Fossil

fuel subsidies from governments have been furthering carbon pricing (Böhringer, 1996). We use the data from the OECD for fossil fuel support in which the subsidies are in the form of tax expenditure and budgetary transfer across a range of fossil fuels (coal, petroleum, natural gas) in power purchasing parity USD. The variable is fossil fuel subsidies per capita after we scale the subsidies amount in USD by population.

**3.3.2.2. Regulative pillar: feed-in tariffs for renewable energy.** Feed-in tariff (FIT) is a market-based economic instrument, offering long-term contracts at a guaranteed price to be paid to a producer of a pre-determined source of electricity per kWh fed into the electricity grid. The variable is mean FIT in USD for seven types of renewable energy source<sup>8</sup> as defined by the OECD database.

**3.3.2.3. Normative pillar: fossil fuel divestment commitments.** As discussed in the literature review, these divestment movements are a representation of the normative pillar of institutional theory. Accordingly, the amount of fossil fuel divestment commitments is a proxy for the pressure from social movements against the fossil fuel industry. In order to capture country-level fossil fuel divestment commitments, we include data sourced from the Divest Invest Initiative (Cojoianu et al., 2021). The data cover the amount of assets committed to divesting from the fossil fuel industry of a wide range of organisations, such as non-governmental organisations (NGOs), private sector firms, governmental bodies, as well as financial institutions since 2018. We aggregate this variable in USD by year and by country.

### 3.4. Control variables

We control for other factors that could affect policymaking of green finance measures. Apart from the standard gross domestic product (GDP) per capita, we control for public expenditure, public employment, environment-related taxes. Moreover, research on environmental regulation, green investments, and green innovation suggests that there exists a positive feedback loop among them (Li et al., 2023), so we also control for country-level green innovation. Furthermore, we use the proportion of renewable energy use provided by the IMF to consider an increased policy density effect of a country with a more mature market of renewable energy (Georgallis et al., 2019). Overall environment indicators related to climate change, ecosystem vitality, and environmental health are also accounted for (Block et al., 2024). Finally, national governance indices which capture government effectiveness, regulatory quality, and accountability are added to account for other institutional factors (Baumöhl et al., 2019; Fan et al., 2011).

### 3.5. Model specification: survival analysis

Fig. 1 displays the cumulative distribution of green finance policies of all the issuing countries.

Fig. 1 suggests that after the first issuance distributions are generally standard across countries, which highlights the importance of the first instance of this type of climate policy. As some countries have not issued green finance policies in the sample period, we employ survival analysis for censored data to investigate potential determinants of the first adoption of green finance policies (Cleves et al., 2016; Melnyk et al., 1995). Survival analysis not only considers whether the event of interest occurs but also the length that it takes for it to occur from the start of the sample period. While the term survival analysis originates in medical studies, in a finance context it has been adopted in the initial public offering (IPO) literature and the influence of institutional factors on the decision to sign up to the United Nations Principles for Responsible Investment (UN PRI) (Espenlaub et al., 2012, 2016; Hoepner et al., 2021).

We analyse the first adoption of green finance policies by countries based on market-based and institutional proxies. The dependent variable in survival analysis consists of the time until the occurrence of an event. In this case, it is the time until a country publishes its first green finance policy in a period given that the country has not issued any such measures up until then.

The equation for the hazard rate of the event (that is the first adoption of a green finance policy by a country) happening is:

$$h(t) = \frac{f(t)}{S(t)} \quad (1)$$

where  $f(t) = F(t)$  is the probability density function for green finance policy issuance conditional on no issuance before  $t$  and  $S(t) = 1 - F(t)$  is the survival function of the probability of no issuance of a green finance policy in a country before time  $t$ .

First, we use Cox proportional hazards model to estimate the effects of factors on the first issuance of green finance policies. The model assumes that the hazard rate  $h_0(t)$  depends on time  $t$  and covariates  $x_{in}$ . It estimates the hazard rate at time  $t$  for country  $i$  with a set of covariates  $x$ .

$$h(t|x_{i1}, \dots, x_{in}) = h_0(t)\exp(\beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_n x_{in}) = h_0(t)\exp(x^T \beta), \quad h_0(t) > 0 \quad (2)$$

where  $\beta_1, \dots, \beta_p$  are parameters displaying the effect of covariates.

In the Cox model, the baseline hazard  $h_0(t)$  is unspecified, which allows results from the model to be robust despite the distributions of the survival time (Iwasaki, 2014).

The full Cox proportional hazards model is:

$$h(t|x) = h_0(t)\exp(\beta_1 \text{MarketBased factors} + \beta_2 \text{Regulative pillar} + \beta_3 \text{Normative pillar} + \beta_4 \text{Controls}) \quad (3)$$

Next, in addition to the Cox model, the Weibull model is used to further check for robustness of the results. The baseline hazard  $h_0(t)$  in this model takes the parametric form of a Weibull distribution,  $pt^{p-1}$  instead of being left undefined as in the Cox model.

$$h(t|x) = pt^{p-1}\exp(\beta_1 \text{MarketBased factors} + \beta_2 \text{Regulative pillar} + \beta_3 \text{Normative pillar} + \beta_4 \text{Controls}) \quad (4)$$

where  $p$  is the shape parameter to be estimated from the data.

We convert coefficients estimated from Eqs. (3) and (4) into hazard ratios. In the results, coefficients and hazard ratios are both presented for each model, but only the hazard ratios are interpreted for economic significance. A statistically significant hazard ratio shows how the probability of a country issuing its first green finance policy is multiplied when a specific covariate changes by one unit. If a hazard ratio of a determinant is above 1, the determinant increases the probability of the first issuance of green finance policies. On the other hand, if the hazard ratio of less than 1, such a covariate (determinant) is deemed a preventive factor decreasing the probability of green finance policy's first issuance. For example, if the hazard ratio of covariate A is 1.1, then one-unit increment in covariate A result in a 10 % increase in probability of a country publishing its first green finance measures.

### 3.6. Endogeneity issues

According to (Baumöhl et al., 2019; Liu, 2012), endogeneity issues can occur in a survivorship model under the following three conditions: (i) when an dependent variable is a future variable; (ii) when the time period of estimation is very short; and (iii) when the dependent variable is a continuous variable. In our model, the dependent variable has been measured until 2019, and therefore is not a future variable. Moreover, all the independent and control variables are lagged by one year and are included in the model up until the first issuance of green finance

<sup>8</sup> Wind, Solar PV, Geothermal, Biomass, Waste, Small Hydro, and Marine

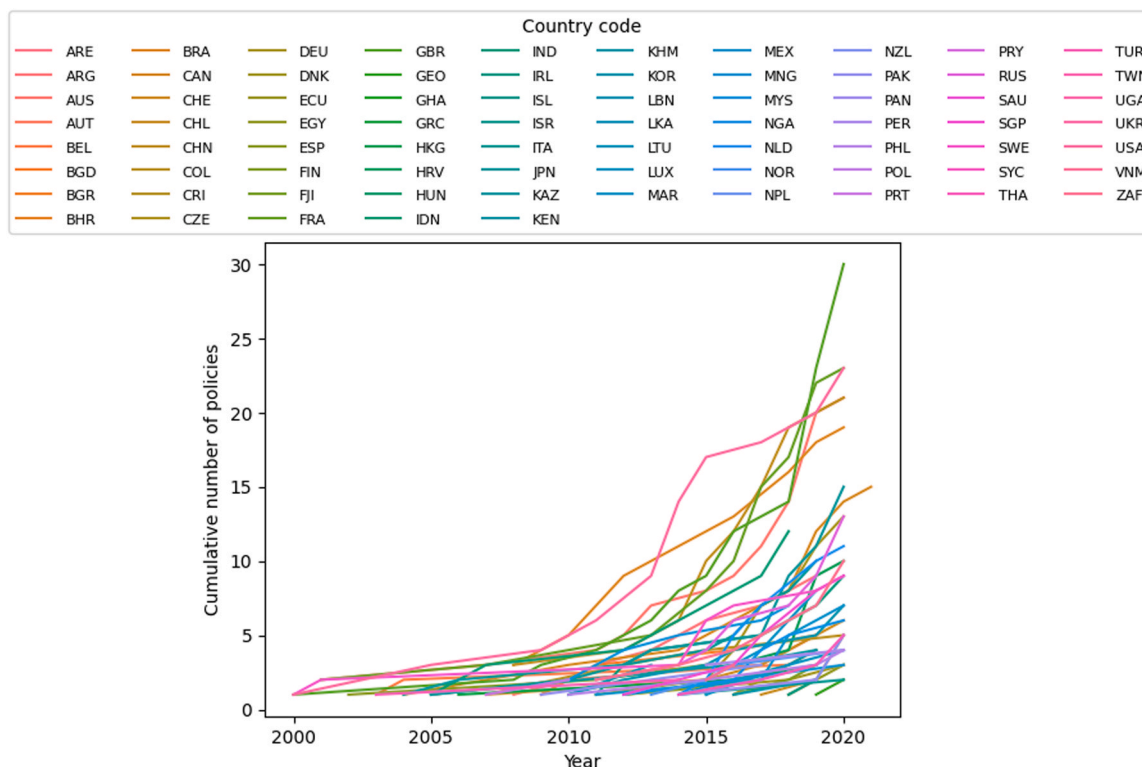


Fig. 1. Cumulative distribution of green finance policies of all the issuing countries.

policies, which does not result in simultaneity issues between dependent and independent variables. Next, the estimation period is sufficient, covering twenty years from 2000 to 2019. Finally, the dependent variable is a binary variable, indicating whether a country issues green finance policies in a specific year. On such grounds, the survival analysis does not violate any of the conditions outlined above.

Similarly, endogeneity is a limited concern in survival analysis (Azeem et al., 2023; Cornett et al., 2007; DesJardine et al., 2019). Reverse causality is mitigated by the empirical design of survival analysis (Ren et al., 2024). This applies in our study where external pressures from divestment commitments, fossil fuel financing, and state support of fossil fuel are taken at baseline and only affect the timing issuance of green finance policies at some later point. Therefore, reverse causation is not a primary concern. As an additional precaution, we follow (da Fonseca et al., 2023; Lee et al., 2019) in lagging all independent and control variables one year. It is also acknowledged that some omitted variables could simultaneously impact green finance policy issuance and its determinants. For example, a country with a higher proportion of public workers may have more human resources to issue more public policies, or a country with better environmental performance may also have higher number of policies regulating emissions. As far as possible, we include such variables as controls, and we re-estimate key baseline models with three different assumptions on the survival time distribution, using Weibull (explained above), exponential, and Gompertz distributions.

## 4. Synthesis of results

### 4.1. Descriptive statistics

Figs. 2–4 display descriptive summaries for the number of countries and green finance measures in the sample from 2000 to 2019.

Figs. 2 and 3 illustrate that, in total, there are 383 measures issued by 75 countries. The number of countries that issue at least one green finance policies increases over time, especially after 2015 (Fig. 2), which

can be understood as a reaction to an external shock, the Paris Agreement. Fig. 3 shows that more than half of the policies are issued by the OECD countries, which highlights the fact that those countries are early adopters of this type of policies.

Fig. 4(a), which presents the number of mandatory and non-mandatory policies, suggests that until 2006 almost all policies are mandatory, but as more green finance measures are issued non-mandatory policies became more widespread. Non-mandatory or voluntary policies include guidelines and consultation papers that do not require any organisations to comply with; they only act as best practice instructions. It is understandable that the number of voluntary policies outnumber that of mandatory policies given that green finance policies remain a new policy toolkit for regulators. They may want to test the markets first before forcing policies into regulatory requirements. We then break down the total number of green finance policies by asset classes affected by those policies. As shown in Fig. 4(b), there are three affected asset classes as defined by the database, which includes banking, insurance, and asset management products. Early on, asset management products are the first targets of green finance policies. However, since 2016, the proportion among the three asset classes become more comparable. Fig. 4(c) displays the number of green finance policies issued by central banks or financial regulators and the total number of green finance policies. Central banks and financial regulators, on the grounds of financial stability concerns as discussed above, are more likely to be engaged in the publication and issuance of green finance policies, especially after the Paris Agreement. This means that for the first issuance of green finance policies, central banks and financial regulators are more likely to be the issuer, prompting our focus on examining these policies in more detail later in the analyses.

On the grounds of divergences of patterns in these breakdowns, it is interesting to explore the impact of the key determinants on each type of policies (that is mandatory vs. non-mandatory policies, policies affecting the asset management, banking, and insurance industries, policies issued by central banks/ financial regulators, and policies issued by OECD countries).

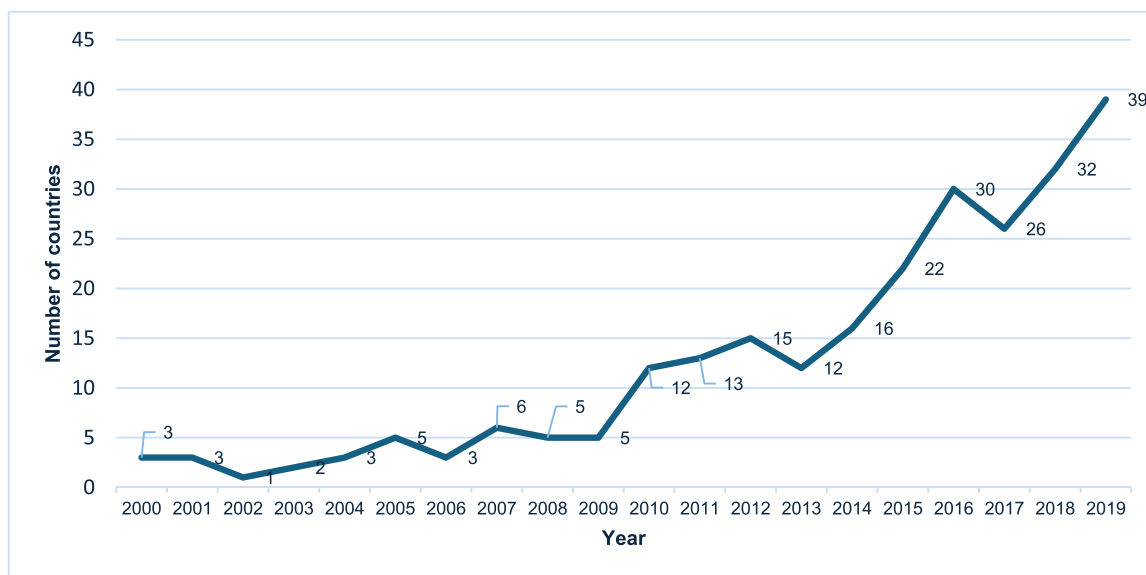


Fig. 2. The number of countries that issue at least one green finance measure from 2000 to 2019.

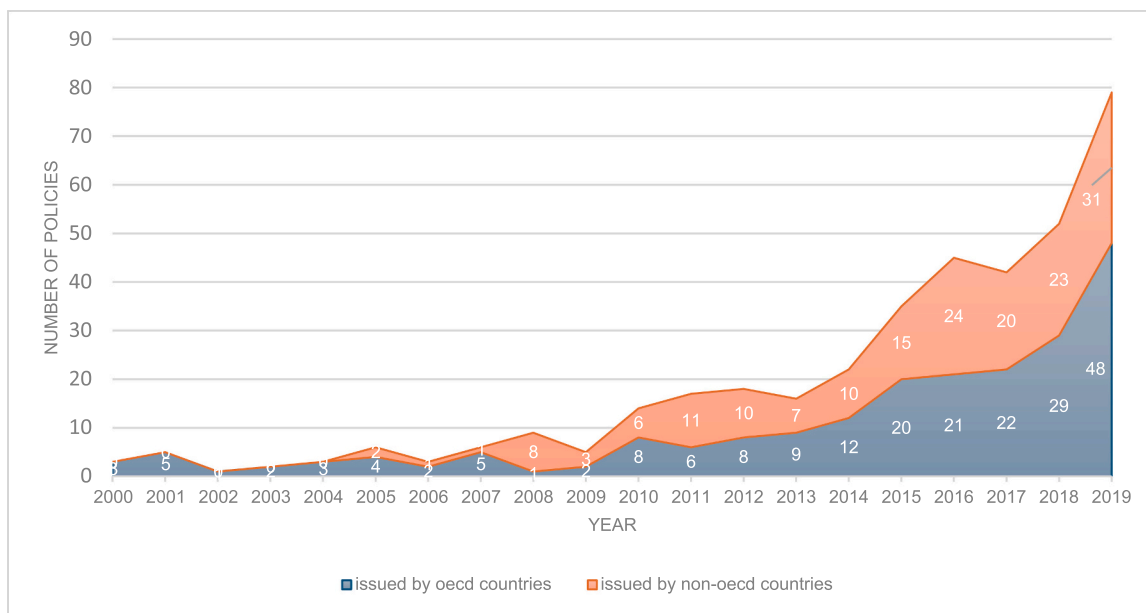


Fig. 3. The number of green finance policies issued OECD countries and non-OECD countries from 2000 to 2019.

#### 4.2. Survival analysis results

##### 4.2.1. Baseline results

Table 3 presents the results of our baseline model (based on Eq. 3) in which we estimate the impacts of relevant factors in the adoption of green finance policies, and correspondingly the dependent variable is time to the first issuance of any green finance policies by a country.

Table 3 suggests that market-based factors (that is fossil fuel financing and green bonds market) positively affect the adoption of green finance policies in our sample of 188 countries, although the effect of green bond issuance is not statistically significant. The hazard ratio of fossil fuel financing on primary markets, which proxies for exposure to financial instability due to climate change risks, indicates that a unit increase in the level fossil fuel financing results in around 12 % increase in the probability of country’s first issuance of green finance policies ( $hazard\ ratio = 1.119 > 1; p < 0.01$ ). Hence, Hypothesis 1 is supported in the baseline model. In terms of evidence to support Hypothesis 2, we

find that green bond issuance positively affects the probability of green finance policies adoption, although the coefficient is not statistically significant and the impact on the first issuance of green finance measures is 1.5 % ( $hazard\ ratio = 1.015 > 1$ ). Regarding institutional factors, fossil fuel government subsidies marginally increase the likelihood of the first green finance policy issuance ( $hazard\ ratio = 1.047 > 1$ ). On the other hand, divestment commitments do not result in an increased probability of first adoption of green finance policies ( $hazard\ ratio = 0.988 < 1$ ). Therefore, Hypothesis 3 is supported while Hypothesis 4 is rejected.

Findings from the baseline model support three out of the four hypotheses based on the literature review, failing to support Hypothesis 4. Specifically, the evidence answers the calls for regulation to address financial instability concerns related to climate change risk (see (Battiston et al., 2021; Campiglio et al., 2018; Chabot and Bertrand, 2023) (Hypothesis 1). In addition, the empirical findings support Hypothesis 2 which argues that the growth of green bonds markets could

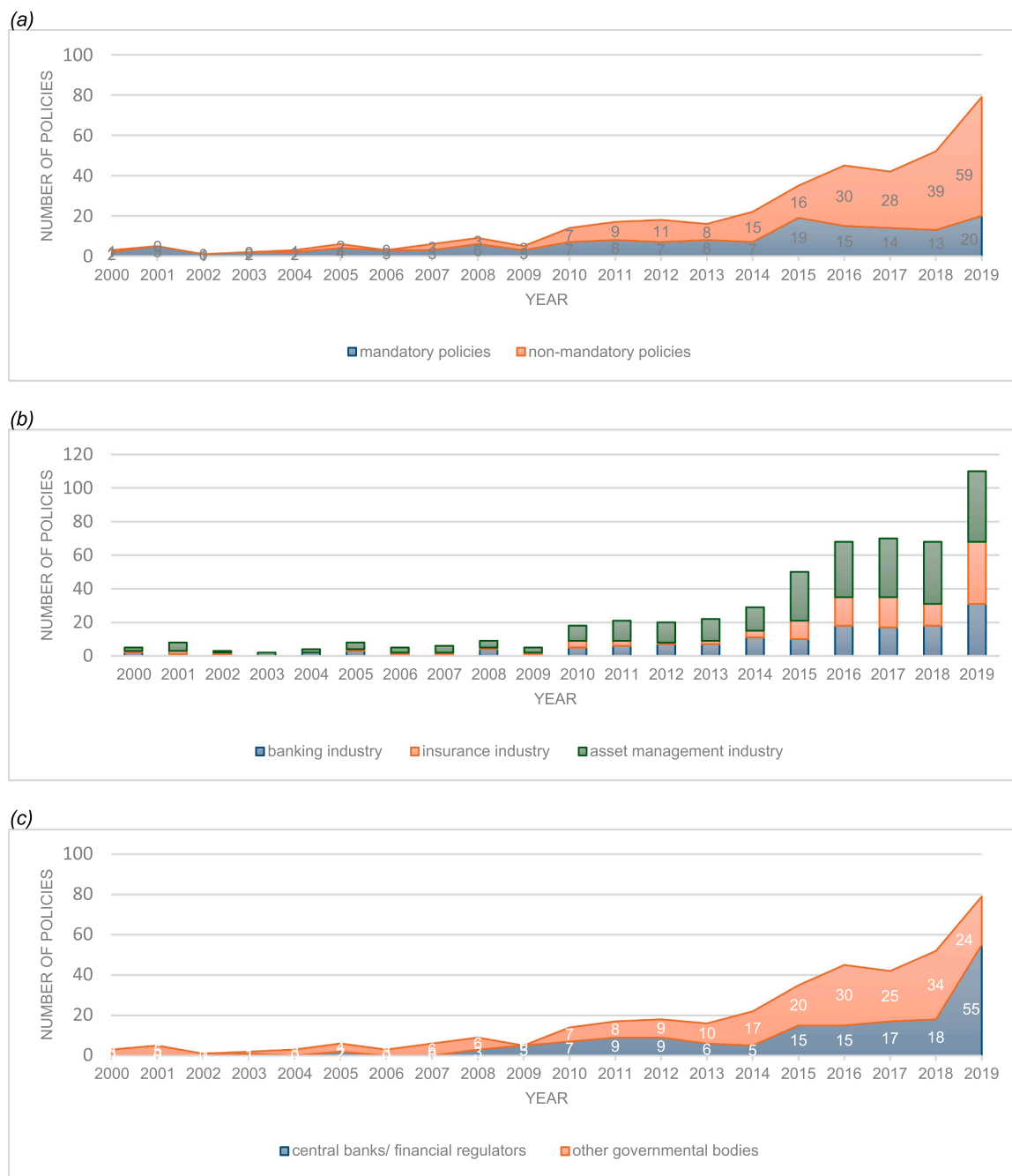


Fig. 4. Green finance policies by (a) compliance type; (b) industry; and (c) issuing authorities/ bodies.

result in policy interventions to scale up investments in sustainable projects via bond financing (Georgallis et al., 2019). Next, in countries with high levels of state subsidies for fossil fuels, it is more likely that those countries will be pioneers in adopting green finance measures to bridge the carbon pricing gap (Geels, 2014) (Hypothesis 3). Finally, feed-in tariff policies do not seem to increase the likelihood of the adoption of green finance policies, which is understandable given that the two types of policies both accelerate the sustainability transitions (Hypothesis 4).

#### 4.2.2. Subsamples' results

Based on our descriptive analysis of the sample of green finance measures, we break down the green finance policies into categories and analyse the effects of the four factors in the first issuance of:

- Mandatory green finance policies and non-mandatory green finance policies (Table 4);
- Green finance policies issued by central banks and financial regulators (Table 5); and
- Green finance policies affecting the banking, insurance, and asset management industries (Table 6).

Table 4 presents the survivorship results when the event of interest is the first issuance of mandatory and non-mandatory policies, respectively.

Table 4 suggested that while divestment commitments are a driving determinant of the adoption of non-mandatory policies (*hazard ratio* = 1.019 > 1), for mandatory policies the level of divestment commitments is a preventive factor (*hazard ratio* = 0.266 < 1; *p* < 0.05). This means that while a one-unit increment in the commitments decreases

Table 3

Determinants of the first issuance of green finance policies (baseline model).

Dependent variable: Time to the first issuance of green finance policies Independent and control variables	All policies	
	Model 1	
	coefficients	hazard ratio
<i>Market-based drivers</i>		
Fossil fuel financing	0.113*** (0.022)	1.119*** (0.0246)
Green bond underwriting	0.015 (0.029)	1.015 (0.0290)
<i>Institutional factors</i>		
Fossil fuel government subsidies per capita	0.046 (0.043)	1.047 (0.0454)
Feed-in tariff	-0.018 (0.223)	0.982 (0.219)
Divestment commitments	-0.012 (0.035)	0.988 (0.0341)
<i>Control variables</i>		
EPI - Climate change indicators	0.104 (0.331)	1.110 (0.367)
GDP per capita	-0.107 (0.119)	0.899 (0.107)
Renewable energy use	1.474*** (0.558)	4.369*** (2.437)
Environmentally-related taxes	0.207*** (0.080)	1.230*** (0.0986)
Green innovation	6.044*** (2.044)	421.5*** (861.6)
Government effectiveness index	0.058 (0.192)	1.059 (0.204)
Regulatory quality index	-0.147 (0.202)	0.864 (0.175)
Voice and accountability index	-0.211 (0.130)	0.810 (0.105)
Public expenditure	-1.350 (1.693)	0.259 (0.439)
Public employment	0.929 (1.266)	2.532 (3.206)
Retained observations	3227	3227
Wald ( $\chi^2$ )	163.1***	163.1***
Log pseudolikelihood	-222.5	-222.5

Notes: Survival analysis using Cox proportional hazards model  
Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Independent and control variables are lagged 1 year.

the likelihood of adopting mandatory policies by 26.6 %, it increases the probability of the first issuance of non-mandatory policies by 1.9 %. This indicates that under the effect of divestment campaigns and commitments, governments opt for less restrictive forms of policies instead of issuing policies that are binding with high-compliance requirements. State support for the fossil fuel industry through subsidies also highlight the different effect of regulative pillar on types of compliance of green finance measures. The higher the level of fossil fuel subsidies, the more likely it is that governments issue non-mandatory green finance measures ( $hazard\ ratio = 1.086 > 1$ ;  $p < 0.05$ ); however, the reverse is true for mandatory policies ( $hazard\ ratio = 0.996 < 1$ ). In other words, the regulative pillar is more likely to shape non-binding green finance policies, which could in turn allow financial market participants to put their resources into industry-based voluntary initiatives such as the Principles for Responsible Investment (PRI) (Hoepner et al., 2021).

In terms of policies issued by central banks and financial regulators (Table 5), although the result for green bond issuance is not statistically significant, its size is the largest across all the models ( $hazard\ ratio = 1.029 > 1$ ). Specifically, a one-unit increase in the amount of green bonds issued on primary markets may lead to an increase of approximately 3 % in the likelihood of adopting green finance policies of a country. Thus, there is evidence to support Hypothesis 2 which emphasises how coherent developments in an emerging new market drive

Table 4

Determinants of the first issuance of green finance policies by type of compliance (mandatory and non-mandatory).

Dependent variable: Time to the first issuance of green finance policies Independent and control variables	Mandatory policies		Non-mandatory policies	
	Model 2		Model 3	
	coefficients	hazard ratio	coefficients	hazard ratio
<i>Market-based drivers</i>				
Fossil fuel financing	0.115*** (0.029)	1.122*** (0.0321)	0.095*** (0.025)	1.100*** (0.0279)
Green bond underwriting	0.030 (0.027)	1.031 (0.0275)	-0.006 (0.020)	0.994 (0.0203)
<i>Institutional factors</i>				
Fossil fuel government subsidies per capita	-0.004 (0.032)	0.996 (0.0322)	0.082** (0.033)	1.086** (0.0360)
Feed-in tariff	0.283 (0.250)	1.327 (0.332)	-0.128 (0.311)	0.880 (0.274)
Divestment commitments	-1.325** (0.623)	0.266** (0.166)	0.019 (0.027)	1.019 (0.0276)
<i>Control variables</i>				
EPI - Climate change indicators	1.173** (0.519)	3.231** (1.678)	0.035 (0.290)	1.035 (0.300)
GDP per capita	-0.075 (0.159)	0.928 (0.147)	-0.194 (0.143)	0.824 (0.118)
Renewable energy use	1.160* (0.692)	3.191* (2.207)	1.132 (0.746)	3.101 (2.313)
Environmentally-related taxes	0.107 (0.092)	1.113 (0.102)	0.180* (0.094)	1.197* (0.113)
Green innovation	3.656 (2.802)	38.69 (108.4)	18.828*** (3.383)	1.502e+08*** (5.084e+08)
Government effectiveness index	0.096 (0.173)	1.100 (0.191)	0.150 (0.249)	1.162 (0.290)
Regulatory quality index	-0.414*** (0.153)	0.661*** (0.101)	-0.159 (0.248)	0.853 (0.212)
Voice and accountability index	-0.144 (0.174)	0.866 (0.151)	-0.204 (0.185)	0.815 (0.150)
Public expenditure	-0.035 (2.133)	0.965 (2.059)	-1.599 (1.959)	0.202 (0.396)
Public employment	1.785 (1.149)	5.962 (6.848)	-1.142 (1.657)	0.319 (0.529)
Retained observations	3350	3350	3442	3442
Wald ( $\chi^2$ )	101.2***	101.2***	137.4***	137.4***
Log pseudolikelihood	-152.2	-152.2	-211.6	-211.6

Notes: Survival analysis using Cox proportional hazards model  
Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Independent and control variables are lagged 1 year.

policy support from regulators (Georgallis et al., 2019). This result could be explained by the remit of either central banks or financial regulators in overseeing and monitoring sustainable finance markets.

Regarding policies that affect different financial industries, Table 6 reports the determinants of green finance policies applicable to banks, insurers, and asset managers. We find that across the three columns in

**Table 5**

Determinants of the first issuance of green finance policies issued by central banks and financial regulators.

Dependent variable: Time to the first issuance of green finance policies	Policies issued by central banks/ financial regulators	
	Model 4	
	coefficients	hazard ratio
<i>Market-based drivers</i>		
Fossil fuel financing	0.166*** (0.032)	1.181*** (0.0382)
Green bond underwriting	0.029 (0.027)	1.029 (0.0278)
<i>Institutional factors</i>		
Fossil fuel government subsidies per capita	-0.056 (0.058)	0.946 (0.0549)
Feed-in tariff	-0.477 (0.368)	0.620 (0.228)
Divestment commitments	-0.048 (0.045)	0.953 (0.0427)
<i>Control variables</i>		
EPI - Climate change indicators	0.575* (0.298)	1.778* (0.530)
GDP per capita	-0.625*** (0.193)	0.535*** (0.103)
Renewable energy use	0.675 (0.902)	1.964 (1.773)
Environmentally-related taxes	0.038 (0.120)	1.039 (0.125)
Green innovation	-2.797 (5.413)	0.0610 (0.330)
Government effectiveness index	-0.170 (0.213)	0.844 (0.180)
Regulatory quality index	-0.375*** (0.126)	0.687*** (0.0863)
Voice and accountability index	0.590 (0.450)	1.803 (0.811)
Public expenditure	0.785 (2.140)	2.193 (4.693)
Public employment	-0.624 (1.943)	0.536 (1.042)
Retained observations	3505	3505
Wald ( $\chi^2$ )	62.93***	62.93***
Log pseudolikelihood	-124	-124

Notes: Survival analysis using Cox proportional hazards model

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Independent and control variables are lagged 1 year.

**Table 6**, the amount of government subsidies for fossil fuels exhibits positive effect, albeit the economic significance is low. This indicates that for green finance policies affecting these industries, fossil fuel state subsidies in fact negate traditional environmental policies (Geels, 2014), which makes it necessary for other types of policies. In addition, exposure to fossil financing on primary financial markets seems to increase the probability of the adoption of green finance policies by a country, which is consistent with the baseline model's result. Divestment commitments also have subtly different effects on the adoption of green finance measures affecting banking, insurance, and asset management industries. Divestment commitments seem to be a determinant factor driving the adoption of green finance policies affecting banking ( $\text{hazard ratio} = 1.026 > 1$ ), and insurance industries ( $\text{hazard ratio} = 1.047 > 1; p < 0.05$ ). However, this is not the case for policies targeting asset managers ( $\text{hazard ratio} = 0.993 < 1$ ). These findings are in line with (Le Billon and Kristoffersen, 2020), which emphasises the risk of being ostracised for banks engaged in underwriting financing deals for fossil fuel companies.

While Steffen (2021) find a negative relationship between the importance of the financial sector in the economy and green finance

policy density, our results across different subsamples suggest that it is the exposure of investment banks to fossil fuel companies via primary financing deals that drives the issuance of green finance policies, which provides empirical support for Hypothesis 1. The findings are consistent across the baseline model and the subsamples' model and strongly suggest that concerns about financial stability may result in policy actions, answering calls for financial regulators' mandates and governments' role in addressing climate-related risks (Campiglio et al., 2018; Chabot and Bertrand, 2023). Another pathway that the financial sector positively affects the issuance of green finance policies is via sustainable finance markets. The role of a coherently developed green finance market (Hypothesis 2) is positively pronounced in case of policies issued by central banks and financial regulators. It indicates that as financial institutions bring more sustainable finance products to the market to meet investors' increased demand, this creates an emergent and distinct industry within the financial sector. This in turns requires financial regulators to publish policies specific to that industry to support it and regulate sustainable finance products. The results contribute to a strand of research analysing regulation and industry emergence in which policy support is formed when government is treated as an exogenous actor receiving signals from a nascent industry with a clear development path (Georgallis et al., 2019; Hoppmann et al., 2013). At the same time, Hypotheses 3 and 4 could not be categorically confirmed nor rejected. However, our findings on social pressure suggest that the positive effects of social pressure as proxied by divestment campaigns are more announced for non-mandatory than for mandatory policies. Hence, more research would shed light on the stringency of green finance policies to assess whether a policy is impactful or symbolic (Schaffrin et al., 2014, 2015).

#### 4.3. Robustness checks

##### 4.3.1. OECD countries and validation dataset

As Steffen (2021) is, to the best of our knowledge, the first systemic effort to locate green finance policies in the literature, and it compiles a database of green finance measures issued by the OECD based on the GGKP database and International Energy Agency's (IEA) Policies Database, we perform a robustness test using this validation dataset of Steffen (2021).

First, we narrow down our own GGKP dataset to filter for policies issued by OECD countries from 2000 to 2019. Out of 383 total policies for the sample period, OECD countries issue 211 measures, accounting for more than 55 %. The validation dataset by Steffen (2021) contains 136 policies. Then, we re-estimate the baseline model using the two datasets to compare their results in Table 7.

Qualitatively, the positive effects of green bond issuance, fossil fuel financing, and divestment commitments on the adoption of green finance measures by OECD countries are consistent in the two models. Specifically, green bond issuance is a statistically significant determinant of green finance policy adoption in OECD countries, which could be explained by a more developed green bond markets in the financial sector there.

##### 4.3.2. Climate change awareness

It is acknowledged that the cognitive pillar in institutional theory could be affecting whether a country adopts an environmentally friendly policy.<sup>9</sup> The reason that we do not include a proxy for this pillar is due to data quality concerns. For this type of measurement, it is typically conducted via large-scale surveys at different time intervals and cannot constitute a consistent time series for a sample period of 20 years. We are aware of studies using the Global Leadership and Organizational Behavior Effectiveness (GLOBE) (Bernhagen and Mitchell, 2009; Hoepner et al., 2021). However, these studies use a much shorter sample

<sup>9</sup> We would like to thank an anonymous reviewer for raising this insight.

Table 6

Determinants of the first issuance of green finance policies affecting banking, insurance, and asset management industries.

Dependent variable: Time to the first issuance of green finance policies	Policies related to the banking industry		Policies related to the insurance industry		Policies related to the asset management industry	
	Model 5		Model 6		Model 7	
	coefficients	hazard ratio	coefficients	hazard ratio	coefficients	hazard ratio
<i>Market-based drivers</i>						
Fossil fuel financing	0.107*** (0.025)	1.113*** (0.0280)	0.080*** (0.025)	1.083*** (0.0274)	0.106*** (0.023)	1.112*** (0.0250)
Green bond underwriting	-0.004 (0.022)	0.996 (0.0216)	-0.030 (0.026)	0.970 (0.0253)	0.011 (0.023)	1.011 (0.0228)
<i>Institutional factors</i>						
Fossil fuel government subsidies per capita	0.045 (0.036)	1.046 (0.0375)	0.053 (0.037)	1.054 (0.0393)	0.057 (0.060)	1.058 (0.0637)
Feed-in tariff	0.135 (0.229)	1.144 (0.262)	0.005 (0.299)	1.005 (0.300)	-0.010 (0.272)	0.990 (0.270)
Divestment commitments	0.026 (0.023)	1.026 (0.0239)	0.046** (0.021)	1.047** (0.0218)	-0.007 (0.024)	0.993 (0.0234)
<i>Control variables</i>						
EPI - Climate change indicators	0.271 (0.445)	1.311 (0.583)	-0.202 (0.329)	0.817 (0.269)	0.195 (0.406)	1.215 (0.493)
GDP per capita	-0.152 (0.151)	0.859 (0.129)	0.137 (0.191)	1.146 (0.219)	-0.073 (0.136)	0.929 (0.126)
Renewable energy use	1.760*** (0.673)	5.813*** (3.911)	1.672** (0.682)	5.324** (3.632)	1.067* (0.597)	2.908* (1.737)
Environmentally-related taxes	0.089 (0.102)	1.093 (0.112)	0.212* (0.109)	1.236* (0.134)	0.238*** (0.092)	1.268*** (0.116)
Green innovation	7.696** (3.124)	2200** (6874)	11.093*** (3.148)	65,724*** (206,886)	4.775** (2.385)	118.5** (282.6)
Government effectiveness index	-0.205 (0.176)	0.815 (0.143)	0.264 (0.293)	1.303 (0.381)	-0.043 (0.220)	0.958 (0.211)
Regulatory quality index	-0.057 (0.235)	0.945 (0.222)	0.483 (0.365)	1.620 (0.592)	-0.023 (0.218)	0.977 (0.213)
Voice and accountability index	0.046 (0.231)	1.047 (0.241)	-0.271 (0.211)	0.763 (0.161)	-0.293** (0.138)	0.746** (0.103)
Public expenditure	-0.859 (2.013)	0.424 (0.853)	-4.724* (2.773)	0.00888* (0.0246)	0.377 (1.824)	1.458 (2.658)
Public employment	1.248 (1.611)	3.482 (5.610)	2.069 (1.429)	7.918 (11.31)	0.689 (1.523)	1.991 (3.033)
Retained observations	3426	3426	3499	3499	3309	3309
Wald ( $\chi^2$ )	105.1***	105.1***	114.6***	114.6***	176.7***	176.7***
Log pseudolikelihood	-185.8	-185.8	-165.2	-165.2	-206	-206

Notes: Survival analysis using Cox proportional hazards model

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Independent and control variables are lagged 1 year.

period of not more than five years. As such, the number of data points to interpolate for years that the GLOBE project does not publish its results is quite limited. For this reason, in all our models, we have tried, to some extent, to account for people's freedom of expression of policy-related matters using the voice and accountability index.

It is still practical, however, to re-estimate our baseline model for countries with high, medium, and low climate change awareness. For this exercise, we employ the Data for Good at Meta and the [Yale Program on Climate Change Communication \(2022\)](#).<sup>10</sup> This dataset aggregates response data from the 2022 Climate Change Opinion Survey and covers 107 countries, of which 104 can be matched with our sample data. The country-level statistics measure the percentage of respondents in each country/territory providing a given response to each question. These measures are then normalised to provide estimates representative of the population in each country. The question and response value we are interested in are "How much do you know about climate change?" and "I know a lot about it", respectively. Based on the percentages of this response, we classify 104 countries into three categories: (i) high climate awareness; (ii) medium climate awareness; and (iii) low climate awareness. Finally, we run the survivorship model for each category of country (Table 8).

Results indicate that in high- and mid-climate-awareness countries,

fossil fuel financing through primary financial markets seem to be driving the adoption of green finance policies. A one-unit increment in this variable is associated with a 14.5 % and 34.3 % increase in the likelihood of the first issuance of green finance measures in the two groups of countries. On the other hand, in low-climate-awareness countries, it is the case that state support for the fossil fuel industry positively affecting the issuance of green finance policies.

#### 4.3.3. Test of proportional-hazards assumption

In a Cox proportional hazard model, a key assumption is the proportional hazard (PH) assumption, which implies that the hazard ratio associated with any determinant or covariate is constant over time. This can be done using graphical illustrations for each explanatory and control variable or Schoenfeld's residuals (Shui et al., 2024). For conciseness as there are 15 variables to test, we choose to run the test of the Schoenfeld's residuals. Results of the test<sup>11</sup> show that the global test is not significant for all Cox models ( $p = 0.6769$ ), and  $p$ -values for all explanatory variables exceeded 0.05, suggesting that our baseline model does not violate the proportionality assumption.

We also re-estimate the Cox proportional hazards model with other assumptions on the survival time distributions. These distributions are Weibull, exponential, and Gompertz. Results are displayed from

<sup>10</sup> Climate Change Opinion Survey

<sup>11</sup> Detailed results are provided in Appendix 4.

**Table 7**

Determinants of the first issuance of green finance policies issued by OECD countries.

Dependent variable: Time to the first issuance of green finance policies Independent and control variables	All policies - OECD countries		All policies - Validation dataset (OECD countries)	
	Model 8		Model 9	
	coefficients	hazard ratio	coefficients	hazard ratio
<i>Market-based drivers</i>				
Fossil fuel financing	0.101*** (0.034)	1.106*** (0.0375)	0.120** (0.052)	1.127** (0.0586)
Green bond underwriting	0.103** (0.048)	1.108** (0.0535)	0.036 (0.035)	1.036 (0.0365)
<i>Institutional factors</i>				
Fossil fuel government subsidies per capita	-0.034 (0.066)	0.967 (0.0636)	0.034 (0.066)	1.034 (0.0680)
Feed-in tariff	0.184 (0.782)	1.202 (0.940)	0.731 (0.555)	2.077 (1.152)
Divestment commitments	-0.044 (0.032)	0.957 (0.0306)	-0.002 (0.045)	0.998 (0.0444)
<i>Control variables</i>				
EPI - Climate change indicators	0.771 (1.066)	2.161 (2.303)	-0.918 (1.464)	0.399 (0.584)
GDP per capita	0.553 (0.514)	1.739 (0.894)	-0.351 (0.743)	0.704 (0.523)
Renewable energy use	1.096 (1.184)	2.991 (3.542)	1.057 (1.820)	2.877 (5.238)
Environmentally-related taxes	-0.376 (0.448)	0.687 (0.308)	1.117 (1.044)	3.056 (3.190)
Green innovation	3.054 (2.846)	21.20 (60.33)	-1.452 (6.703)	0.234 (1.569)
Government effectiveness index	-0.613 (2.276)	0.542 (1.232)	-0.427 (2.525)	0.652 (1.647)
Regulatory quality index	-1.515 (1.811)	0.220 (0.398)	-1.915 (2.691)	0.147 (0.397)
Voice and accountability index	-0.994 (1.495)	0.370 (0.553)	0.948 (2.073)	2.581 (5.352)
Public expenditure	-2.080 (5.773)	0.125 (0.722)	-0.530 (5.930)	0.588 (3.490)
Public employment	0.914 (2.250)	2.494 (5.612)	-1.681 (2.534)	0.186 (0.472)
Retained observations	443	443	497	497
Wald ( $\chi^2$ )	74.32***	74.32***	36.88***	36.88***
Log pseudolikelihood	-74.61	-74.61	-72.34	-72.34

Notes: Survival analysis using Cox proportional hazards model  
Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Independent and control variables are lagged 1 year.

Appendices 5–7 and demonstrate that the effect of key factors such as fossil fuel financing, and green bonds issuance is largely invariant to different assumptions of survival time distributions.

## 5. Conclusion

This paper explores drivers of green finance policy issuance on a country-level basis from 2000 to 2019 using policy data collated by the GGKP. Building on work by Steffen (2021), it aims to contribute to the scarce literature analysing the history of green finance policies and their drivers of growth. Drawing from the literature on market-based drivers of policies, financial stability concerns, and institutional economics, our results suggest that the emergence of green finance measures is shaped by increasingly developed green finance markets, adverse effects of

climate change risks on the financial sector, and institutional structures (that is existing regulations supporting the fossil fuel industry, social pressure via divestment campaigns, and green innovation profile of a country).

We outline a theoretical framework to build a systematic assessment of this type of policy, starting by underlining the socioeconomic drivers of regulatory interventions. This is one of the first steps to address the research agenda for this policy instrument type put forward by Steffen (2021). Existing studies related to green finance policies or financial policies aimed to mitigate climate change emphasise the roles of these measures in such settings as inducing green innovation (Wang and Li, 2022), affecting financial stability in networks of banks and investment funds (Roncoroni et al., 2021), loan interest rates (Dafermos and Nikolaidi, 2021), and asset pricing (Karydas and Xepapadeas, 2022). We conceptualise potential socioeconomic motivations in the process of issuing green finance policies, which furthers the use of the theory in the literature of sustainable finance (Cao et al., 2022; Chortareas et al., 2024; Harjoto et al., 2021; Liu et al., 2024; Zhu et al., 2012).

Empirically, we find support for a positive relationship between a country's level of fossil fuel financing on primary financial markets and the probability of the first issuance of a green finance policies. These findings suggest that the amount of fossil fuel financing in a country could be a source of financial stability risks (Campiglio et al., 2018), which requires financial policies that could potentially reallocate investments away from fossil fuel infrastructure (Battiston et al., 2017; Hong et al., 2020). The effects of fossil fuel financing on the adoption of green finance measures are different between countries with a high level of climate change awareness and those with a low level of climate change awareness. In the latter group of countries, state subsidies for fossil fuels play a bigger role in driving the first issuance of green finance policies. Green bond issuance is also important in determining whether a country adopts green finance policies, especially policies issued by central banks/ financial regulators and in OECD countries. Further studies could include political positions' influence on the formation and diffusion of this policy instrument (Geddes et al., 2020). In addition, another potential factor affecting the input process of green finance policies is the type of market economy (Ćetković and Buzogány, 2016; Meckling, 2011). For example, there is a long-established literature on "varieties of capitalism", and how these varieties result in different types of policies. In addition, the effectiveness of renewable energy policies is constrained by political economic settings (Ćetković and Buzogány, 2016; Meckling, 2011).

## CRedit authorship contribution statement

**T.F. Cojoianu:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **D. French:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **A.G.F. Hoepner:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **L. Sheenan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **A. Vu:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Table 8

Determinants of the first issuance of green finance policies in high, mid, and low climate awareness countries.

Dependent variable: Time to the first issuance of green finance policies	High climate awareness		Medium climate awareness		Low climate awareness	
	Model 10		Model 11		Model 12	
	coefficients	hazard ratio	coefficients	hazard ratio	coefficients	hazard ratio
<i>Market-based drivers</i>						
Fossil fuel financing	0.135*** (0.048)	1.145*** (0.0551)	0.295*** (0.075)	1.343*** (0.101)	-0.066 (0.081)	0.936 (0.0760)
Green bond underwriting	0.033 (0.047)	1.034 (0.0491)	0.039 (0.066)	1.040 (0.0684)	-1.605 (24.192)	0.201 (4.858)
<i>Institutional factors</i>						
Fossil fuel government subsidies per capita	-0.150** (0.066)	0.861** (0.0567)	0.182 (0.294)	1.200 (0.353)	0.617*** (0.192)	1.853*** (0.356)
Feed-in tariff	0.174 (1.283)	1.190 (1.528)	0.543 (1.030)	1.721 (1.772)	-0.169 (0.366)	0.845 (0.309)
Divestment commitments	0.013 (0.045)	1.013 (0.0455)	0.000 (0.000)	1 (0)	92.590 (0.000)	1.626e+40 (0)
<i>Control variables</i>						
EPI - Climate change indicators	1.376 (0.934)	3.960 (3.697)	-0.789 (1.321)	0.454 (0.600)	0.000 (0.000)	0.000 (0.000)
GDP per capita	-0.510** (0.215)	0.600** (0.129)	-1.806** (0.864)	0.164** (0.142)	2.631** (1.125)	13.89** (15.62)
Renewable energy use	-0.069 (1.021)	0.933 (0.953)	8.449* (5.039)	4673* (23,544)	0.351 (2.401)	1.420 (3.410)
Environmentally-related taxes	0.234* (0.137)	1.263* (0.173)	0.977 (0.648)	2.655 (1.722)	-0.394** (0.156)	0.674** (0.105)
Green innovation	-4.765 (6.281)	0.00853 (0.0536)	8.738 (7.213)	6234 (44,964)	136.069 (100.440)	1.242e+59 (1.248e+61)
Government effectiveness index	-0.579 (0.509)	0.561 (0.285)	-0.071 (2.086)	0.931 (1.942)	0.599 (0.818)	1.820 (1.489)
Regulatory quality index	-1.042** (0.450)	0.353** (0.159)	-5.904** (2.406)	0.00273** (0.00656)	0.422 (0.356)	1.524 (0.543)
Voice and accountability index	-0.093 (0.299)	0.911 (0.272)	0.247 (1.319)	1.280 (1.688)	1.694* (1.001)	5.440* (5.444)
Public expenditure	-3.405 (3.986)	0.0332 (0.132)	26.116 (34.577)	2.198e+11 (7.599e+12)	43.658** (18.625)	9.132e+18** (1.701e+20)
Public employment	4.483** (2.225)	88.52** (196.9)	12.086 (9.415)	177,304 (1.669e+06)	-0.549 (7.738)	0.578 (4.471)
Retained observations	461	461	560	560	580	580
Wald ( $\chi^2$ )	78.14***	78.14***	67.34***	67.34***	304.7 ***	304.7***
Log pseudolikelihood	-58.70	-58.70	-19.86	-19.86	-17.19	-17.19

Notes: Survival analysis using Cox proportional hazards model. The number of countries in high, mid, and low categories is 35, 35, and 34, respectively.

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1. Independent and control variables are lagged 1 year.

### Author contributions

All co-authors contribute equivalently to the article.

### Conflict of interest

Hoepner serves as the Head of the Data Science Hub of the European Commission's Platform on Sustainable Finance (PSF). This is a volunteer role with bi-monthly in person meetings whereby expenses are covered.

Cojoianu is a full member of the EU Platform on Sustainable Finance. This is a volunteer role with bi-monthly in person meetings whereby expenses are covered.

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### Appendix A. : Variable definition

Variable name	Variable description	Data sources
<i>Dependent variable</i>		
Time to the first issuance of green finance policies	The dependent variable in the model is determined by two parts: <i>an event indicator</i> (i.e. whether a country issues its first green finance policy) and <i>a measure of time</i> from baseline to the event or censoring.	Own calculation based on GGKP database on green finance policies
<i>Independent variables - Market-based drivers</i>		
Fossil fuel financing	Total fossil fuel financing per country is aggregated from raw data on investment deals with three groups of deals: (i) issuance of equity, (ii) issuance of debt, and (iii) syndicated loans.	Dealogic

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Variable name	Variable description	Data sources
Green bond underwriting	We aggregate fossil fuel financing amount in USD by year and by the brokering bank parent country. Finally, we divide the fossil fuel financing amount by total financing amount (including equity, debt, and syndicated loan) to arrive at the variable as a proportion of fossil fuel financing over total financing on primary markets. We use the nationality of the parent bank to classify green bond deals brokered by investment banks headquartered in a specific country. Total value (in USD) of each deal is divided equally among investment banks involved in the deal since we do not have specific information on the actual deal amount by individual bank. We then aggregate the deal amount in USD by year and by the brokering bank parent country. Finally, we divide the green bond financing amount by the total debt financing amount to arrive at the variable as a proportion of green bond issuance over total debt issuance on primary markets.	Dealogic
<b>Independent variables - Institutional drivers</b>		
Fossil fuel government subsidies per capita	We use the data from the OECD for fossil fuel support in which the subsidies are in the form of tax expenditure and budgetary transfer across a range of fossil fuels in power purchasing parity USD. The variable is fossil fuel subsidies per capita after we scale the subsidies amount in USD by population.	OECD
Feed-in tariff	The variable is mean FIT in USD for seven types of renewable energy source as defined by the database.	OECD
Divestment commitments	The data cover the amount of assets committed to divesting from the fossil fuel industry of a wide range of organisations, such as NGOs, private sector firms, governmental bodies, as well as financial institutions since 2018. We aggregate this variable in USD by year and by country.	Divest Invest Initiative
<b>Control variables</b>		
Environmental Performance Index (EPI) – Climate change indicators	Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. We use 8 climate change indicators of the EPI.	Yale University
GDP per capita	GDP per capita	IMF
Power generated by renewable energy sources	Proportion of electricity generation by renewable energy sources over total electricity generation.	IMF
Environment-related taxes per capita	The data are based on OECD Policy Instruments for Environment (PINE). PINE has quantitative information on environmentally related fees, tradeable permits and offsets, deposit fund schemes. Negative values may be due to “environmentally beneficial subsidies and payments and voluntary approaches used for environmental policy”.	OECD
Green innovation	The variable is the percentage of patents related to environmental technologies over the total number of patents registered in a country	OECD
Government effectiveness index	The index measures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies.	World Governance Indicators (WGI)
Regulatory quality index	The index measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	World Governance Indicators (WGI)
Voice and accountability index	The index measures perceptions of the extent to which a country’s citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	World Governance Indicators (WGI)
Public expenditure	We use World Bank’s database on ‘General government final consumption expenditure’. The expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees). We then divide the government spending by population to arrive at government spending per capita.	World Bank
Public employment	The Worldwide Bureaucracy Indicators (WWBI) is a dataset on public sector employment and wages. We use the indicator ‘Public sector employment as a share of total employment’.	World Bank

## Appendix B. : Summary of descriptive statistics of variables used on the baseline model

Variable	N	Mean	Std. Dev.	Min	Max
Time to the first policy (years)	3227	9.792	5.661	0	20
Fossil fuel financing proportion	3227	.04	.112	0	1
Green bond issuance proportion	3227	.001	.013	0	.382
Fossil fuel subsidies per capita (USD)	3227	9991555	1.825e+08	0	5.631e+09
Feed-in tariff (USD)	3227	.188	2.495	0	81.834
Divestment commitments (USD)	3227	1.840e+09	3.284e+10	0	1.091e+12
Environmental Performance Index	3227	46.522	18.232	0	95.504
GDP per capita (USD)	3227	12328.995	17835.761	108.066	125200.14
Renewable energy proportion	3227	.316	.336	0	1
Environmentally-related taxes per capita (USD)	3227	185.545	357.503	-271.216	3015.153
Green innovation proportion	3227	.005	.028	0	.34
Government effectiveness index	3227	-.025	.977	-2.439	2.47
Regulatory quality index	3227	-.027	.97	-2.548	2.252
Voice and accountability index	3227	-.021	.985	-2.259	1.801
Public expenditure proportion	3227	.149	.088	0	.795
Public employment proportion	3227	.114	.116	0	.473

### Appendix C. : Data collection steps from the GGKP dataset

We are grateful to Camille Andre – Green Finance Manager at the Green Growth Knowledge Partnership for the Excel file on green finance measures. From the file we received in 2021 with 717 policies, we perform the following steps to arrive at the number of green finance policies that we use across our models.

Step	Description	Number of policies left
1	We only include policies that appear on the website	496
2	We include policies issued from 2000 to 2019	413
3	We exclude policies made at regional levels (e.g. EU ones)	383

### Appendix D. : Test of proportionality-hazards assumption (baseline model)

Independent & control variables	rho	chi2	df	Prob>chi2
Green bond underwriting	0.09657	0.22	1	0.6395
Fossil fuel financing	-0.16818	2.91	1	0.088
Fossil fuel government subsidies per capita	-0.02536	0.06	1	0.8136
Divestment commitments	-0.05229	0.13	1	0.7226
Green innovation	0.20313	1.16	1	0.2817
EPI - Climate change indicators	-0.12637	0.65	1	0.4218
GDP per capita	0.2514	2.66	1	0.1029
Renewable energy use	0.217	2.17	1	0.141
Feed-in tariff	-0.06401	0.05	1	0.831
Environmentally-related taxes	0.18183	2.33	1	0.1268
Government effectiveness index	-0.00747	0	1	0.972
Regulatory quality index	0.35966	3.52	1	0.0606
Voice and accountability index	-0.24041	1.09	1	0.2956
Public expenditure	-0.04464	0.03	1	0.8633
Public employment	-0.11915	0.62	1	0.4326
<b>Global test</b>		<b>12.03</b>	<b>15</b>	<b>0.6769</b>

Note: robust variance-covariance matrix used

### Appendix E. : Re-estimating the determinants of green finance policies issuance using Weibull distribution

Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
<i>Market-based drivers</i>									
Fossil fuel financing	1.110***	1.118***	1.105***	1.180***	1.101***	1.083***	1.105***	1.085**	1.098*
	(0.024)	(0.031)	(0.028)	(0.039)	(0.027)	(0.027)	(0.026)	(0.036)	(0.058)
Green bond underwriting	1.012	1.027	0.986	1.035	1.004	0.975	1.019	1.048	1.042
	(0.031)	(0.026)	(0.019)	(0.026)	(0.021)	(0.024)	(0.023)	(0.042)	(0.032)
<i>Institutional factors</i>									
Fossil fuel government subsidies per capita	1.046	0.996	1.084**	0.953	1.046	1.058	1.053	0.991	1.056
	(0.043)	(0.033)	(0.035)	(0.049)	(0.037)	(0.038)	(0.064)	(0.046)	(0.075)
Feed-in tariff	0.889	1.075	0.916	0.636	1.069	0.897	0.708	0.670	1.279
	(0.241)	(0.365)	(0.225)	(0.245)	(0.267)	(0.291)	(0.310)	(0.537)	(0.660)
Divestment commitments	1.007	0.468***	1.019	0.946	1.034	1.054***	1.022	1.017	1.040
	(0.032)	(0.015)	(0.026)	(0.045)	(0.023)	(0.022)	(0.023)	(0.034)	(0.040)
<i>Control variables</i>									
EPI - Climate change indicators	1.154	3.339**	1.078	1.531	1.274	0.861	1.364	3.924	0.894
	(0.380)	(1.696)	(0.317)	(0.442)	(0.552)	(0.294)	(0.601)	(4.352)	(1.275)

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Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
GDP per capita	0.851 (0.101)	0.900 (0.135)	0.819 (0.124)	0.555*** (0.111)	0.837 (0.123)	1.084 (0.209)	0.838 (0.116)	0.967 (0.412)	0.483 (0.331)
Renewable energy use	3.642** (2.027)	2.852 (1.971)	3.063 (2.256)	1.723 (1.512)	5.414*** (3.548)	4.946** (3.333)	2.500 (1.557)	3.663 (4.366)	2.921 (5.122)
Environmentally-related taxes	1.238*** (0.102)	1.121 (0.106)	1.185 * (0.111)	1.011 (0.131)	1.097 (0.114)	1.263** (0.144)	1.287*** (0.126)	1.110 (0.631)	3.917 (3.896)
Green innovation	4275.930*** (10,507.724)	104.300 (346.628)	5.958e+08*** (1.708e+09)	0.025 (0.149)	87,482.935** (451,391.117)	77,349.781*** (307,210.933)	1264.792*** (3402.261)	71.839 (196.700)	0.184 (1.285)
Government effectiveness index	1.114 (0.227)	1.191 (0.226)	1.209 (0.349)	0.862 (0.176)	0.867 (0.147)	1.324 (0.387)	0.993 (0.253)	1.378 (3.493)	1.583 (4.331)
Regulatory quality index	0.839 (0.173)	0.649*** (0.099)	0.872 (0.248)	0.732*** (0.080)	0.979 (0.235)	1.621 (0.592)	0.931 (0.201)	0.077 (0.163)	0.060 (0.176)
Voice and accountability index	0.832 (0.117)	0.880 (0.149)	0.811 (0.185)	1.805 (0.924)	1.045 (0.232)	0.754 (0.157)	0.775 (0.123)	0.500 (0.674)	2.449 (4.929)
Public expenditure	0.214 (0.370)	0.908 (1.904)	0.276 (0.524)	2.810 (5.999)	0.356 (0.723)	0.009 (0.025)	1.059 (1.972)	0.028 (0.147)	0.064 (0.345)
Public employment	2.770 (3.308)	6.601 (7.760)	0.364 (0.628)	0.766 (1.540)	3.216 (4.925)	7.630 (10.981)	2.692 (3.953)	1.454 (2.656)	0.112 (0.326)
Retained observations	3227	3350	3442	3505	3426	3499	3309	443	497
Wald ( $\chi^2$ )	162.1***	806.4***	165.2***	85.70***	109.8***	133.1***	185.7***	63.33***	19.59
Log pseudolikelihood	-70.36	-69.80	-38.03	-44.29	-56.05	-42.92	-67.79	-26.76	-37.91

Notes: Survival analysis using Weibull parametric model. Only hazard ratios are displayed.

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1. Independent and control variables are lagged 1 year.

## Appendix F. : Re-estimating the determinants of green finance policies issuance using exponential distribution

Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
<i>Market-based drivers</i>									
Fossil fuel financing	1.087*** (0.024)	1.105*** (0.031)	1.074*** (0.026)	1.153*** (0.038)	1.088*** (0.027)	1.064** (0.029)	1.083*** (0.026)	1.062* (0.036)	1.081 (0.053)
Green bond underwriting	1.043 (0.031)	1.054** (0.025)	1.036* (0.020)	1.085*** (0.027)	1.042** (0.022)	1.015 (0.028)	1.034 (0.023)	1.056 (0.038)	1.043 (0.032)
<i>Institutional factors</i>									
Fossil fuel government subsidies per capita	1.071* (0.040)	1.011 (0.034)	1.081** (0.034)	0.966 (0.054)	1.058* (0.032)	1.078** (0.033)	1.078 (0.060)	1.027 (0.047)	1.057 (0.067)
Feed-in tariff	1.208 (0.274)	1.316 (0.366)	1.161 (0.291)	0.705 (0.333)	1.250 (0.307)	1.107 (0.368)	0.977 (0.351)	1.025 (0.770)	1.550 (0.813)
Divestment commitments	1.035 (0.029)	0.418*** (0.013)	1.046* (0.028)	0.952 (0.046)	1.061** (0.027)	1.091*** (0.026)	1.050** (0.025)	1.032 (0.030)	1.046 (0.039)
<i>Control variables</i>									
EPI - Climate change indicators	1.073	3.250**	0.939	1.279	1.177	0.854	1.295	8.307*	1.497

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Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
GDP per capita	(0.351) 0.949 (0.106)	(1.686) 0.989 (0.143)	(0.273) 0.891 (0.119)	(0.354) 0.652** (0.117)	(0.478) 0.903 (0.113)	(0.311) 1.104 (0.182)	(0.568) 0.935 (0.118)	(9.454) 1.258 (0.478)	(1.946) 0.702 (0.373)
Renewable energy use	3.603** (1.871)	2.854 (1.844)	2.866 (1.851)	2.037 (1.626)	4.756*** (2.734)	4.598*** (2.583)	2.531 (1.489)	3.230 (3.424)	2.596 (4.115)
Environmentally-related taxes	1.225***	1.104	1.258**	1.039	1.145	1.329**	1.252**	0.908	2.871
Green innovation	(0.094) 4.598 (6.139)	(0.099) 5.114 (13.701)	(0.120) 40.039*** (52.838)	(0.121) 0.000 (0.001)	(0.114) 19.955 (36.683)	(0.147) 18.421** (26.010)	(0.110) 3.495 (6.505)	(0.371) 0.631 (1.113)	(2.337) 0.036 (0.208)
Government effectiveness index	0.900	1.038	0.872	0.700*	0.772*	1.014	0.825	0.300	0.767
Regulatory quality index	(0.128) 0.767*	(0.178) 0.643***	(0.124) 0.732**	(0.138) 0.725***	(0.110) 0.829	(0.188) 1.044	(0.144) 0.829	(0.643) 0.110	(2.006) 0.087
Voice and accountability index	(0.111) 0.836	(0.087) 0.848	(0.111) 0.798*	(0.078) 1.612	(0.141) 0.966	(0.237) 0.760**	(0.121) 0.793**	(0.233) 1.025	(0.245) 1.553
Public expenditure	(0.092) 0.106 (0.168)	(0.124) 0.740 (1.444)	(0.097) 0.041 (0.084)	(0.767) 0.961 (2.188)	(0.167) 0.207 (0.411)	(0.092) 0.002** (0.005)	(0.093) 0.708 (1.294)	(1.342) 0.342 (1.427)	(2.901) 0.337 (1.644)
Public employment	0.848 (0.928)	3.420 (3.903)	0.191 (0.264)	0.299 (0.528)	0.372 (0.464)	0.840 (0.972)	0.782 (1.073)	0.375 (0.652)	0.096 (0.248)
Retained observations	3227	3350	3442	3505	3426	3499	3309	443	497
Wald ( $\chi^2$ )	157.2***	1175***	195.7***	121.7***	199.8***	170.4***	232.2***	65.15***	27.03**
Log pseudolikelihood	-86.37	-73.40	-74.41	-57.45	-72.03	-61.92	-81.85	-29.83	-38.58

Notes: Survival analysis using exponential parametric model. Only hazard ratios are displayed.

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1. Independent and control variables are lagged 1 year.

## Appendix G. : re-estimating the determinants of green finance policies issuance using gompertz distribution

Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
<i>Market-based drivers</i>									
Fossil fuel financing	1.118*** (0.025)	1.122*** (0.031)	1.109*** (0.029)	1.186*** (0.040)	1.110*** (0.027)	1.091*** (0.028)	1.112*** (0.026)	1.099*** (0.038)	1.131** (0.066)
Green bond underwriting	1.011 (0.030)	1.020 (0.025)	0.986 (0.020)	1.027 (0.026)	0.996 (0.020)	0.964 (0.024)	1.017 (0.022)	1.049 (0.043)	1.037 (0.033)
<i>Institutional factors</i>									
Fossil fuel government subsidies per capita	1.044 (0.046)	0.996 (0.033)	1.079** (0.037)	0.956 (0.049)	1.045 (0.039)	1.055 (0.040)	1.054 (0.066)	0.979 (0.049)	1.052 (0.080)
Feed-in tariff	0.956 (0.225)	1.135 (0.342)	1.047 (0.226)	0.724 (0.233)	1.170 (0.272)	1.023 (0.285)	0.804 (0.299)	0.748 (0.589)	1.281 (0.716)
Divestment commitments	0.997 (0.031)	0.460 ** (0.016)	1.019 (0.025)	0.946 (0.044)	1.026 (0.022)	1.050** (0.021)	1.013 (0.023)	1.005 (0.033)	1.021 (0.041)
<i>Control variables</i>									
EPI - Climate change indicators	1.144 (0.381)	3.328** (1.671)	1.061 (0.313)	1.546 (0.448)	1.271 (0.559)	0.837 (0.283)	1.337 (0.595)	1.986 (2.233)	0.267 (0.414)
GDP per capita	0.860	0.899	0.829	0.559***	0.851	1.106	0.850	0.951	0.333

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Dependent variable: Time to the first issuance of green finance policies	All policies	Mandatory policies	Non-mandatory policies	Policies issued by central banks/ financial regulators	Policies related to the banking industry	Policies related to the insurance industry	Policies related to the asset management industry	All policies - OECD countries	All policies - Validation dataset (OECD countries)
Independent and control variables	Model 1 hazard ratio	Model 2 hazard ratio	Model 3 hazard ratio	Model 4 hazard ratio	Model 5 hazard ratio	Model 6 hazard ratio	Model 7 hazard ratio	Model 8 hazard ratio	Model 9 hazard ratio
Renewable energy use	(0.105) 3.900**	(0.136) 2.950	(0.125) 2.955	(0.112) 1.849	(0.129) 5.789**	(0.224) 5.181**	(0.125) 2.664	(0.422) 3.735	(0.245) 2.984
Environmentally-related taxes	(2.181) 1.234**	(2.066) 1.118	(2.205) 1.177*	(1.627) 1.008	(3.968) 1.082	(3.676) 1.223*	(1.668) 1.285**	(4.710) 1.055	(5.772) 5.338
Green innovation	(0.103) 2943.189*** (6211.803)	(0.107) 142.023 (429.604)	(0.112) 1697970.038*** (3939346.646)	(0.129) 0.031 (0.180)	(0.111) 55,055.113*** (225,563.770)	(0.137) 136,679.580*** (436,748.438)	(0.127) 1382.351*** (3500.789)	(0.561) 267.720** (709.293)	(5.615) 2.045 (15.190)
Government effectiveness index	1.111	1.189	1.174	0.872	0.846	1.283	0.990	2.149	3.080
Regulatory quality index	(0.239) 0.865	(0.231) 0.654***	(0.344) 0.887	(0.177) 0.725***	(0.145) 0.996	(0.399) 1.720	(0.264) 0.972	(6.003) 0.066	(9.440) 0.042
Voice and accountability index	(0.191) 0.812	(0.103) 0.875	(0.262) 0.835	(0.079) 1.786	(0.246) 1.062	(0.696) 0.775	(0.229) 0.750*	(0.139) 0.469	(0.126) 5.750
Public expenditure	(0.118) 0.284	(0.153) 1.001	(0.196) 0.305	(0.911) 2.815	(0.249) 0.443	(0.182) 0.017	(0.123) 1.456	(0.651) 0.021	(14.540) 0.034
Public employment	(0.492) 3.146 (4.020)	(2.117) 7.479* (9.060)	(0.569) 0.338 (0.604)	(5.887) 0.683 (1.377)	(0.898) 4.653 (7.613)	(0.051) 11.018 (17.189)	(2.750) 2.895 (4.503)	(0.117) 2.691 (5.554)	(0.182) 0.174 (0.535)
Retained observations	3227	3350	3442	3505	3426	3499	3309	443	497
Wald ( $\chi^2$ )	179***	780.2***	168.8***	85.80***	104.3***	132.5***	180***	61.08***	23.34*
Log pseudolikelihood	-66.46	-68.90	-39.68	-43.83	-51.12	-38.88	-63.91	-24.24	-35.94

Notes: Survival analysis using Gompertz parametric model. Only hazard ratios are displayed.

Robust standard errors in parentheses. The Wald test examines the null hypothesis that all coefficients are zero.

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1. Independent and control variables are lagged 1 year.

## Data availability

Data will be made available on request.

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