

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/369605964>

National culture and green bond issuance around the world

Article in *European Financial Management* · March 2023

DOI: 10.1111/eufm.12419

CITATIONS

7

READS

446

2 authors:



Charilaos Mertzanis

Abu Dhabi University

90 PUBLICATIONS 929 CITATIONS

[SEE PROFILE](#)



Imen Tebourbi

University of Birmingham

27 PUBLICATIONS 158 CITATIONS

[SEE PROFILE](#)

National culture and green bond issuance around the world

Charilaos Mertzanis¹  | Imen Tebourbi² 

¹College of Business, Abu Dhabi University, Abu Dhabi, United Arab Emirates

²Birmingham Business School, University of Birmingham, Dubai Campus, United Arab Emirates

Correspondence

Charilaos Mertzanis, College of Business, Abu Dhabi University, Abu Dhabi 59911, United Arab Emirates.
Email: charilaos.mertzanis@adu.ac.ae

Abstract

We analyze the impact of Hofstede's culture dimensions on green bond issuance in 84 countries during 1991–2021, using novel International Monetary Fund data. We control for environmental, macroeconomic and institutional factors. Our results show that countries that score higher on individualism, masculinity and indulgence are associated with lower green bond issuance, whilst countries that score high on long-term orientation and uncertainty avoidance are associated with higher green bond issuance. Culture appears to play a role in green bond market development. The culture effect remains broadly robust after applying sensitivity and endogeneity tests, adding new controls and performing coefficient stability and dominance analysis.

KEYWORDS

green bonds, national culture, environmental conditions, institutions, global

JEL CLASSIFICATION

G32, O16, Q57, Z10

1 | INTRODUCTION

The widely agreed upon transition to a low-carbon global economy to contain global warming and environmental degradation requires political will and significant private and public investment. The Sustainable Development Goals (SDGs) were established in 2015 with the

We would like to thank the editor (John A. Doukas) and an anonymous referee of the European Financial Management for aid and advice and very timely feedback.

overreaching aim of guiding the achievement of a sustainable future for all (The United Nations Framework Convention on Climate Change (UNFCCC), 2015). The Group of Twenty's (G20) Green Finance Synthesis Report estimates that investment of about USD 90 trillion would be needed during the next 15 years to achieve the global sustainable development objectives (The Green Finance Study Group, 2016). However, most green investment projects are capital-intensive (Baulkaran, 2019) and their implementation is associated with higher risk and possibly lower return (Chiesa & Barua, 2019; Quatrini, 2021). Thus, there is a need for developing new sources of green financing and suitable green investment mechanisms.

The introduction of green bonds could help both the private and public sectors to fund environmentally friendly investment projects and therefore contribute to achieving the SDGs (Tolliver et al., 2020). Green bonds could help address the challenges caused by environmental degradation (Anzolin & Lebdioui, 2021) and also maintain financial efficiency (Reboredo & Ugolini, 2020). Green bonds are defined as debt instruments, whose proceeds shall exclusively finance or refinance eligible new or existing green projects (International Capital Market Association, 2018). Like conventional bonds, green bonds make periodic interest payments and principal repayment at maturity, but their issuance proceeds are used for financing environmentally friendly projects. The latter include investment *inter alia* in the sectors of renewable energy, energy efficiency, pollution prevention and control, environmentally sustainable management of living natural resources and land use, terrestrial and aquatic biodiversity conservation, clean transportation, sustainable water and wastewater management, climate change adaptation, ecoefficient and circular economy adapted products, production technologies, and processes and green buildings. Potential issuers in these sectors can use this new financing instrument. However, issuers need to secure third-party certification that provides assurance to investors regarding the proper use of funds raised and contains the risk of greenwashing. The latter refers to the risk that some issuers might only pretend to maintain environmental responsibility and might instead use the issue for marketing purposes or without a significant impact on the environment. The materialization of greenwashing risks would jeopardize investor confidence and the integrity of the green bond market. Greenwashing risks assume various forms conditional upon local institutional practices, such as trust (De Freitas Netto et al., 2020).

The International Monetary Fund's (IMF's) Climate database shows that some European countries issued green bonds in the 1990s. However, the European Investment Bank made the first major issuance of green bonds in 2007, followed by the World Bank in 2008. Today the green bonds market has increased rapidly, especially since 2011, with a total value of more than USD 260 billion worldwide and an average value of about USD 5.2 billion per issue (CBI, 2019). The 2015 Paris Agreement has had a catalytic impact on the green bond market's growth by inducing signatory countries to act. Further, the European Commission (2019) launched the European Green Deal policy, which aims at transforming the European Union into a sustainable economy by pooling together stakeholders with sustainability-driven incentives. To achieve the green economy objectives, international cooperation and partnership are required to raise public and private funds. To mitigate greenwashing risks and encourage investor confidence thereby fostering the development of the green bond market, the European Commission issued in 2021 a voluntarily complied Green Bond Standard and an associated taxonomy of environmentally sustainable activities that would increase transparency and harmonization in the green bond market (Badenhoop, 2022). Additional policy measures aiming at the green bond market development include worldwide improvements in the transparency and disclosure regime of securities issuance to incorporate issuers' environmentally relevant

information. However, despite its impressive growth, the green bond market is still in its early development stage and the average issuance value is small relatively to those in the conventional bond market (CBI, 2022).

Understanding the key drivers of green bond issuance is critical to advancing the global climate and sustainable development investment agenda. The conditions for the market's further development have only recently been subject to rigorous analysis. Some studies focused on the green bond's specific characteristics. Green bonds often have cost-reducing advantages, such as flexible payment schedules, credit enhancement techniques and alignment with long-term project planning (Curley, 2014). Municipal green bonds proved useful supplements of budget shortages in capital-intensive infrastructure finance schemes (Clapp et al., 2015). Corporate green bonds improved their issuers' financial performance and environmental footprint levels (Flammer, 2021). Issuers also benefited from lower servicing costs that outweighed their certification costs (Gianfrate & Peri, 2019). The positive environmental effects of green bond financing also appeal to socially responsible investors aiming at diversifying their investment portfolios by including ecofriendly and fixed-payment securities (Chatzitheodorou et al., 2019).

Other studies focused in the market effect of economic policies. For example, government guarantees, tax reductions and other favourable policy treatments of green bond issuance have appealed to long-term investors seeking a hedge against inflation, market instability or default (Veys, 2010). Moreover, higher transparency standards provide investors with postissuance information on issuer sustainability that aligns with the need to develop a more dynamic green financing system (Ng, 2018). Yet other studies focus on the role of institutions and social conditions (Piñeiro-Chousa et al., 2021; Sangiorgi & Schopohl, 2021; Tolliver et al., 2020; Yamahaki et al., 2020). Institutions react and adapt slowly to change, which may affect the mitigation of risks associated with environmental sustainability (Gupta et al., 2010; Nguyen et al., 2021). Whether local institutions and practices are conducive to environmental adaptation in general and with respect to economic transactions remains an open question. Moreover, only few studies have analyzed the link between environmental considerations and financing decisions across countries and therefore enabled the identification of the cross-country determinants of green financing and therefore elucidate the cross-country variations in green bond issuance.

In this paper, we fill some of the literature gaps by exploring the effect of national culture across countries on the issuance of green bonds and the development of the green bond market. It is conceivable that the very nature of green bonds, being different from the traditional debt instruments, makes their issuance contingent upon the prevalence of social and institutional factors in different ways than conventional debt issuance. Moreover, the fact that their proceeds are ear-marked to ecofriendly investments suggests that green bond issuance may be affected by different social sustainability considerations. National culture has been linked to environmental concerns (Dangelico et al., 2020; Lahuerta-Otero & González-Bravo, 2018; Onel & Mukherjee, 2014; Park et al., 2007; Peng & Lin, 2009). These studies approximate national culture using Hofstede's (Hofstede, 1980; Hofstede et al., 2010) cultural dimensions and demonstrated their environmental significance.

In this paper, we explore the effect of national culture, measured by Hofstede's culture dimensions, on the value of green bond issuance in 84 countries during 1991–2021 based on recently released data by the IMF. We follow Hofstede's (1980) definition of national culture, and we specifically examine the association between his six cultural dimensions of individualism, power distance, masculinity, uncertainty avoidance, time orientation and indulgence with the country value

of green bond issuance, with direct implications for the green bond market development. We further control for the effect of environmental, macroeconomic and institutional factors. A concern is the potential endogeneity of cultural measures in our analysis. We believe that reverse causality is rather unlikely to run from green bond issuance to culture, previous studies postulate that beliefs, values and preferences are changing slowly (Guiso et al., 2006). To address the endogeneity challenge, we apply a two-stage least square (2SLS) and a generalized method of moments (GMM) estimation model using a country-based measure of prevalent infectious diseases as an external instrument for national culture (Boubakri et al., 2021; Thornhill & Fincher, 2014). Our findings remain qualitatively unchanged. Our evidence remains robust after applying various additional tests that include alternative measures of variables, alternative sample structures and alternative model specifications.

The results show that countries that score higher on Hofstede's dimensions of individualism, masculinity and indulgence are on average associated with lower volumes of green bond issuance, whilst countries that score higher on uncertainty avoidance and long-term orientation (LTO) are associated with higher volume of green bond issuance. Higher scores of power distance are weakly associated with higher green bond issuance, depending on model specification. It appears that national culture plays a role in the development of green bond market.

Our paper is, to our knowledge, the first to formally analyze the effect of cultural values on the issuance activity of green bonds. It therefore contributes to the literature on green finance in several ways: first, we provide robust evidence that national cultural values influence green bond issuance (Dangelico et al., 2020; Lahuerta-Otero & González-Bravo, 2018) and therefore contributes to the understanding of the mitigating role of social and institutional factors on the link between environmental considerations and finance. Second, we contribute to the literature that documents the significant effect of national culture on issuers' corporate social responsibility (CSR) performance Ho et al., 2012; Ringov & Zollo, 2007; Waldman et al., 2006). Third, our sample period is considerably long and our cross-section range is considerably wide to capture key green finance trends and other potential long-run effects across countries. We extend previous studies by controlling for environmental, economic and institutional effects, thereby containing omitted variables bias. Fourth, we perform endogeneity analysis using Oster's (2019) test for coefficient stability, as well as dominance analysis that highlights the dominant role of LTO as a key driver. Finally, we focus on the total value of green bond finance and therefore capture both private and public sector initiatives on green financing, which enables us to analyze the culture effects on national financing behaviour. However, we also consider disaggregated effects by analyzing corporate green bond financing separately.

The paper is structured as follows. Section 2 summarizes the literature on green bond market development. Section 3 describes the data and the empirical methodology. Section 4 analyzes the baseline results. Section 5 applies sensitivity tests and Section 6 carries out endogeneity analysis. Section 7 applies additional robustness checks and finally Section 8 concludes the paper.

2 | RELATED LITERATURE

2.1 | National culture and environmental considerations

National culture is defined as a set of values and beliefs that are transmitted across generations and therefore affect individual behavioural patterns, perceptions and ultimately decision-

making (Guiso et al., 2006; Hofstede, 1983; North, 1990). One could then assume that culture influences business and financial decision-making. Hofstede (1980, 2001) and Hofstede et al. (2010) establish a culture framework that has become widely adopted by researchers in cross-country business and finance studies. Aggarwal et al. (2016) argue that cultural factors are important variables for financial decision-making and therefore should not be omitted. The analysis of the effect of national culture has been used incorporated in different contexts in recent years, including corporate and government finance decisions. The literature has examined its effect on various corporate outcomes, such as corporate innovation (Boubakri et al., 2021), corporate external financing decisions (Kutan et al., 2021), capital structure decisions (Chui et al., 2002; K. Li et al., 2011), initial public offering underpricing (Chourou et al., 2018; Geng & Tan, 2021), M&A activity, post-M&A integration and synergies (Ahern et al., 2015; Y. Weber et al., 1996), international investment flows (Siegel et al., 2011), stock performance and investors' behaviour (Chui et al., 2010; Eun et al., 2015), as well as on environmentally related outcomes, such as country overall environmental performance (Griffin et al., 2021; Ringov & Zollo, 2007) and social responsible investment (Connelly, 2017; Labidi et al., 2021). However, the impact of national cultural values on green bond market development has so far remained unexplored.

Hofstede's (1980, p. 25) identification of six cultural dimensions has been a widely accepted approximation of national culture. He identifies culture as "the collective programming of the mind which distinguishes the members of one human group from another, the interactive aggregate of common characteristics that influence a human group's response to its environment." The approximation of national culture is made on the basis of Hofstede's six cultural dimensions of individualism, power distance, masculinity, uncertainty avoidance, time orientation and indulgence with national volumes of green bond issuance. Below we elucidate the likely association between six culture dimensions and green bond issuance activity. Due to the lack of specific studies, we conjecture that the link is elusive.

2.1.1 | Power distance

Hofstede (2001) defined power distance as the extent to which a nation is willing to accept differences and inequalities in power distribution. High power distance societies indicate social behaviour that accepts autocratic and centralized power systems, where power is exerted by a few at the top, as well as inequality as the basis of societal order (Hofstede et al., 2010). A low power distance score indicates that the organizational structure is flatter and that decision-making is shared and participative. The effect of power distance dimension has been used in the context of international investment. Siegel et al. (2011) associate low power distance, interpreted as egalitarianism, to greater social responsibility in investment activity. The authors study the effect of egalitarian distance between countries on investor investment flows through corporate actions, security issuance and syndicated loans and find that high egalitarianism distance is negatively associated with all types of investment flows. The authors also find that cross-border mergers and acquisitions between countries with high levels of egalitarian distance are value destructive. Hill et al. (2007) argue that national culture has an influence on socially responsible investment. Nations with lower power distance, such as the European countries and the United States, demonstrate greater social awareness, which has resulted in more developed socially responsible practices, thereby affecting their private financing and investment decisions. Cai et al. (2016) study the factors affecting corporate social performance

in 36 countries and find that countries with low power distance experience higher performance. These findings tend to suggest that countries with lower power distance scores are expected to experience higher investments in green bonds.

However, on the other hand, high power distance is associated with centralized power, which makes private and public sector organizations' decision-making easier as they face less push-back from their diverse stakeholders. A higher level of power distance could make it easier for a government to introduce stringent measures without worrying too much about compliance and resistance (Chen et al., 2021). Such power structure would make it easier for governments to implement effective climate change mitigation policies and for organizations to take necessary actions towards reducing their exposure to adverse environmental impact and achieving better environmental performance. Considering the pressure that private and public organizations face to meet the 2015 Paris Agreement SDGs, we argue that countries with high power distance can act faster than lower power distance ones. Therefore, it is possible that private and public organizations in high power distance societies move faster towards the adoption of green bonds as a sustainable finance tool of their environmentally friendly investment projects. Ho et al. (2012) find a positive association between Hofstede's power distance index (PDI) and corporate social performance suggesting that countries with high PDI likely have stringent environmental regulations and enforcement mechanisms. Dangelico et al. (2020) use a sample of 62 countries and do not find any significant relationship between PDI and three measures of environmental performance. Connelly (2017) documents a positive but insignificant relationship between power distance and socially responsible investment. Labidi et al. (2021) find that power distance adversely affects conventional investment flows but it exerts no significant differential effect on socially responsible investment flows. On the basis of the above literature, we conclude that power distance has an impact on green bond issuance, which direction remains largely an empirical issue. Thus, applying Berger et al. (2021) approach on opposing cultural hypotheses in our setting, we identify the first testing hypothesis:

Hypothesis 1a. *High power distance is associated with higher levels of green bonds issuance.*

Hypothesis 1b. *Higher power distance is associated with lower levels of green bonds issuance.*

2.1.2 | Individualism versus collectivism

Individualism has been defined by Hofstede (1983) as cultural behaviour whereby individuals are disconnected from social groups. Individuals prefer to take care of themselves and their immediate family, value their freedom, take initiatives and expect a reward for their hard work. The ties between members of the society would be weak. On the other side, a collectivist society values social group membership of individuals, who are tightly knit and take care of one another, and thus members of the community would have strong connections and be expected to be loyal. Markus and Kitayama (1991) explained collectivism as the interdependent self or the collective whole, which is characteristic of nonwestern countries. They further defined individualism as a trait, whereby individuals are independent and self-focused on their autonomy. Ringov and Zollo (2007) argue that firms in highly individualist cultures would not mind the impact of their activities on the society and would be associated with lower environmental and social performance, unless the latter is in the managers' best interest. Their

findings demonstrate that individualism would not significantly affect firms' environmental and social performance.

Another stream of literature suggests that individualistic societies are more prone to the development of environmental groups (Katz et al., 2001) and that such groups have greater presence in individualistic societies compared to the collectivistic ones (Husted, 2005). Connelly (2017) argues that individualism is associated with an increase in socially responsible investment. Griffin et al. (2021) examine corporate, social and environmental performance across 43 countries during 2003–2015 and find a positive association between social and environmental performance and firm market value, which is more pronounced in individualistic countries. Dangelico et al. (2020), Lahuerta-Otero and González-Bravo (2018), Onel and Mukherjee (2014) and Vachon (2010) also find a positive and significant relationship between the individualism in a country and its environmental performance. Boubakri et al. (2021) find that individualism is associated with a higher degree of corporate innovation. The latter could also include the emergence of environment-related innovation.

Collectivism is associated with higher socially responsible investment, since these collectivist cultures value collective welfare and focus more on people's interdependence. Nagy and Konya (2018) find that individualism has a negative association with the countries' environmentally conscious behaviour. Ho et al. (2012) find support for the idea that collectivist societies have higher corporate social performance. Labidi et al. (2021) find that individualism has a strong positive effect on conventional investment flows but no significant relation with socially responsible investment flows. From a government standpoint, a collectivist society could interfere more to secure collective and social well-being, which could also include environmental and social welfare considerations. Government intervention in collectivist societies could exert higher influence on corporate decision-making compared with individualist societies. Boubakri and Saffar (2019) provide support for the social effects of government ownership of firms and their financing of innovation. They suggest that partially privatized firms exhibit higher social and environmental performance compared with the fully privatized ones. Along similar lines, Hsu et al. (2014) find evidence that more collectivist state-owned enterprises exhibit higher engagement in social and environmental activities, which influence their financing decisions. Davis and Williamson (2019) argue that government in collectivistic societies could increase regulatory intervention to push forward a social policy agenda that includes environmental issues. On the basis of the above literature, we conclude that individualism has an impact on green bond issuance, whose direction remains largely an empirical issue. Thus, in our setting, our second testing hypothesis is defined as follows:

Hypothesis 2a. *Individualism is positively associated with lower levels of green bonds issuance.*

Hypothesis 2b. *Individualism is negatively associated with lower levels of green bonds issuance.*

2.1.3 | Masculinity versus femininity

Another important cultural dimension is gender-inspired. Masculine societies are competitive and driven towards achieving power and success (McGrath et al., 1992). Individuals in masculine societies would maintain strong egos, focus on achieving goals, value financial

success and are more assertive. Individuals in feminine societies would value relationships, social harmony and modesty, and would focus more on life quality and preservation (Hofstede, 2001). In the latter societies, decision-making is achieved through discussion, cooperation and input from different parties. Ringov and Zollo (2007) conduct an international study in 23 countries (Asia, North America and Europe) and find that cultural masculinity is associated with lower levels of social and environmental performance. Labidi et al. (2021) find that masculinity is adversely associated with socially responsible investment flows. Sievänen et al. (2013) find that Sweden and Norway who have the lowest masculinity scores are associated with the highest levels of socially responsible investment per capita. Masculine societies are more profit-driven and are less concerned about environmental welfare (Hofstede, 2001; Palmer et al., 1995). Peng and Lin (2009) as well as Lahuerta-Otero and González-Bravo (2018) also document a negative association between masculinity and corporate environmental performance. Considering that feminine societies can prioritize societal welfare and preservation to pure financial gains, we expect feminine societies to promote green bonds financing. Thus, in our setting, our third testing hypothesis is defined as follows:

Hypothesis 3. *Masculinity is associated with lower levels of green bond issuance.*

2.1.4 | Uncertainty avoidance

Uncertainty avoidance represents the society's degree of tolerance or aversion to uncertain outcomes or unknown situations. In countries with high uncertainty avoidance, individuals try to take control of their lives and make them as predictable as possible. People in low uncertainty avoidance countries can be more inclusive and open to innovation and change. Mihet (2013) finds that societies with high uncertainty avoidance exhibit lower risk-taking and innovative behaviour. Boubakri et al. (2021) find that firms operating in low uncertainty avoidance countries tend to innovate more. Keswani et al. (2016) argue that investors from high uncertainty avoidance countries tend to avoid alternative investments and instead prefer conventional investments. Labidi et al. (2021) argue that high uncertainty avoidance investors may find it difficult to deviate from conventional investment choices and to integrate environmental, social and governance (ESG) factors into their investment choices. They provide evidence that socially responsible investment flows are lower in countries with high uncertainty avoidance. Connelly (2017) obtain similar results in a cross-county analysis.

Another trait that characterizes societies with higher uncertainty avoidance is that they prefer to have a clear structure, hierarchy, strict laws and security measures to reduce uncertainty. For example, Ho et al. (2012) find that higher country scores of uncertainty avoidance are positively associated with corporate social performance as stakeholders prefer more strict social intervention. Similarly, Dangelico et al. (2020), Peng and Lin (2009) and Onel and Mukherjee (2014) find a positive relationship between uncertainty avoidance and corporate environmental performance. Ringov and Zollo (2007) do not find evidence that countries with high uncertainty avoidance scores have lower environmental and social performance.

Interestingly, Hofstede (2001) discussed another characteristic of high uncertainty avoidance societies. He argued that the latter could take higher risks if that would help them reduce the overall uncertainty and ambiguity. Considering that the new environmental and social challenges countries face could lead to unknown future situations, societies

characterized by high uncertainty avoidance could mitigate this risk by acting and implementing regulations to protect the environment. We argue that responsible investment, including investment in green bonds, while new and risky (because of the lack of diversification experience), could be a choice to reduce future uncertainty. Therefore, countries with higher uncertainty avoidance scores could engage in alternative, environmentally friendly investments. On the basis of the above literature, we conclude that uncertainty avoidance has an impact on green bond issuance, whose direction remains largely an empirical issue. Thus, in our setting, our fourth testing hypothesis is defined as follows:

Hypothesis 4a. *Uncertainty avoidance is positively associated with higher levels of green bond issuance.*

Hypothesis 4b. *Uncertainty avoidance is negatively associated with higher levels of green bond issuance.*

2.1.5 | Long-term orientation

Hofstede (2001, 2011) considers LTO as an additional national characteristic. LTO focuses on the people's incentive for thriftiness, the importance of saving for the long-term, deferring gratification, patience, persistence, collectiveness and seeking long-term payoffs. The social values associated with LTO include widely implemented economic and social equality. Short-term orientation is focused on short-term profits, immediate consumption and individualism (Mamman & Saffu, 1998). Zheng et al. (2012) find that companies operating in long-term orientated societies are more forward-thinking, have greater flexibility in their decision-making and take less risk. In contrast, companies operating in short-term orientated societies tend to focus on short-term profits and take higher risks. As a result, short-term-oriented managers may not develop strategic policies and may not engage in innovation towards environmental sustainability, as these are long-term investments, that may negatively affect the short-term performance choices (Nakata & Sivakumar, 1996). Dangelico et al. (2020) provide evidence suggesting that countries with high LTO realize higher country-level environmental performance. Connelly (2017) finds that LTO is positively related to socially responsible investment flows. Following this rationale and the characteristics of long-term-oriented societies, we expect LTO to be associated with a greater interest in green bond investments. Hence, our fifth testing hypothesis is defined as follows:

Hypothesis 5. *Long-term orientation is associated with higher levels of green bond issuance.*

2.1.6 | Indulgence versus restraint

Social indulgence describes the way individuals in a society engage in leisurely activities and focus on their own happiness. Countries with high indulgence scores tend to be optimistic, focus on material consumption to boost their happiness, tend to spend more and in general “don't take life too seriously.” In contrast, restrained societies tend to be more pessimistic, feel less healthy and exhibit more disciplined behaviour and tied social norms. Low indulgence

scores are observed in eastern European countries and Russia, whereas Western Europe, North and South American countries exhibit higher indulgence scores. This dimension is fairly new and therefore little empirical evidence exists on its impact on country and corporate decisions. Hofstede (2011) further argues that there is a negative association between high indulgence and LTO. Issuance of green bonds is meant to finance environmentally friendly projects. The latter is predominantly long-term-oriented projects, which could more likely be associated with more disciplined societies. Connelly (2017) find a negative association between high indulgence scores and socially responsible investment. Similarly, Petruzzella et al. (2017) find that indulgence is negatively associated with the firm's environmental performance. On the other hand, Dangelico et al. (2020) suggest that higher indulgence in a country is associated with higher environmental performance. They build on the idea that employees in indulgent companies have more time and freedom to experiment and innovate (Prim et al., 2017), which would likely result in better environmental performance. From another perspective, indulgent societies are associated with higher income and higher levels of education, which are both characteristics of environmentally responsible investors (Glac, 2012; Inglehart & Baker, 2000). Overall, both indulgent and restrained societies could influence green bond issuance decisions, the direction of which remains largely an empirical issue. Thus, in our setting, our sixth testing hypothesis is defined as follows:

Hypothesis 6a. *Indulgence is associated higher levels of green bond issuance.*

Hypothesis 6b. *Indulgence is associated lower levels of green bond issuance.*

2.2 | The role of economic factors

Macroeconomic factors are significant determinants of both conventional and green bond issuance. Claessens et al. (2007) document the significant role of macroeconomic factors in the development of government bonds markets and the government's ability to issue bonds in local currency across 36 countries. Their findings suggest that economic development, inflation and the government's fiscal balance position determine the country's solvency status and therefore its risk-taking behaviour and subsequently the development of the government bond market. Further, sovereign credit ratings affect bond market activity and investment decisions, including green bond activity (Chiesa & Barua, 2019; Prajapati et al., 2021; Rusike & Alagidede, 2021). Moreover, the inflation rate is shown to be negatively associated with green bond issuance (Tu et al., 2020). Eichengreen and Luengnaruemitchai (2004) examine the development of bond markets in 41 Asian economies. They find that macroeconomic fundamentals, such as trade openness, the size of the economy and capital market openness affect the development of bond markets. Bae (2012) analyzes the differential effects on the different types of bond market development in 43 countries during 1990–2009. They differentiate between government, corporate and alternative bond markets and find that gross domestic product (GDP) per capita and the government's fiscal balance explain bond market development. The author also argues that fiscal policy is an important determinant of government bond market development, which also spills over into corporate bond market development. Reboredo (2018) analyzes the behaviour and association among the government, corporate and green bond markets and finds a strong correlation among them. He also finds that stock and commodity price fluctuations do not affect green bond price fluctuations and

conclude that green bonds could be used to achieve efficient portfolio diversification. Tolliver et al. (2020) study the determinants of green bond market growth and find that macroeconomic factors, such as the GDP level and economic development, affect the growth of both conventional and green bond markets. Using a sample of European countries, Glomsrød and Wei (2018) find similar results suggesting that higher GDP levels are associated with higher levels of green bonds issuance. Likewise, Tu et al. (2020) document that financial markets development plays an important role in the growth of green bond market. Finally, credit information has been documented as a key factor in the development of bond markets and their liquidity (Bao et al., 2011; Becker & Josephson, 2016; Flammer, 2021). Overall, macroeconomic factors and especially economic development, fiscal balance, financial and monetary stability appear to be robust determinants of both conventional and green bond market development.

2.3 | The role of environmental factors

Consideration of the role of ESG practices in financial decision-making and strategy development has become increasingly important among corporate managers and directors. Corporate social and environmental responsibility is another important consideration for investors when analyzing financial performance (Capelle-Blancard & Monjon, 2014). Prior studies have shown that CSR has a positive impact on financial performance and firm valuation over both the short and the long term. While the evidence is still accumulating, better ESG scores improve corporate credit rating, tend to lower the cost of external finance, and mostly improve financial performance (Chava, 2014; El Ghouli et al., 2011). Capelle-Blancard et al. (2019) find that countries with high ESG ratings tend to have lower credit default risk and lower sovereign bond spreads. Consideration of environmental performance is important for green bond market development. Fatica and Panzica (2021) study the implication of green bond issuance on firms' environmental performance in terms of reducing their carbon emissions. They compare the effects of green bond issuance to those of conventional bonds by issuers with similar environmental and financial performance and conclude that green bond issuance results in a reduction of the issuer's carbon footprint. This reduction is larger for green bonds issued after the 2015 Paris Agreement and those that have been certified externally. Flammer (2020) and D. Y. Tang and Zhang (2020) find that stock market valuations respond positively to the issuance of green bond announcements. They also suggest that green bonds are an effective tool for improving environmental performance, especially those green bonds that are externally certified.

Further, Flammer (2021) shows that green bond issuance exerts a signalling effect whereby issuers signal their commitment to environmental protection to existing and potential investors. Green bond issuers subsequently enjoy improvements in their postissuance environmental performance, measured by higher environmental ratings and lower carbon emissions. Immel et al. (2022) explore whether ESG ratings affect green bond pricing and find that green bond issuance benefits from lower risk premiums. They also find that the higher the ESG rating, the lower the spread: a one basis point increase in ESG rating results in a spread reduction between 6 and 13 basis points. J. Wang et al. (2020) document that investors are willing to pay a premium on Chinese green bonds compared to the conventional ones, which is higher for high CSR issuers and when ownership structure is less concentrated and includes long-term-oriented institutional investors. They also find a positive stock market return on green bond issuance, suggesting that sustainable financing is consistent with shareholders' value maximization goals. S. Wang and Wang (2022) examine the impact of ESG performance on green bond issuance in the Chinese market during 2016–2020. They suggest that

improvements in the overall ESG performance and its constituent factors boost green bond issuance by Chinese listed firms and that ESG performance changes could guide investors towards identifying environmentally responsible firms. Prajapati et al. (2021) suggest that retail investors are more likely to invest in green bonds issued in the Indian market if the issuers' ESG rating and the credit rating are high coupled with proper tax incentives. On the basis of the above literature and considering the importance of environmental performance to green bonds, we expect a positive effect of environmental performance measures and green bond issuance.

3 | DATA AND METHODOLOGY

3.1 | Data

To identify the causal effect, we use cross-section data capturing the countries' experience of green bond issuance over multiple years. We carry out the analysis by drawing on a unique set of panel data comprising 351 public issues (in USD billion) of green bonds offered by 84 countries during 1991–2021. However, the largest portion of the issues took place after 2011. Data on green bond issuance have been collected after the public dissemination of the *Green Bond Principles* by a consortium of global investment banks, which established standard procedures for issuing green bonds as well as suitable transparency and comparability requirements that raised market confidence on this new financial asset (Cheong & Choi, 2020). Moreover, the UN-supported *Principles for Responsible Investment* today has more than 1700 signatories from more than 50 countries. After 2011, the literature on the issuance and trading of green bonds has increased due to data availability (MacAskill et al., 2020). In our sample, about 9.4% of the issues are government green bonds, whilst the majority of them are corporate green bonds. The IMF's Climate database provided the data for the value of green bond issues.¹ This is perhaps the largest database on green bonds. The Climate Bond Initiative database contains a smaller number of green bond issues and for a shorter period of time (2014–2021). We further merged our green bond data with data from different sources capturing environmental, macroeconomic and institutional conditions. Our final baseline data set includes 349 green bond issues globally from 84 countries. Some countries have very few and small issues.

3.2 | Variables

In our analysis, the outcome variable is the value of green bonds issued per country as a whole (in USD billion) (GRBND). Figure 1 shows an exponential growth of the value of green bonds issued worldwide. During the last decade, and especially after the 2018, the value of green bonds issued increased rapidly. Global market sentiment and investment conditions appeared ripe for the issuance of both corporate and government green bonds. Moreover Table 1 shows the country distribution of the average value of green bond issued across the entire sample period. The global average value of green bonds in our sample is USD 5.2 billion, which is lower than the average issuance value of conventional bonds, but nevertheless a considerable one.

¹The IMF's Climate database can be accessed at <https://climatedata.imf.org/datasets/8e2772e0b65f4e33a80183ce9583d062/explore>.

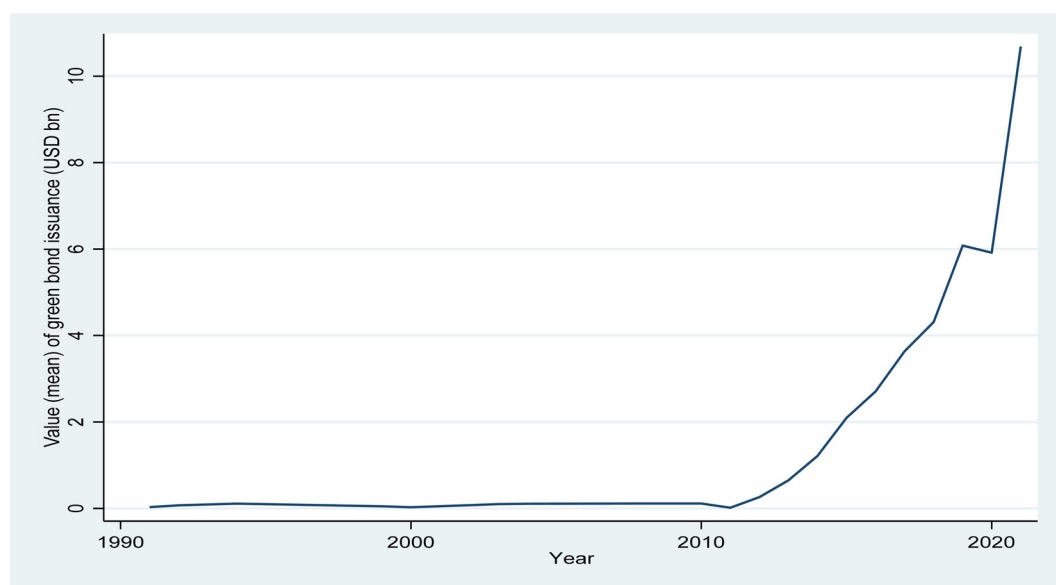


FIGURE 1 The growth of the green bond market worldwide measured by the average value (USD billion) of green bond issuance per year during 1991–2021. It is based on authors' calculations of International Monetary Fund data. Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1111/efm.12419)

The distribution of green bond issuance is as follows: China has issued the largest value of green bonds (29.91 billion), followed by France (24.02 billion) and the Netherlands (16.96 billion). Costa Rica (1.02 billion) has occupied the middle place, followed by the Czech Republic (0.96 billion) and Taiwan (0.93 billion). Finally, at the lower end of the spectrum, we find Namibia (0.87 billion) followed by Seychelles (0.03 billion) and Morocco (0.01 billion). Overall, it appears that, in addition to the firstcomer China, the European countries have been the staunchest supporters of green bond issuance. Smaller and middle/low-income countries have also entered the green bond market. Despite considerable demand/supply-side barriers, the issuance of green bonds is associated with new growth opportunities, which attract smaller growth-oriented countries (Nguyen et al., 2021).

Our key independent variables are Hofstede's (2001, 2010) six dimensions of approximating a country's cultural values: individualism (IND), power distance (PDI), masculinity (MAS), uncertainty avoidance (UAI), time orientation (LTO) and indulgence (IVR). More specifically, power distance (PDI) captures the degree of hierarchy and inequality among people accepted by society. People in countries with higher power distance score accept more easily unequal power distribution and hierarchical relations in society, thereby perpetuating inequalities between people. The dimension of individualism versus collectivism (IND) measures the extent to which individuals in a country are disconnected from groups. People in countries with higher individualism score are more individualistic, rewarding personal efforts and initiative-taking. The dimension of masculinity (MAS) measures the prevalence of masculine values of competitiveness and assertiveness in society. People in countries with higher masculinity score are characterized by strong egos and are target driven in their interaction. The dimension of uncertainty avoidance (UAI) measures the extent of a society's acceptance of outcome ambiguity and inherent uncertainty. Individuals in countries with high scores of uncertainty avoidance tend to be risk averse. The dimension of time orientation (LTO) measures the extent

TABLE 1 Average value of green bond issuance per country.

This table reports the average values of green bond issuance (USD billion) per country during the 1991–2021 period based on International Monetary Fund data.

Country	Value	Country	Value
Argentina	0.68	Luxembourg	3.46
Australia	2.03	Macao	0.84
Austria	1.42	Malaysia	0.29
Bangladesh	0.35	Marshall Islands	0.2
Belgium	5.83	Mauritius	2.48
Bermuda	1.09	Mexico	2.3
Brazil	0.87	Morocco	0.01
British Virgin I	1.77	Namibia	0.87
Canada	5.47	The Netherlands	16.96
Cayman Islands	3.54	New Zealand	0.34
Chile	4.69	Nigeria	0.08
China	29.91	Norway	2.96
Colombia	0.31	Pakistan	0.53
Costa Rica	1.01	Panama	0.25
Czech Republic	0.96	Peru	0.48
Denmark	4.14	Philippines	0.45
Egypt	3.02	Poland	2.46
Estonia	0.07	Portugal	1.78
Fiji	0.09	Romania	0.48
Finland	2.12	Russia	0.79
France	24.02	Serbia	4.53
Georgia	0.75	Seychelles	0.03
Germany	12.94	Singapore	2.18
Greece	0.78	Slovak Republic	0.45
Guernsey	0.19	Slovenia	0.08
Hong Kong	7.36	South Africa	0.12
Hungary	2.71	Spain	7.44
Iceland	0.88	Sweden	7.76
India	2.16	Switzerland	0.75
Indonesia	2.04	Taiwan	0.93
Ireland	4.88	Thailand	0.61

TABLE 1 (Continued)

Country	Value	Country	Value
Israel	1.56	Turkey	0.72
Italy	6.22	Ukraine	1.65
Japan	5.45	United Arab Emirates	0.45
Jersey	0.55	The United Kingdom	9.25
Korea, Republic	6.66	The United States	15.15
Latvia	0.08	Vietnam	0.18
Liechtenstein	0.35	Total average	5.15
Lithuania	0.42		

to which societies exhibit more of a long-term versus short-term orientation in decisions. People in societies with higher long-term score focus on the future outcomes by addressing long-term challenges and ensuring supporting growth and prosperity. Finally, the dimension of indulgence versus restraint (IVR) captures the extent to which societies ensure freedom for their people to pursue their own needs and desires. People in societies with higher indulgence scores tend to be optimistic and value discussion, response and coaching in decision-making.

Our control variables capture the effect of environmental, macroeconomic and institutional conditions in a country. These variables are the following: First, *the environmental performance index (EPI)*. Investors increasingly pay attention to more soft criteria, such as ESG performance indicators, when they decide to invest. Environmental performance criteria are closely related to socially responsible investment objectives as well as to CSR considerations (MacAskill et al., 2020). Responsible investment increasingly focuses on companies with balance sheets that properly account for and reflect corporate behaviour towards environmental concerns and indicators (Ntsama et al., 2021). Prior studies showed that ESG indicators positively affect bond market activity and are associated with lower borrowing costs (Capelle-Blancard et al., 2019; Margaretic & Pouget, 2018). In China, corporate considerations of environmental issues are associated with lower interest cost in the issuance of green bonds, higher yields, better financial conditions and a longer-term issuance orientation (B. Li et al., 2022). Countries with LTO collaborate and communicate effectively with third parties, thereby raising investors' trust (Margaretic & Pouget, 2018). Higher environmental performance ratings are associated with higher socially responsible investment decisions (Diouf et al., 2016). Further, in developing countries, higher environmental risk is associated with higher investment financing needs (Prajapati et al., 2021). We capture these effects by using the EPI. The index captures the state of sustainability around the world and ranks countries on climate change performance, environmental health and ecosystem vitality. We expect a positive effect of better environmental performance on green bond issuance.

Second, the *comparative advantage in low-carbon technology products (COMTECH)*. Technological innovation has facilitated the development of green bond markets globally by improving credit-risk analysis and bond pricing, with the increasing involvement of fixed-income investors and rating agencies (Ketterer et al., 2019). Apple Inc. (2022) has announced that its switch to purchasing carbon-free aluminium provided a major advancement in smelting technology to reduce emissions in the production of smartphones. It financed the \$4.7 billion

free-carbon investment by issuing green bonds. Technological advantage in low-carbon products generates gains from trade, thereby leading to higher trade openness. The latter could accordingly be associated with higher green bond issuance and market growth (Tolliver et al., 2020) and lower green bond spread thereby encouraging green bond issuance (Capelle-Blancard et al., 2019). We capture these effects by using a country's comparative advantage in low-carbon technology products index as an independent variable. We expect a positive relation between higher comparative advantage in low-carbon products and bond issuance.

Third, the *sovereign debt rating (RATING)*. Credit ratings analyze issuers' creditworthiness using economic and noneconomic information. Credit ratings have a significant influence on bond market activity. They affect investment decisions on issuing all types of, including green, bonds (Prajapati et al., 2021) and therefore they are associated with higher issues of green bond (Chiesa & Barua, 2019). Moreover, ratings influence the spreads and yields of green bonds (B. Li et al., 2022). Low rating scores are associated with higher financing costs for they reflect the issuer's ability to meet their debt obligations and access capital market (Benito et al., 2016). Recent literature has shown that the changes in the sovereign rating affect equity and debt markets, respectively (Rusike & Alagidede, 2021). These changes, and especially the negative ones, exert significant effects on both at the domestic and foreign markets. We capture these effects by using Moody's sovereign debt ratings, recoded between investment and noninvestment grade (Capelle-Blancard et al., 2019). We expect a positive effect of higher sovereign ratings on green bond issuance.

Fourth, the state's *fiscal balance (FSCALB)*. Fiscal balance is a key factor in the decision to issue bonds. Yamahaki et al. (2020) showed that the fiscal balance could influence the development of not only the conventional but also the green bond market. Previous studies showed that improvements in the fiscal balance are associated with lower bond issuance (Ahwireng-Obeng & Ahwireng-Obeng, 2019). Further, the fiscal balance influences not only issuance activity directly but also the bond spread volatility (Capelle-Blancard et al., 2019; Presbitero et al., 2016) thereby encouraging issuance. Fiscal imbalances exert positive and significant effects on bond spreads (Balima & Combes, 2019; Nickel et al., 2011) and lead to higher issuance of government bonds (Balima & Combes, 2019). We capture this effect by using the level of fiscal balance (%GDP) in a country. We expect a negative relation between the size of the fiscal balance and the issuance of green bonds.

Fifth, the *inflation rate (INFL)*. Changes in the inflation rate reflect the quality of macroeconomic management that directly influences issuers' default risk. Higher inflation rates cause macroeconomic instability that lowers state creditworthiness (Nickel et al., 2011). Further, the inflation rate influences access to long-term finance (Alexopoulou et al., 2010). Higher inflation decreases the probability of issuing government bonds since it raises borrowing costs (Presbitero et al., 2016). In addition, higher inflation was found to have a negative impact on energy efficiency in the OECD countries (Tu & Rasoulinezhad, 2021). Likewise, higher inflation rate is associated with adverse effects on the issuance and expansion of the green bond market (Anh Tu et al., 2020). In recent years, loose monetary policy and quantitative easing have been beneficial for bond issuance (Grosse-Rueschkamp et al., 2019). We capture these effects using the inflation rate (percent of price change). We expect a negative effect of higher inflation rates on the issuance of green bonds.

Sixth, the *gross domestic product per capita (GDPCAP)*. The size of the economy influences the capacity to issue green bonds (Tolliver et al., 2020). Economic size and economic development levels have been associated with higher issuance of corporate and sovereign bonds in developing countries (Presbitero et al., 2016). Moreover, higher GDP levels are associated

with higher relative levels of green bond financing globally and especially in European countries (Glomsrød & Wei, 2018). We capture these effects by using the level of GDP per capita (a proxy for economic development) as an independent variable. We expect a positive association between GDP per capita and green bond issuance.

Seventh, *the level of credit to the private sector (CREDIT)*. Larger and deeper financial sectors allow for better risk management capacity, which facilitates the issuance of bonds. For example, in Europe, bond market growth has been characterized by shifts in the composition of bond issuers towards smaller and riskier issues, using the proceeds to invest and grow rather than repay bank loans, as well as by investors that pursue stable “buy-and-hold” bond strategies (Darmouni & Papoutsi, 2022). Moreover, higher levels of financial intermediation reduce inefficiencies in bond markets and facilitate market growth, especially for smaller size issuers (Becker & Josephson, 2016). In developing countries, expanded financial intermediation facilitates bond market development by increasing the potential of asset securitization (Hawkins, 2002). Financial market development has been a significant factor in the development of green bond markets in developing economies (Tu et al., 2020). We capture these effects by using the value of total credit to the private sector (%GDP) as our independent variable. We expect a positive association between financial development and green bond issuance.

Eighth, *the extent of credit information coverage (CRINFO)*. Credit information coverage and transparency are crucial for bond market liquidity and development (Bao et al., 2011). In many countries, poorly functioning bankruptcy procedures and inadequate credit information force viable but insolvent firms to restructure informally to the benefit of traditional bank intermediation, thereby restraining the development of bond markets (Becker & Josephson, 2016). Due to credit information inefficiencies, often small firms are discouraged from issuing bonds and, if they do, they prefer a mix of bond issues and bank loans (Hale & Santos, 2008; Johnson, 1997). Credit information is crucial for both the issuance and liquidity of green bond market, much like conventional corporate bonds (Flammer, 2021). We capture this effect by using the credit information coverage country-level index as a proxy of credit information conditions. We expect a positive relation between higher index values and green bond issuance. The appendix provides detailed information on the variables used in our analysis.

Finally, we note that differences in cultural values may be geographic- rather than country-specific (Beugelsdijk et al., 2017). Thus, we distinguish between the country-based and culture-based scope of values by considering the effect of supranational cultural zones. Accordingly, drawing on Cumming and Zhang (2019) and Boubakri et al. (2021), we control for the effect of broader culture-based zones by adding dummy variables representing the following 10 regional zones (Ronen & Shenkar, 2013): African, Arabic, Anglo-Saxon, Germanic, Nordic, Latin America, Latin Europe, Eastern Europe, Near East, Far East and Confucian.

Table 2 shows the descriptive statistics of the variables. These statistics show considerable variation among countries. The mean sample value of green bond issue is \$2.84 billion, with a considerable standard deviation of \$5.66 billion and a maximum value of \$34.4 billion, indicating considerable differences among countries. The mean and median values are different indicating considerable skewness in the sample distribution. Further, as expected, the values of cultural dimensions also vary considerably among countries. The environmental variables also show large dispersion. Environmental performance ranges between the low 37.8 and the high 88 scores, with a mean score of 66 and a standard deviation of 13.65. Countries show different adherence levels to environmental performance criteria, and different commitments to socially

TABLE 2 Summary statistics.

This table reports the summary statistics of the variables. The statistics include the number of observations (count), the mean, standard deviation (SD), the minimum (min) and maximum (max) values as well as the 25th, 50th and 75th percentile values. The appendix provides a definition of the variables.

Variable	Count	Mean	SD	Min	P25	P50	P75	Max
GRBND	349	2.84	5.66	0.01	0.12	0.72	2.54	34.43
PDI	349	56.11	23.58	22.00	31.00	54.00	78.00	95.00
IDV	349	49.31	26.26	11.00	25.00	46.00	69.00	91.00
MAS	349	49.35	25.07	8.00	34.00	55.50	63.00	95.00
UAI	349	65.18	18.60	44.00	49.00	50.01	85.00	95.00
LTO	349	37.97	19.85	12.00	25.69	32.75	34.51	87.91
IVR	349	60.11	17.66	19.87	45.09	55.13	68.08	97.32
EPI	349	65.95	13.65	37.80	54.35	68.28	76.47	88.00
COMTECH	349	0.82	0.349	0.01	0.35	0.59	1.14	2.24
FSCALB	349	65.71	61.03	13.91	31.34	41.17	59.12	237.96
RATING	349	0.94	0.25	0.01	1.00	1.00	1.00	1.00
GDPCAP	349	10.35	0.64	8.90	9.86	10.53	10.98	11.16
CREDIT	349	4.90	0.55	3.84	4.56	4.99	5.14	5.90
INFL	349	2.43	2.68	−1.93	1.06	2.08	3.03	15.18
CRINFO	349	76.02	32.52	0.01	53.80	100.00	100.00	100.00
N	349							

responsible investment objectives and CSR considerations. Likewise, the countries' comparative advantage in low-carbon technology products, their macroeconomic performance and institutional conditions show considerable variation.

3.3 | Estimation model

Identifying a causal effect running from culture in a country to the issuance of green bonds in this country is challenging due to the possible presence of unobserved country-level factors that are correlated simultaneously with the cultural dimensions and the firms' and government's decisions to issue green bonds. We include alternative model specifications to reduce this possibility. We start with fitting a pooled ordinary least squares (OLS) estimation model for producing our baseline results. We use country and year fixed effects to capture time-invariant (i.e., institutions, norms, etc.) and time-varying (i.e., crises) heterogeneity. The disadvantage of the OLS linear estimation is that it does not account for nonlinearities, has poor extrapolation properties, is sensitive to outliers and it may produce too low predicted values for the outcome variable, due to attenuation bias. However, the OLS estimation avoids the problem of incidental parameter bias that is embedded in nonlinear estimation. The inclusion of country-year fixed

effects in the analysis reduces the OLS estimation bias in relative terms. However, to check the robustness of the OLS baseline results, we deploy additional sensitivity and endogeneity analysis. In the regression, we consider only nonmissing observations of our variables. In our setting, we measure the key predictor variables (cultural dimensions) at the country level whereas we measure our outcome variables as both the sum of corporate and government green bond issues per country. We therefore cluster the standard errors at the country level to contain potential bias due to the effect of aggregate cultural variables on multiple issues (Moulton, 1990). In a given country and year, there may be different observations per each key predictor observation. The error term of the estimation might be relatively larger since it is difficult to fit all outcome values at the same time thereby inducing a more conservative estimate of the effect of the key predictor variable. Our estimation model is therefore given by the following equation:

$$\text{GRBND}_{jt} = a + \text{Culture}_j\beta_1 + X1_{jt}\beta_2 + X2_{jt}\beta_3 + X3_{jt}\beta_4 + \mu_{jt}. \quad (1)$$

In the above regression equation (1), the variable GRBND_{jt} is the outcome variable (green bond issuance value) of country j in year t ; the variable Culture_j captures separately each of Hofstede's six culture dimensions per country j ; the vector $X1_{jt}$ includes environmental controls; the vector $X2_{jt}$ includes macroeconomic controls; and the vector $X3_{jt}$ includes institutional controls of country j in year t . The final term μ_{jt} represents the regression's composite error term, which comprises the sum of γ_j , δ_t and e_{jt} terms. More specifically, the term γ_j accounts for the influence of country effects; the term δ_t accounts for the influence of year effects; and the remaining term e_{jt} is the error parameter assumed to vary across years and countries and be normally distributed. We are well aware of the difficulty in interpreting the observed correlations as causal effects. We therefore interpret our results as strength of association rather than causation, and the use of the words “predict” or “impact” or “affect” is made to simplify exposition.

Table 3 shows the correlations for the variables used in estimation. It shows that the issuance value of green bonds is negatively correlated with individualism and indulgence and positively correlated with power distance, uncertainty avoidance and the LTO at the 1% significance level. This provides initial evidence on the association between green bond issuance and cultural values, which we analyze further in the subsequent sections. Table 3 also indicates correlation among the cultural value dimensions, implying potential collinearity risk, which we circumvent by estimating separately the effect of each cultural dimension (Table 4).

4 | BASELINE RESULTS

We apply regression tests of the effects of cultural value dimensions on green bond issuance after controlling for environmental, macroeconomic and institutional factors. Table 5 presents the regression estimates. Columns (1)–(6) report the results, which indicate that the six cultural value dimensions are associated with green bond issuance. First, markets in countries with higher scores on power distance are on average associated with higher volumes of green bond issuance, which supports our hypothesis H1a. It appears that markets in countries that accept more hierarchical social relations are more likely to support green bond financing. Markets characterized by more centralized power relations are able to adopt changes to green finance faster, as they face lower push-back pressure and more social support. Our results deviate from

TABLE 3 Correlation matrix.

This table reports the Pearson correlation coefficient between the green bond issuance value (GRBND), the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Oriented (LTO) score, the Indulgence versus Restraint (IVR) score, the environmental performance index (EPI), the index of comparative advantage in low-carbon technology products (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The table also reports the mean value of the variance inflation factor (VIF) for the whole sample. VIF values above 4 (small sample) or 10 (large sample) indicate collinearity. The appendix provides a definition of the variables.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GRBND (1)	1														
PDI (2)	0.02*	1													
IDV (3)	-0.14***	-0.73***	1												
MAS (4)	0.01	0.09*	0.00	1											
UAI (5)	0.05*	0.42***	-0.16***	0.08	1										
LTO (6)	0.21***	-0.02	0.02	0.09*	0.20***	1									
IVR (7)	-0.09*	-0.31***	0.28	-0.03	-0.18***	-0.49***	1								
EPI (8)	0.02	-0.36***	0.45***	-0.07	-0.03	0.09	0.20***	1							
COMTECH (9)	0.22***	-0.14**	0.08	0.18***	-0.03	0.41***	-0.14**	0.20***	1						
FSCALB (10)	0.10	0.01	0.15**	0.44***	0.29***	0.23***	-0.09	0.17***	0.32***	1					
RATING (11)	0.13**	-0.19***	0.24	-0.20***	0.01	-0.20***	0.15***	0.10*	0.26***	-0.06	1				
GDPCAP (12)	0.10	-0.40***	0.44***	-0.10	-0.14**	0.12*	0.13**	0.45***	0.25***	0.08	0.43***	1			
CREDIT (12)	0.28**	-0.44***	0.37***	0.27**	-0.14	0.35***	-0.23*	0.43***	0.40***	0.36***	0.27**	0.42***	1		
INFL (13)	-0.09	0.25***	-0.19***	0.05	0.05	-0.19***	0.08	-0.34***	-0.26***	-0.20***	-0.42***	-0.45***	-0.32***	1	

TABLE 3 (Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
CRINFO (14)	−0.11*	−0.30***	0.27***	0.12*	−0.09	−0.09	0.15**	0.23***	0.09	0.10	0.07	0.23***	0.30***	−0.11*	1
VIF	2.39														
N	349														

* $p > 0.1$.
** $p > 0.05$.
*** $p > 0.01$.

TABLE 4 Baseline results.

This table reports the baseline regression estimates of Hofstede's six culture dimensions on the value of green bonds and the control variables based on the regression equation (1). The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Orientation (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (% GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The regressions employ a pooled ordinary least squares model with country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short- term orientation (5)	Indulgence versus restraint (6)
PDI	6.941*** (1.735)					
IDV		−2.348*** (0.587)				
MAS			−4.695*** (1.174)			
UAI				3.991*** (0.998)		
LTO					30.180*** (7.486)	
IVR						−19.866*** (4.888)
EPI	0.406** (0.158)	0.412** (0.158)	0.401** (0.158)	0.403** (0.158)	0.411** (0.157)	0.421** (0.156)
COMTECH	8.666* (4.923)	8.234* (4.923)	8.332* (4.923)	8.612* (4.923)	8.245* (4.885)	8.234* (4.846)
FSCALB	0.987*** (0.327)	0.912*** (0.327)	0.933*** (0.327)	0.977*** (0.327)	0.889*** (0.324)	0.878*** (0.322)
RATING	50.054** (20.449)	−3.636 (20.085)	50.589* (26.190)	25.240 (19.146)	470.144*** (113.009)	372.543*** (9237.919)

TABLE 4 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
GDPCAP	72.807*** (18.589)	71.127*** (18.589)	70.447*** (18.589)	69.553*** (18.589)	69.527*** (18.443)	71.211*** (18.296)
CREDIT	41.509** (20.131)	41.509** (20.131)	41.509** (20.131)	41.509** (20.131)	41.509** (19.973)	41.509** (19.814)
INFL	−1.906** (0.813)	−1.723** (0.813)	−1.456** (0.813)	−1.236** (0.813)	−1.872** (0.807)	−1.238** (0.800)
CRINFO	−0.163* (0.095)	−0.163* (0.095)	−0.163* (0.095)	−0.163* (0.095)	−0.163* (0.095)	−0.163* (0.094)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.673	0.673	0.673	0.673	0.677	0.681
N	349	349	349	349	348	348

those of Connelly (2017) and Labidi et al. (2021), who documented an insignificant association between power distance and socially responsible investment. Our finding may be the result of stricter regulatory policies in the post-2016 period. For example, Liu and Liu (2022) found that stricter environmental regulation had a dampening effect on conventional financial asset investment.

Second, countries with higher scores on individualism are associated with lower volumes of green bonds, thereby confirming hypothesis H2b. People in individualist countries are disconnected from social groups and therefore appear to be less likely to embrace alternative investments due to the potentially unfavourable risk-return tradeoffs. Social collectivism is associated with higher green bond issuance, driven by stronger welfare considerations and greater focus on social interdependence. Our results are in line with those of Petruzzella et al. (2017), who documented a negative effect of individualism on environmental performance and of Park et al. (2007) who found an insignificant effect of individualism on environmental performance.

Third, countries with higher scores on masculinity are also associated with lower volumes of green bonds, also confirming hypothesis H3. Markets in countries with high competitiveness and assertiveness levels appear less likely to consider alternative investments options, which would require prior debate and more tolerant attitudes. Markets in more feminine societies support green bond financing since they prioritize higher societal welfare and preservation relative to pure financial gain. Our results are in line with those of Dangelico et al. (2020).

TABLE 5 Sensitivity analysis I: Alternative measures of culture.

This table reports the regression estimates of L. Tang and Koveos (2008) alternative measures of culture dimensions on the value of green bonds and the control variables based on the regression equation (1). The value of green bonds issued is based on International Monetary Fund data. L. Tang and Koveos (2008) five culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score and the Long-term versus Short-Orientation (LTO) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The regressions employ a pooled ordinary least squares model with country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus Collectivism (2)	Masculinity versus Femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)
PDI1	3.528*** (0.840)				
IND1		−2.153*** (0.513)			
MAS1			−12.755*** (3.036)		
UAI1				3.189*** (0.759)	
LTO1					−0.676 (2.172)
EPI	0.449*** (0.162)	0.493*** (0.178)	0.503*** (0.211)	0.341*** (0.115)	0.412*** (0.167)
COMTECH	9.890* (5.562)	9.112* (5.113)	8.977* (4.766)	9.562* (5.226)	9.511* (5.477)
FSCALB	1.006*** (0.308)	1.246*** (0.325)	1.778*** (0.377)	2.012*** (0.267)	1.234*** (0.433)
RATING	8.849 (18.272)	14.943** (17.332)	−8.248 (19.111)	5.059** (17.533)	57.062** (24.492)
GDPCAP	74.113*** (17.787)	73.453*** (15.433)	74.511*** (16.522)	75.332*** (17.588)	72.783*** (16.533)

TABLE 5 (Continued)

Variable	Power distance (1)	Individualism versus Collectivism (2)	Masculinity versus Femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)
CREDIT	39.594* (20.183)	39.123* (20.003)	38.398* (21.377)	39.116* (17.163)	36.653* (18.143)
INFL	−1.941** (0.913)	−1.633** (0.833)	−1.955** (0.894)	−1.733** (0.925)	−1.899** (0.876)
CRINFO	−0.122 (0.101)	−0.136** (0.112)	−0.154 (0.123)	−0.156 (0.105)	−0.112** (0.121)
Regional dummies	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.691	0.691	0.691	0.691	0.691
N	248	248	245	247	244

Fourth, markets in countries with higher uncertainty avoidance scores are associated with higher volumes of green bonds. This finding confirms hypothesis H4a. Markets in countries with little tolerance of uncertainty and ambiguity are more likely to consider alternative investment options, given the rising risk and uncertainty posed by deteriorating environmental conditions. Our findings are broadly in line with those of Peng and Lin (2009) and Onel and Mukherjee (2014) on the relation between uncertainty avoidance on environmental performance.

Fifth, markets in countries with higher LTO scores are also associated with higher volumes of green bonds, thereby confirming hypothesis H5. Markets in countries, which focus on future outcomes more steadily by addressing future challenges and sustaining future growth and prosperity in view of the deteriorating environmental conditions, would naturally support alternative financing through green bond issuance. These markets tend to value more economic and social equality as well as long-term payoffs. Our results are consistent with those of Zheng et al. (2012), who find that long-term-oriented firms are more forward-thinking and are more flexible in their decision-making. They are also in line with those of Lahuerta-Otero and González-Bravo (2018), who document a positive impact of LTO on country environmental performance.

Finally, markets in countries with higher indulgence scores are associated with lower volumes of green bonds, which is consistent with the prediction of hypothesis H6b. Markets in countries with general optimism and support of interactive coaching in decision-making appear to provide lower support of green bond issues. Our results are consistent with the idea that indulgent cultures are short-term oriented while more disciplined ones are long-term oriented and therefore more oriented towards green financing as a solution to mounting environmental issues. Our results are consistent with those of Connelly (2017) and Petruzzella et al. (2017), who find a negative association between high indulgence scores and socially responsible investments and environmental performance, respectively.

In addition, the effects of the environmental variables are strongly significant. Countries that score higher on environmental performance and have developed a comparative advantage in low-carbon technological products tend to support alternative financing through green bonds. Finally, higher levels of credit information coverage are on average associated with lower levels of green bond issuance. This is a rather surprising result. It may be the case that the relatively large proportion of small- and medium-size firms in many countries with high credit information coverage have disadvantages and inefficiencies, which prevent them from resorting to direct alternative financing or encourage them to use a mix of direct and indirect financing of their investment needs (Hale & Santos, 2008; Johnson, 1997).

5 | SENSITIVITY TESTS

The estimation analysis must deal with a number of potential econometric problems. First, there is a possibility that the volume of green bond issuance might endogenously influence the cultural behaviour of countries, giving rise to a problem of reverse causation. This, in turn, would cause regressors to be correlated with the error term. However, we contend that endogeneity concerns arising from reverse causality do not apply in this study. It is not reasonable to assume a feedback effect from the financing decisions of firms and governments to the cultural traits of countries. This is because the formation of cultural behaviours predates the measurement of the dependent variables for years, especially due to long-term nature of cultural values and their persistence over time. Also, the large cross-section of countries also limits the possibility of reverse causation. We further added diverse country-level controls and include dummies capturing fixed effects and regional cultural effects. Subject to these controls, we argue that the baseline results remain relatively robust.

However, to check further the robustness of our baseline results, we apply additional sensitivity tests below, focusing on alternative measurement and estimation methodologies. The first sensitivity test uses an alternative measure of the key independent cultural variables. L. Tang and Koveos (2008) updated Hofstede's cultural value dimensions by accounting for economic conditions. Their main findings are that power distance, individualism and LTO scores vary over time with national wealth, while masculinity and uncertainty avoidance stay relatively stable. We use L. Tang and Koveos's (2008) five updated cultural value dimensions as alternative measures of national cultural values. We define them as PDI1 (alternative power distance measure), IND1 (alternative individualism measure), MAS1 (alternative masculinity), UAI1 (alternative uncertainty avoidance measure) and LTO1 (alternative LTO measure). L. Tang and Koveos (2008) did not update the indulgence dimension, so we omit it. We estimate Equation (1) using the alternative measures of culture. Table 5 presents the results. The new estimates show that the use of the alternative measures of national culture does not qualitatively alter the baseline results in terms of significance and direction, except for the LTO1 effect, which is insignificant. The latter remains relatively stable.

The second sensitivity test uses an alternative sample structure. The latter includes only the green bond issues issued by private corporations. High investor demand for green bonds in recent years has created a so-called "greenium" (green premium). Government bonds tend to offer a lower greenium compared to corporate bonds and moreover present a more complex case regarding the efficiency of government use of funds raised (Fidelity International, 2021).

TABLE 6 Sensitivity analysis II: Alternative sample structure.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of private sector green bonds only and the control variables based on the regression equation (1). The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Orientation (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The regressions employ a pooled ordinary least squares model with country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus sort- term orientation (5)	Indulgence versus restraint (6)
PDI	6.221*** (1.692)					
IND		−2.104*** (0.572)				
MAS			−4.209*** (1.144)			
UAI				3.577*** (0.973)		
LTO					27.051*** (7.299)	
IVR						−78.697*** (7.624)
EPI	0.394** (0.158)	0.322** (0.112)	0.315** (0.221)	0.344** (0.126)	0.324** (0.217)	0.396** (0.142)
COMTECH	8.825* (4.588)	8.215* (4.348)	8.555* (4.868)	8.389* (4.134)	8.815* (4.326)	8.811* (4.546)
FSCALB	0.977*** (0.324)	0.912*** (0.322)	0.915*** (0.322)	0.957*** (0.342)	0.916*** (0.312)	0.977*** (0.319)
RATING	53.209** (19.783)	5.085 (18.547)	−37.001 (24.153)	30.967* (18.080)	429.750*** (111.314)	336.001*** (98.031)

(Continues)

TABLE 6 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short- term orientation (5)	Indulgence versus restraint (6)
GDPCAP	71.180*** (18.829)	71.002*** (18.211)	70.234*** (18.455)	71.003*** (18.546)	71.112*** (18.681)	71.176*** (18.533)
CREDIT	31.513* (18.067)	31.513* (18.067)	31.513* (18.067)	31.513* (18.067)	31.513* (17.925)	31.513* (17.782)
INFL	−1.929** (0.781)	−1.912** (0.723)	−1.945** (0.733)	−1.856** (0.715)	−1.921** (0.775)	−1.922** (0.769)
CRINFO	−0.251*** (0.086)	−0.244*** (0.078)	−0.2486*** (0.088)	−0.249*** (0.081)	−0.252*** (0.089)	−0.247*** (0.079)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.678	0.678	0.678	0.678	0.682	0.686
N	287	287	285	284	283	281

We therefore exclude government green bonds from sample. We estimate Equation (1) using the new sample structure. Table 6 presents the new results. The new estimates also show that the use of the alternative sample structure does not qualitatively alter the baseline results in terms of significance and direction. The new estimates appear to be smaller in magnitude relatively to the baseline estimates, except for indulgence, which is considerably larger. It appears that the effect of indulgent societies is exerted more strongly through corporate than government financing decisions. Martins and Lopes (2016) argue that the indulgence effect operates through the organizational culture of corporations.

The third sensitivity test also uses another sample structure. The latter excludes the largest country in terms of green bond issuance value, which is China. It is possible that the large issuance value of the latter country drives the results leading to biased coefficients. Moreover, unlike many other countries, the greenium in China has so far been practically nonexistent (Fidelity International, 2021). We estimate Equation (1) using the new sample structure. Table 7 presents the new results. Similarly, the new estimates show that the use of the alternative sample structure does not qualitatively alter the baseline results in terms of significance and direction. Likewise, the new estimates appear to be smaller in magnitude relatively to the baseline estimates, except for indulgence, which again is considerably larger.

TABLE 7 Sensitivity analysis III: Exclusion of the largest country.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of green bonds after excluding China, the country with the largest issuance value, and the control variables based on the regression equation (1). The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Orientation (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (% GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The regressions employ a pooled ordinary least squares model with country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus sort-term orientation (5)	Indulgence versus restraint (6)
PDI	6.912*** (1.657)					
IND		−2.103*** (0.433)				
MAS			−4.512*** (1.277)			
UAI				3.213*** (0.544)		
LTO					32.598*** (6.566)	
IVR						−98.640*** (46.446)
EPI	0.389** (0.134)	0.367** (0.121)	0.412** (0.167)	0.367** (0.211)	0.423** (0.452)	0.418** (0.152)
COMTECH	8.666* (4.923)	8.246* (4.233)	8.655* (4.902)	8.546* (4.902)	8.641* (4.885)	8.642* (4.846)
FSCALB	0.987*** (0.327)	0.987*** (0.327)	0.987*** (0.327)	0.987*** (0.327)	0.987*** (0.324)	0.987*** (0.322)
RATING	50.054** (20.449)	−3.636 (20.085)	50.589* (26.190)	25.240 (19.146)	470.144*** (113.009)	37.543*** (92.911)

(Continues)

TABLE 7 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
GDPCAP	72.807*** (18.589)	72.201*** (18.443)	72.757*** (18.512)	71.844*** (18.437)	72.812*** (18.443)	72.765*** (18.296)
CREDIT	41.509** (20.131)	41.329** (20.002)	41.566** (20.034)	41.489** (20.135)	41.659** (19.973)	41.509** (19.814)
INFL	-1.886** (0.813)	-1.816** (0.804)	-1.911** (0.821)	-1.912** (0.821)	-1.897** (0.807)	-1.902** (0.801)
CRINFO	-0.163* (0.095)	-0.161* (0.090)	-0.158* (0.094)	-0.164* (0.098)	-0.160* (0.091)	-0.162* (0.092)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.673	0.673	0.673	0.673	0.677	0.681
N	342	342	342	342	341	341

6 | ENDOGENEITY ANALYSIS

6.1 | Instrumental variables (IVs)

Another potential econometric problem is measurement error. When the explanatory variable is measured with error, this error is embedded in the residual. However, the observed explanatory variable also contains error, causing a correlation of the regression error term and the explanatory variable that generally results in estimation bias. The latter is especially severe when the variability of the error is large, which is of particular concern in our cross-country setting. Moreover, omitted variables may also cause estimation bias. Despite the inclusion of fixed effects controlling for invariant country factors, our estimates may not produce unbiased assessments of the culture effect on green bond issuance, because of the possible presence of country-level factors affecting cultural behaviour and bond issuance conditions simultaneously. Under such circumstances, the covariance term between the culture variables and the error term in Equation (1) might be nonzero, because even if it is conditional on the fixed effects, the cultural effects might be endogenous to financial considerations. For these reasons, we use IV methods to further check the robustness of our estimates. For comparison purposes, we apply IV methods that deploy separately the 2SLS estimator and the two-step GMM estimator (Greene, 2012). The latter uses the first difference transformation treating the lag values of the

outcome variables as internal instruments for the lagged outcome variable thereby producing more consistent and unbiased estimates.

We identify an external variable that is strongly related to the (allegedly) mismeasured regressor, but with a measurement error that is uncorrelated to the measurement error in the key institutional regressor. In our context, we have a natural candidate for an external instrument: the country index of historically prevalent infectious diseases as an external instrument for cultural values. Psychology studies document that the extent of the historical prevalence of infectious diseases is associated with differences in cultural value dimensions. Prevalent infectious diseases bring morbidity and thereby influence the course of natural selection (Wolfe et al., 2007). Countries with strong historical prevalence of infectious diseases are more likely to develop specific social attitudes towards their prevention, such as prejudice, isolation and ethnocentrism. Drawing on these findings, business studies analyzing the effect of cultural value dimensions on economic outcomes have used the index of historical prevalence of infectious diseases as an external instrument for cultural values (Boubakri et al., 2021; Thornhill & Fincher, 2014).

Table 8 presents the results for the 2SLS estimator. In the first-stage analysis, we regress each of the six cultural value dimensions (PDI, IND, MAS, UAI, LTO and IVR) on the index of the historical prevalence of infectious diseases. The Sanderson–Windmeijer F statistic suggests that the endogenous variable object of testing is not weakly identified and therefore our instrument is not weak, associated with relatively small standard errors. Since clustering errors at the country level implies a drop in the i.i.d. assumption, the appropriate Kleibergen–Paap LM statistic suggests that our model is not underidentified and the external instrument is broadly relevant. Further, the Stock–Wright LM statistic suggests that the overidentifying restrictions are valid, suggesting that our IV estimates are broadly consistent. Thus, our selected external instrument satisfies the conditions that are necessary to be a valid instrument. In the second-stage analysis, we regress our green bond value (GRBND) on the estimated cultural value dimensions and the control variables. The results show that the effects on GRBND of the five cultural measures of IND, MAS, UAI, LTO and IVR obtained from stage 1 remain significant with the same sign, but lower magnitude. However, the effect of PDI turns out to be insignificant. The estimates of the control variable effects remain qualitatively similar to those of the baseline results.

To further ease our endogeneity concerns, in addition to a two-stage IV approach, we implement a GMM IV approach (Arellano & Bover, 1995; Blundell & Bond, 1998). The latter approach uses the lagged first differences of the dependent variable as instruments. Table 9 presents the results for the two-step GMM estimator. Likewise, the first and second-stage results are broadly similar to the 2SLS estimator, indicating that all culture dimensions, except for PDI, are significant predictors of GRBND. The AR(2) test in the GMM estimation indicates no second-order Arellano–Bond serial autocorrelation at the 5% level.

Finally, to insulate our results further from the possibility of inconsistency and omitted variable bias, we use an alternative IV method that might fit better our estimation framework. We use a conditional mixed process with the maximum likelihood estimator executed by the Stata module *cmp* (Roodman, 2011) for the estimation of potential endogeneity of our culture dimensions. The conditional process means that the model can vary by observation. An estimation method can be dropped for observations for which it is not relevant. The mixed process means that different equations can have different types of dependent variables (different response types). The maximum likelihood approach to estimating the separate equations as a system (mixed process), rather than as a two-step estimator, has benefits. It

TABLE 8 Endogeneity analysis I.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of green bonds and the control variables after applying an instrumental variable (IV) method using the two-stage least square (2SLS) estimator. The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Oriented (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The external instrument used in the IV analysis is the countries' prevalence to epidemiological diseases index (PRVDIS). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The estimation includes country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
PDI	1.004 (1.244)					
IND		−0.348** (0.136)				
MAS			−0.555* (0.303)			
UAI				0.308** (0.143)		
LTO					0.224*** (0.082)	
IVR						−0.320** (0.161)

TABLE 8 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
EPI	−0.486 (0.365)	0.226** (0.114)	0.232* (0.153)	−0.145 (0.106)	0.243** (0.103)	0.311** (0.143)
COMTECH	12.023 (18.922)	1.898 (1.957)	−2.627 (2.392)	1.736 (2.274)	−5.837*** (2.087)	−6.017** (2.752)
FSCALB	0.149 (0.155)	0.071*** (0.026)	−0.159 (0.100)	0.075** (0.030)	0.131*** (0.043)	0.087** (0.037)
RATING	7.040 (11.039)	2.315* (3.673)	−9.552 (6.862)	−1.394 (3.635)	3.701*** (1.398)	6.179* (4.373)
GDPCAP	5.400 (4.262)	3.092** (1.546)	11.501* (5.886)	5.458*** (2.025)	5.569*** (1.856)	5.985*** (2.268)
CREDIT	−31.106 (40.356)	10.781** (4.494)	4.896 (3.878)	−4.854 (3.114)	−1.488 (1.379)	2.668* (2.158)
INFL	−1.749 (2.444)	−1.117** (0.552)	−0.500 (0.539)	−0.041 (0.238)	−0.335** (0.163)	−0.504 (0.374)
CRINFO	−0.352 (0.511)	−0.123** (0.051)	0.028 (0.061)	−0.031 (0.040)	−0.004* (0.020)	−0.051 (0.052)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes

(Continues)

TABLE 8 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
<i>First stage</i>						
PRVDIS	0.629*** (1.576)	0.729*** (1.666)	0.871** (1.785)	0.173*** (1.634)	0.967*** (1.812)	0.415** (2.124)
F statistic	12.032	17.882	12.032	13.885	17.245	14.456
<i>Second stage</i>						
Kleibergen–Paap LM (p - v)	3.554 (0.257)	9.219 (0.002)	5.980 (0.014)	3.702 (0.054)	6.882 (0.009)	3.010 (0.063)
Kleibergen–Paap Wald F	0.758	10.234	3.379	13.637	76.752	11.938
Stock–Wright stat (p - v)	13.8 (0.000)	13.8 (0.000)	13.7 (0.000)	13.7 (0.000)	13.8 (0.000)	13.6 (0.000)
N	338	338	337	340	341	332

TABLE 9 Endogeneity analysis II.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of green bonds and the control variables after applying an instrumental variable (IV) method using the two-step GMM estimator. The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Oriented (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The external instrument used in the IV analysis is the countries' prevalence to epidemiological diseases index (PRVDIS). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The estimation includes country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
PDI	1.012 (1.224)					
IND		−0.344** (0.123)				
MAS			−0.525* (0.325)			
UAI				0.311** (0.152)		
LTO					0.221*** (0.087)	
IVR						−0.322** (0.165)

(Continues)

TABLE 9 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
EPI	−0.482 (0.342)	0.222** (0.125)	0.230** (0.162)	−0.143 (0.123)	0.245** (0.136)	0.321** (0.136)
COMTECH	12.023 (18.922)	1.898** (1.957)	−2.627 (2.392)	1.736 (2.274)	5.837*** (2.087)	−6.017** (2.752)
FSCALB	0.149 (0.155)	0.071*** (0.026)	−0.159 (0.100)	0.075** (0.030)	0.131*** (0.043)	0.087** (0.037)
RATING	7.040 (11.039)	2.309** (3.656)	−9.543 (6.853)	−1.332 (3.678)	3.723*** (1.452)	6.123** (4.367)
GDPCAP	5.402 (4.232)	3.032** (1.478)	11.532* (5.806)	5.423*** (2.017)	5.554*** (1.833)	5.974*** (2.275)
CREDIT	−31.145 (40.366)	10.712** (4.487)	4.854 (3.878)	−4.854 (3.122)	−1.488 (1.384)	2.668 (2.162)
INFL	−1.749 (2.444)	−1.112** (0.552)	−0.534 (0.539)	−0.054 (0.238)	−0.332** (0.163)	0.521 (0.374)
CRINFO	−0.350 (0.514)	−0.124** (0.056)	0.032 (0.067)	−0.054 (0.056)	−0.004 (0.023)	−0.055** (0.054)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes

TABLE 9 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
<i>First stage</i>						
PRVDIS	4.199 (4.822)	12.124*** (3.790)	7.590* (4.129)	13.672*** (3.702)	19.335*** (2.207)	14.164*** (4.099)
<i>Second stage</i>						
Kleibergen–Paap LM	0.55 (0.412)	9.23 (0.004)	5.97 (0.011)	3.73 (0.065)	6.82 (0.008)	3.01 (0.085)
Kleibergen–Paap Wald F	0.765	10.326	3.385	13.734	76.703	11.856
Stock–Wright_stat	13.64 (0.000)	13.64 (0.000)	13.02 (0.000)	13.24 (0.000)	13.84 (0.000)	13.66 (0.000)
AR(2)	0.71 (0.478)	0.31 (0.758)	1.33 (0.182)	0.98 (0.328)	−1.35 (0.177)	0.42 (0.675)
N	338	338	337	340	341	332

overcomes several potential problems of unobservable influences, but at the cost of estimation efficiency. Like before, we use the index of historical prevalence of infectious diseases as an external instrument. We cluster standard errors at the country level. Table 10 reports the results of the mixed conditional process for each culture dimension. The LR- χ^2 statistic is high, which shows that the model specification is a good approximation. Comparison among the different process estimates provides the basis for assessing endogeneity. The key point of reference is the significance of the Atanhrho12 correlation parameter. The latter captures the correlation between the error terms of the separate and mixed process equations. If it is significant, then there are unobserved factors simultaneously affecting the outcome and the regressor variables, implying endogeneity. The results show that the Atanhrho coefficient is insignificant for most of the dimensions, indicating that the null hypothesis of their exogeneity is not rejected at the 10% level. The key exception is the coefficient for PDI and weakly for MAS.

6.2 | Coefficient stability analysis

We investigate further the robustness of our results against omitted variable bias. Despite adding observable covariates in a model to capture some confounding bias, we cannot ensure that their selection alone would control for omitted variable bias. We apply Oster's (2019) bias-adjusted treatment test to account for the effect of the inclusion of unobserved covariates on omitted variable bias. The test assesses such bias by exploiting variations in coefficient stability and in total explained variation on the basis of changes between observed and unobserved covariates.

Oster (2019) drew on earlier work by Altonji et al. (2005) and developed a novel method for assessing bias from unobservable factors. She argues that observable covariates can be viewed as a random subset (proportional) of all relevant covariates. Subsequently the confounding of the causal effect depends on estimating bounds of the treatment effect under assumptions regarding the degree of selection of unobservable covariates. Given the presence of omitted variables, the coefficient β of the treatment effect on the outcome variable cannot be identified. Instead, a certain range (bounds) of the treatment effect can be identified, which depends on both the degree of proportionality, δ , between observable and unobservable covariates, and the unknown overall model fit, $R_{\max}$, that comprises both observable and unobservable covariates. The parameter δ captures the strength of correlation between unobservable covariates and the outcome variable relative to observable covariates. Large values of δ imply stronger endogeneity. For $\delta = 1$, observable and unobservable covariates have equal importance, whilst for $\delta > 1$, unobservable covariates exert a stronger impact than observables, and vice versa (Oster, 2019) assumes $\delta > 1$ and specifically $\delta = 2$. Moreover, $R_{\max}$ indicates the degree of variation in the outcome variable that can be explained by controlling for both observable and unobservable covariates and therefore it cannot be estimated too. Thus, to identify β , one needs assumptions (bounds) about δ and $R_{\max}$. Following Oster (2019), we set $R_{\max} = 1.3R^2$ and use the Stata module *psacalc* to produce the estimates.

Table 11 presents the results for each cultural dimension. Column (1) shows the estimated treatment effect and the associated R^2 in parentheses. Column (2) presents the estimates after all covariates and fixed effects are included in the regression. Column (3) includes the identified set of bounds. Column (4) indicates whether the estimation of the treatment effect includes zeros, and column (5) shows the δ parameter. The estimated treatment effect for PDI is 0.0421 with an R^2 of 0.028, whilst the corresponding estimate

TABLE 10 Endogeneity analysis III.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of green bonds and the control variables after applying an instrumental variable (IV) method using the conditional mixed process maximum likelihood estimator (CMP). The value of green bonds issued is based on International Monetary Fund data. Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Orientation (LTO) score and the Indulgence versus Restraint (IVR) score. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). The external instrument used in the IV analysis is the countries' prevalence to epidemiological diseases index (PRVDIS). The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus sort-term orientation (5)	Indulgence versus restraint (6)
PDI	0.398*** (0.142)					
IND		0.204** (0.147)				
MAS			−1.503 (1.039)			
UAI				0.495** (0.193)		
LTO					0.217*** (0.078)	
IVR						−0.863** (0.429)
EPI	−0.128 (0.080)	0.160** (0.078)	0.143* (0.078)	0.145* (0.078)	0.256*** (0.077)	0.183** (0.083)
COMTECH	−1.829 (1.812)	0.619** (1.657)	1.174 (1.622)	−0.913 (1.669)	6.491*** (2.057)	−2.188 (1.826)
FSCALB	0.030 (0.022)	0.042** (0.021)	0.039 (0.025)	0.039* (0.022)	0.145*** (0.035)	0.047** (0.022)
RATING	−1.350 (2.580)	1.220** (2.516)	0.818 (2.617)	−1.010 (2.535)	4.286** (2.740)	−1.111 (3.106)

(Continues)

TABLE 10 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
GDPCAP	4.460*** (1.476)	4.239*** (1.475)	4.381*** (1.566)	4.596*** (1.483)	5.711*** (1.388)	5.010*** (1.504)
CREDIT	6.351** (3.058)	1.756 (3.012)	4.640** (2.094)	3.719 (2.504)	−2.371 (2.721)	4.380** (2.128)
INFL	0.410 (0.303)	−0.044** (0.339)	0.326 (0.282)	0.277 (0.279)	−0.333 (0.256)	−0.178 (0.318)
CRINFO	−0.063* (0.038)	0.013 (0.037)	0.045 (0.029)	0.037 (0.031)	−0.011** (0.032)	0.024 (0.034)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
LR- χ^2	75.833	58.092	24.414	43.134	115.656	31.261
Atanhrho	−1.169**	0.091	0.612*	0.471	−0.174	−0.850
N	342	342	341	341	342	341

for the fully controlled model is 6.940 with an R^2 of 0.850. This finding shows that, as we move from the baseline to the controlled model, there is a relatively small movement in the coefficients associated with a large improvement in the model fit. The bounds exclude 0, which indicates robustness against omitted variables. The estimated value of δ is relatively low, indicating the lower likelihood of endogeneity. Similar observations can be made for the coefficient stability of the other cultural variables, except for the masculinity dimension. The latter's bounds include a 0, associated with a relatively stronger δ , indicating a higher likelihood of omitted variable bias. These findings broadly lend support to our results obtained from the IV methods.

7 | ADDITIONAL ROBUSTNESS CHECKS

7.1 | New control variables

The association between Hofstede's cultural dimensions and the value of green bond issuance is in fact more complex. Different countries experience different business cycle fluctuations and different environmental and social conditions and are subject to different institutional

TABLE 11 Coefficient stability analysis.

This table reports the results of applying the Oster (2019) test for analyzing the model's sensitivity to omitted variable bias using the Stata module *psacalc*. Column (1) presents the estimates of the treatment effect, β . Column (2) estimates the treatment effect in the full model. Column (3) presents the estimated bounds on β . The left number within the bracket is the upper bound. Column (4) indicates whether the treatment effect excludes the 0 value. Column (5) presents the estimation of the δ parameter that captures the relation between captures the strength of correlation between unobservable covariates and the outcome variable. The appendix provides a definition of the variables.

Variable	Baseline treatment effect (β , R^2) (1)	Controlled effect (b , R^2) (2)	Bounds of β ($\delta = 2$, $R_{\max} = 1.3 * R^2$) (3)	Treatment effect excludes 0 (4)	δ (for $\beta = 0$) (5)
PDI	0.0421 (0.028)	6.940 (0.850)	[6.940, 0.049]	Yes	−0.0633
IND	−0.0766 (0.114)	−2.347 (0.850)	[−2.347, −0.082]	Yes	−0.0815
MAS	−0.0277 (0.012)	−4.695 (0.850)	[−4.695, 0.024]	No	−0.132
UAI	0.0493 (0.021)	3.991 (0.850)	[3.991, 0.043]	Yes	−0.105
LTO	0.0248 (0.07)	30.179 (0.849)	[30.179, 0.024]	Yes	−0.0347
IVR	−0.0444 (0.019)	−19.640 (8.48)	[−19.640, −0.044]	Yes	−0.0364

influences. These differences influence the culture effects on green bond issuance. We captured some of the influences by controlling for additional environmental, macroeconomic and institutional influences. We now apply additional robustness checks to control for the impact of additional country-specific conditions, which could contain the adverse effects of measurement error and omitted variables. Prior studies provide directions. For example, O. Weber and Saravade (2019) argued that rising global temperatures have been instrumental in raising public awareness and therefore inducing countries to issue green bonds. Peszko et al. (2020) stress the importance of country preparedness for its transition to a low-carbon condition and the concomitant financing needs through green instruments. Polbennikov et al. (2016) argue that not only environmental but also social conditions influence corporate behaviour and performance and therefore their decision to issue green bonds.

We test for these conjectures by re-estimating Equation (1) to include the impact of a country's temperature conditions (TEMP), preparedness for low-carbon transition index (CARPREP) and the strength of family ties index (FAMTIES). Table 12 presents the results. The addition of the new environmental and social variables does not fundamentally change the influence of the culture dimensions. Moreover, the added variables are broadly significant. Higher average yearly temperatures in a country are associated with a higher volume of green bond issuance in all models. These findings are in line with the suggestions of O. Weber and Saravade (2019). Further, higher country preparedness for low-carbon transition is associated with higher levels of green bond issuance when the masculinity (MAS), LTO and indulgence (IVR) effects are considered. It appears that country preparedness is a complex outcome of a process in which economic, institutional and cultural factors interact to this end, associated with varying effectiveness (Peszko et al., 2020). Finally, countries with tighter family ties are associated with lower volumes of green bond issuance in all models, and especially when the

TABLE 12 Additional robustness checks.

This table reports the regression estimates of Hofstede's six culture dimensions on the value of green bonds after adding new control variables. The new controls include the average annual temperature per country (TEMP), the country preparedness for low-carbon transition index (CARPREP) and the index of the strength of family ties in a country (FAMTIES). Hofstede's six culture dimensions include the Power Distance (PDI) score, the Individualism versus Collectivism (IDV) score, the Masculinity versus Femininity (MAS) score, the Uncertainty Avoidance (UAI) score, the Long-term versus Short-Orientation (LTO) score and the Indulgence versus Restraint (IVR) score. The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The regressions employ a pooled ordinary least squares model with country and year fixed effects as well as regional dummies. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
PDI	7.076*** (1.428)					
IND		−2.375*** (0.479)				
MAS			−3.502*** (0.707)			
UAI				3.189*** (0.644)		
LTO					107.791*** (216.335)	
IVR						−37.638*** (7.533)
EPI	0.396** (0.157)	0.382** (0.155)	0.391** (0.148)	0.391** (0.159)	0.384** (0.144)	0.391** (0.152)
COMTECH	7.286 (5.948)	7.176 (5.902)	7.280 (5.942)	7.282 (5.943)	7.278 (5.953)	7.281 (5.843)
FSCALB	1.167*** (0.254)	1.160*** (0.251)	1.162*** (0.243)	1.172*** (0.265)	1.161*** (0.250)	1.165*** (0.255)
RATING	70.375*** (20.378)	16.232 (21.073)	1.246 (22.232)	55.325** (19.982)	141.453*** (2847.453)	617.820*** (135.091)
GDPCAP	60.178*** (13.678)	62.328*** (13.544)	60.123*** (13.677)	60.211*** (13.579)	60.143*** (13.438)	60.023*** (13.563)
CREDIT	58.440*** (16.963)	58.120*** (16.763)	58.542*** (16.762)	58.267*** (16.766)	58.023*** (15.963)	57.327*** (16.821)

TABLE 12 (Continued)

Variable	Power distance (1)	Individualism versus collectivism (2)	Masculinity versus femininity (3)	Uncertainty avoidance (4)	Long-term versus short-term orientation (5)	Indulgence versus restraint (6)
INFL	−2.059** (0.870)	−2.067** (0.815)	−2.043 (0.854)	−2.062** (0.844)	−2.0378* (0.870)	−2.067** (0.863)
CRINFO	−0.115 (0.085)	−0.115* (0.085)	−0.115 (0.085)	−0.115 (0.085)	−0.115* (0.085)	−0.115 (0.085)
TEMP	7.939*** (2.771)	7.912*** (2.433)	7.859*** (2.657)	7.945*** (2.785)	7.976*** (2.673)	7.859*** (2.748)
CARPREP	54.659 (172.033)	60.993 (171.288)	274.118* (150.431)	231.432 (153.873)	293.405*** (5812.865)	887.236*** (153.511)
FAMTIES	−162.824*** (56.962)	−162.809*** (56.960)	−132.520** (51.867)	−83.804* (44.222)	950.074*** (178.790)	714.977*** (131.146)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.730	0.730	0.730	0.730	0.730	0.734
N	322	322	321	321	321	320

LTO and indulgence effects are considered. Overall, the additional controls appear on average to be significant predictors of green bond issuance and they confirm the predictive power of national culture dimensions.

7.2 | Dominance analysis

While Hofstede's dimensions are characterized by varying degrees of association with green bond issuance, there remains the question of their relative dominance in predicting the outcome variable. Determining the relative importance of individual regressors in a statistical model has been a key focus of dominance analysis (Azen & Budescu, 2006). The latter draws on the Shapley value decomposition in game theory and determines the relative importance of the independent variables based on each variable's individual contribution to prediction assessed by comparisons of the overall fit statistic. Relative regressor importance is determined by assessing the extent to which an individual regressor reduces prediction error (Luchman et al., 2020). To assess the relative predictive power of the six cultural dimensions, we carry out dominance analysis using the Stata module *domin* (Luchman, 2021). The dominance statistic

TABLE 13 Dominance analysis.

This table reports the statistical effects of applying dominance analysis to assess the relative importance of Hofstede's culture dimensions in predicting the value of green bonds issued. Dominance analysis is based on the Shapley decomposition theory and executed by the Stata module *domin*. The outcome variable is the green bond value issued. Panel A presents the results of applying dominance analysis to the cultural dimensions only. Panel B presents the results of applying dominance analysis to all regressors. Column (1) shows the general dominance statistic, which is calculated as the weighted average marginal/incremental contribution to the overall fit statistic that an independent variable makes across all models in which the independent variable is included. Column (2) shows the standardized dominance statistic. Higher statistic implies a higher dominance effect. The appendix provides a definition of the variables

Variable	Panel A. Culture dimensions only		Panel B. All regressors	
	Dominance statistic (1)	Standardized dominance statistic (2)	Dominance statistic (1)	Standardized dominance statistic (1)
PDI	0.0088	0.0980	0.0207	0.0469
IDV	0.0273	0.3022	0.0467	0.1056
MAS	0.0002	0.0021	0.0190	0.0431
UAI	0.0060	0.0667	0.0209	0.0474
LTO	0.0421	0.4668	0.0492	0.0886
IVR	0.0058	0.0643	0.0248	0.0561
EPI			0.0359	0.0811
COMTECH			0.0319	0.0721
FSCALB			0.0224	0.205
RATING			0.0083	0.0189
GDPCAP			0.0567	0.1283
CREDIT			0.0311	0.0704
INFL			0.0049	0.0112
CRINFO			0.0112	0.0254
Overall fit statistic	0.0903		0.4421	
N	349		348	

represents the average net increase in the model's overall R^2 resulting from adding an independent variable to models constructed using all possible subsets of the other predictors. Table 13 presents the results. Panel A presents the dominance effect for the cultural values only, whilst Panel B presents the results for all regressors. The results in Panel A show that the LTO has the highest value, which implies that, when included in the model, LTO results in a 4.21% increment to the overall R^2 . Individualism (IDV) follows next, whilst the other dimensions appear less dominant in the horse-race. Moreover, the results in Panel B show that, when all regressors are included, GDP per capita is the dominant variable, whose inclusion in the model increases over model fit by 5.67%. LTO follows second, contributing a 4.92% increase

TABLE 14 Long-term orientation, gender equality policy and green bond issuance.

This table reports the regression estimates of Hofstede's long-term orientation (LTO) dimension on the value of green bonds and the control variables. We use gender equality policy as an additional driver and interact it with the different measures of green bond value. We measure gender equality policy by the World Bank's Women Business and the Law (WBL) index. The value of green bonds issued is based on International Monetary Fund data. The control variables include the environmental performance index (EPI), the comparative advantage in low-carbon technology products index (COMTECH), the fiscal balance of the state (%GDP) (FSCALB), Moody's sovereign rating (RATING) score, the value of gross domestic product per capita (GDPCAP), the value of total credit in the economy (%GDP) (CREDIT), the annual inflation rate (INFL) and the credit coverage information index (CRINFO). Columns (1)–(3) present the effect on corporate, sovereign and total green bond value, respectively. The parentheses report standard errors clustered at the country level. The sample period is 1991–2021. The appendix provides a definition of the variables. The symbols *, ** and *** correspond to $p < 0.1$, $p < 0.05$ and $p < 0.01$, respectively.

Variable	(1)	(2)	(3)
LTO	11.223*** (2.539)	9.782* (3.433)	11.326*** (2.430)
WBL	69.6251*** (3.379)	60.112* (5.344)	72.705*** (2.462)
LTO * WBL	−2.071*** (0.634)	−1.653* (0.458)	−2.174*** (0.596)
EPI	0.344*** (0.120)	0.321** (0.231)	0.331*** (0.110)
COMTECH	7.011* (3.897)	6.034* (4.456)	7.085** (3.379)
FSCALB	0.603*** (0.208)	0.598*** (0.244)	0.584*** (0.192)
RATING	32.263*** (89.409)	30.368*** (89.409)	275.775*** (75.403)
GDPCAP	40.706*** (11.669)	38.766*** (12.279)	37.984*** (11.056)
CREDIT	24.296 (19.986)	15.986 (16.732)	12.840 (15.020)
INFL	0.934 (0.966)	0.712* (1.432)	0.895 (0.913)
CRINFO	−0.003 (0.095)	−0.054 (0.015)	−0.086 (0.075)
Regional dummies	Yes	Yes	Yes
Country effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes

(Continues)

TABLE 14 (Continued)

Variable	(1)	(2)	(3)
Adjusted R^2	0.844	–	0.866
N	343	343	343

in overall model fit, after it is included in the regression. Individualism (IDV) follows next contributing a 4.67% increase in model fit. These results imply that countries with higher LTO scores and higher economic development are relatively more likely to experience higher green bond issuance activity.

7.3 | LTO and gender equality effect

The preceding dominance analysis highlighted the importance of LTO in predicting green bond issuance value. In this section, we explore the effect of gender equality policy on green bond issuance depending on the countries' LTO disposition as a channel of influence. Gender equality is a key corporate decision-making factor, but also strongly influenced by culture. For example, focusing on future-oriented societies, Palley and Gelb (1992) argued that in traditional Confucian societies, characterized by stronger LTO, women are in a disadvantaged position. Du (2016) also documents relatively low board gender diversity in Confucian societies. In contrast, Bertsch and S  derholm (2012) argue that long-term-oriented countries promote gender equality through the provision of equal opportunities to both men and women. Jin (2016) further argues that gender inequality in Confucian societies is due less to inherent cultural values and more to social inaction towards institutional improvements. On the other hand, B. Li et al. (2022) argue that, with their emphasis on LTO, Confucian societies are more conducive to support green finance based on a strong link between science education and sustainability. We test for these conjectures by exploring the joint effect of Hofstede's LTO variable and gender equality against the law, as captured by the World Bank's Women Business and the Law index (WBL) (<https://wbl.worldbank.org/en/wbl>). The index measures the extent to which gender equality in the law is established with respect to several economic, institutional and social functions in each country. Table 14 provides the results. Columns (1)–(3) presents the effect on corporate, sovereign and total market green bond issuance value, respectively. In addition to the strong long-orientation effect, our results show that higher gender equality is associated with a direct positive effect on green bond issuance of all types. However, the significant interaction term estimates show that the positive gender equality effect is constrained in countries with LTO values. These new results show that, while exerting a positive direct effect on green bond finance, long-term-oriented countries may exert an adverse indirect effect through the perpetuation of gender inequality. These results highlight the complex nature of the interplay between cultural values and social institutions in determining green finance decisions.

8 | CONCLUSIONS

In this paper we explored the relationship between the national culture and the countries' green bond issuance activity. National cultures outline a country's value system, which affects the shaping of individuals' and markets' attitudes and commitment towards dealing with environmental problems and determining associated financing policies. We measured national culture using Hofstede's six culture dimensions. While prior studies analyzed the culture effect on environmental performance in general with mixed results, they have not specifically considered the effect on green bonds. However, the culture effect on environmental performance may not coincide with the effect on green bond issuance, as the latter integrates both environmental and financial considerations. The variance of culture effect can be attributed to the different methodologies and sample structures applied. In this paper, we use a novel IMF data set comprising 349 private and public issues of green bonds offered by 84 countries during 1991–2021.

Our results are the first to capture the direct culture effect on green bond issuance. We found that on average across all countries, markets in countries with higher scores of power distance, uncertainty avoidance and LTO are associated with higher volumes of green bond issuance, whilst markets in countries with higher scores of individualism, masculinity and indulgence are associated with lower volumes of green bond issuance. We also found that improvements in the overall environmental performance of countries and the pace of technological progress in low-carbon products lend support to the development of green bond market. In contrast, we find that higher credit information coverage tends to exert a rather dampening effect on market development.

While not directly comparable, our results are broadly in line with those of prior findings, but also differ in some important respects. For example, it appears that markets in countries that accept more hierarchical social relations and centralized power are more prone to support green bond financing. The state of relevant regulatory policies might influence these findings. Further, in contrast to prior predictions, social collectivism appears to be an important driver of green bond market development. The effective pursuit of environmentally friendly financing requires more social cohesion and support than individualist societies would provide. Moreover, markets in societies with high competitiveness attributes are less likely to support environmental investments, which require prior debate and tolerance to alternative options as well as better appreciation of societal preservation considerations. Furthermore, the green bond market development will be faster in societies that value uncertainty avoidance. It appears that economies that experience high levels of uncertainty and ambiguity consider environmentally friendly financing options more favourably due to their association with lower future environmental risk levels. In addition, markets in countries that prioritize their long-term options steadily to better meet future challenges and sustain future growth and prosperity are more likely to support the development of the green bond market and the associated long-term payoffs. Finally, in contrast to expected prediction, markets in countries that are more optimistic and embrace good living appear less willing to support the development of green bond market. This may be the result of short-term orientation and lax discipline of indulgent cultures that prevents them from developing the necessary awareness and required commitment.

While the slowly changing characteristics of national culture affect the prospects of the green bond market development, the latter can also benefit from country-level policies aiming at raising awareness of and commitment to improving their overall environmental

performance, technological progress aiming at the development of low-carbon products, macroeconomic stabilization to contain excessive leverage, and proper assessment of the inherent financial risks of issuers. Finally, the role of institutions in fostering green bond market development appears to be less clear. Higher transparency and general legal rights may not by themselves produce the desired effects. More research is necessary to disentangle and assess in detail the role of the various institutional effects in different settings.

Overall, using Hofstede's framework that examines national culture under six individual cultural dimensions, this paper examines and finds support for the association between national culture and green bond market development around the world. Our study produces several implications for academics and corporate managers, especially those who are globally active. Decisions to choose green financing should consider the specifics of a market's cultural context to customize and adopt practices that are most appreciated in each context. Moreover, policy makers that influence corporate and government financing choices should inform the style and extent of their intervention by properly accounting for their jurisdiction's prevalent cultural context. This would provide policy-makers with insights about the most effective intervention solutions, thereby allowing them to gain a competitive advantage by properly evaluating potential investors' sensitivity and the domestic dynamics. Capitalizing on the knowledge that national culture has a robust and long-term influence on the financing decisions and performance of firms could generate a successful strategic shift in managerial approaches. Finally, the connection between a country's environmental performance with the financing decisions of firms and governments domestically could also provide useful insight into effective international environmental cooperation by carefully accounting for the whole cultural setting within which firms, communities, consumers and the state interact and make decisions.

While our analysis documents for the first time the relation between national culture and green bond market development, it also suffers from certain limitations. For example, the culture effect on green bond market development may deviate according to the different issuers' characteristics, such as size, sector of activity and ownership structure. While our data does not include such testable information, future research should account for the effect of the issuers' characteristics. Moreover, while we accounted for the effect of country-level variables that proved to be significant predictors, the risk of omitted variables bias remains. We mitigated the omitted variable risk by using an IV analysis, but more needs to be done. Further, Hofstede's six cultural dimensions are not the only approximations of national culture. While we used alternative cultural measures, other measures of national value systems should be considered. Finally, the role of additional institutions should be explicitly considered and their cross-country and longitudinal effects should be analyzed in more detail Mertzanis, 2021; The United Nations Framework Convention on Climate Change (UNFCCC), 2015).

DATA AVAILABILITY STATEMENT

The data used for this study are publicly available in the IMF climate database and other sources.

ORCID

Charilaos Mertzanis  <http://orcid.org/0000-0002-9028-5585>

Imen Tebourbi  <http://orcid.org/0000-0001-9473-5187>

REFERENCES

- Aggarwal, R., Faccio, M., Guedhami, O., & Kwok, C. C. Y. (2016). Culture and finance: An introduction. *Journal of Corporate Finance*, 41, 466–474.
- Ahern, K. R., Daminelli, D., & Fracassi, C. (2015). Lost in translation? The effect of cultural values on mergers around the world. *Journal of Financial Economics*, 117, 165–189.
- Ahwireng-Obeng, A. S., & Ahwireng-Oberg, F. (2019). Macroeconomic determinants of sovereign bond market development in African emerging economies. *International Journal of Emerging Markets*, 5, 651–659.
- Alesina, A., & Giuliano, P. (2010). The power of the family. *Journal of Economic Growth*, 15, 93–125.
- Alexopoulou, I., Bunda, I., & Ferrando, A. (2010). Determinants of government bond spreads in new EU countries. *Eastern European Economics*, 48(5), 5–37.
- Altonji, J. G., Elder, T. E., & Taber, C. R. (2005). Selection on observed and unobserved variables: Assessing the effectiveness of catholic schools. *Journal of Political Economy*, 113(1), 151–184.
- Anzolin, G., & Lebdioui, A. (2021). Three dimensions of green industrial policy in the context of climate change and sustainable development. *The European Journal of Development Research*, 33(2), 371–405.
- Apple Inc. (2022). *Apple's \$4.7B in green bonds support innovative green technology*, March 24. <https://www.apple.com/newsroom/2022/03/apples-four-point-seven-billion-in-green-bonds-support-innovative-green-technology/>
- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51.
- Azen, R., & Budescu, D. V. (2006). Comparing predictors in multivariate regression models: An extension of dominance analysis. *Journal of Educational and Behavioral Statistics*, 31(2), 157–180.
- Badenhoop, N. (2022). *An assessment of the proposed EU Green Bond Standard and its potential to prevent greenwashing*. Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.
- Bae, K.-H. (2012). *ADB working paper series on regional economic integration 'determinants of local currency bonds and foreign holdings: Implications for bond market development in the People's Republic of China No. 97*. Asian Development Bank.
- Balima, H. W., & Combes, J.-L. (2019). Remittances and bond yield spreads in emerging economies. *Review of international Economics*, 27(1), 448–467.
- Bao, J., Pan, J., & Wang, J. (2011). The illiquidity of corporate bonds. *The Journal of Finance*, 66, 911–946.
- Baulkaran, V. (2019). Stock market reaction to green bond issuance. *Journal of Asset Management*, 20, 331–340.
- Becker, B., & Josephson, J. (2016). Insolvency resolution and the missing high-yield bond markets. *Review of Financial Studies*, 29(10), 2814–2849.
- Benito, B., Guillaumont, M.-D., & Bastida, F. (2016). The impact of transparency on the cost of sovereign debt in times of economic crises. *Financial Accountability & Management*, 32(3), 309–334.
- Berger, A. N., Li, X., Morris, C. S., & Roman, R. A. (2021). The effects of cultural values on bank failures around the world. *Journal of Financial and Quantitative Analysis*, 56(3), 945–993.
- Bertsch, A., & Söderholm, G. W. (2012). *Updating cross cultural management: Exploring the relationships between cultural values and gender inequality practices*. Paper presented at the Annual Meeting of the Academy of International Business (AIB), Washington, DC, USA.
- Beugelsdijk, S., Kostova, T., & Roth, K. (2017). An overview of Hofstede-inspired country-level culture research in international business since 2006. *Journal of International Business Studies*, 48(1), 30–47.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- Boubakri, N., Chkir, I., Saadi, S., & Zhu, H. (2021). Does national culture affect corporate innovation? International evidence. *Journal of Corporate Finance*, 66, 101847.
- Boubakri, N., & Saffar, W. (2019). State ownership and debt choice: Evidence from privatization. *Journal of Financial and Quantitative Analysis*, 54(3), 1313–1346.
- Cai, Y., Pan, C. H., & Statman, M. (2016). Why do countries matter so much in corporate social performance? *Journal of Corporate Finance*, 41, 591–609.
- Capelle-Blancard, G., & Monjon, S. (2014). The performance of socially responsible funds: Does the screening process matter? *European Financial Management*, 20(3), 494–520.

- Capelle-Blancard, G., Crifo, P., Diaye, M. A., Oueghlissi, R., & Scholtens, B. (2019). Sovereign bond yield spreads and sustainability: An empirical analysis of OECD countries. *Journal of Banking & Finance*, 98, 156–169.
- Chatzitheodorou, K., Skouloudis, A., Evangelinos, K., & Nikolaou, I. (2019). Exploring socially responsible investment perspectives: A literature mapping and an investor classification. *Sustainable Production and Consumption*, 19, 117e129.
- Chava, S. (2014). Environmental externalities and cost of capital. *Management Science*, 60(9), 2223–2247.
- Chen, D., Peng, D., Rieger, M. O., & Wang, M. (2021). Institutional and cultural determinants of speed of government responses during COVID-19 pandemic. *Humanities and Social Sciences Communications*, 8, 171.
- Cheong, C., & Choi, J. (2020). Green bonds: A survey. *Journal of Derivatives and Quantitative Studies: 선물연구*, 28, 175–189.
- Chiesa, M., & Barua, S. (2019). The surge of impact borrowing: The magnitude and determinants of green bond supply and its heterogeneity across markets. *Journal of Sustainable Finance & Investment*, 9, 138–161.
- Chourou, L., Saadi, S., & Zhu, H. (2018). How does national culture influence IPO underpricing? *Pacific-Basin Finance Journal*, 51, 318–341.
- Chui, A. C. W., Lloyd, A. E., & Kwok, C. C. Y. (2002). The determination of capital structure: Is national culture a missing piece to the puzzle? *Journal of International Business Studies*, 33, 99–127.
- Chui, A. C. W., Titman, S., & Wei, K. C. J. (2010). Individualism and momentum around the world. *The Journal of Finance*, 65, 361–392.
- Claessens, S., Klingebiel, D., & Schmukler, S. L. (2007). Government bonds in domestic and foreign currency: The role of institutional and macroeconomic factors. *Review of International Economics*, 15(2), 370–413.
- Clapp, C. S., Alfsen, K. H., Torvanger, A., & Lund, H. F. (2015). Influence of climate science on financial decisions. *Nature Climate Change*, 5(2), 84–85.
- Connelly, B. J. (2017). *National culture and the relationship to socially responsible investing* (Doctoral Dissertation). Benedictine University, No. 29017.
- Cumming, D., & Zhang, M. (2019). Angel investors around the world. *Journal of International Business Studies*, 50(5), 692–719.
- Curley, M. (2014). *Finance policy for renewable energy and a sustainable environment*. CRC Press.
- Dangelico, R. M., Fraccascia, L., & Nastasi, A. (2020). National culture's influence on environmental performance of countries: A study of direct and indirect effects. *Sustainable Development*, 28, 1773–1786. <https://doi.org/10.1002/sd.2123>
- Darmouni, O., & Papoutsis, M. (2022). *The rise of bond financing in Europe* [Working Paper, No. 2663]. European Central Bank.
- Davis, L. S., & Williamson, C. R. (2019). Does individualism promote gender equality? *World Development*, 123, 104627.
- De Freitas Netto, S. V., Sobral, M. F. F., Ribeiro, A. R. B., & Soares, G. R. L. (2020). Concepts and forms of greenwashing: A systematic review. *Environmental Sciences Europe*, 32(19), 1–12.
- Diouf, D., Hebb, T., & Toure, E. H. (2016). Exploring factors that influence social retail investors' decisions: Evidence from Desjardin funds. *Journal of Business Ethics*, 134, 45–67.
- Du, X. (2016). Does Confucianism reduce board gender diversity? Firm-Level evidence from China. *Journal of Business Ethics*, 136, 399–436.
- Eichengreen, B., & Luengnaruemitchai, P. (2004). *Why doesn't asia have bigger bond markets?* [NBER Working Paper, No. 10576]. National Bureau of Economic Research.
- El Ghouli, S., Guedhami, O., Kwok, C. C. Y., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, 35(9), 2388–2406.
- Eun, C. S., Wang, L., & Xiao, S. C. (2015). Culture and R2. *Journal of Financial Economics*, 115, 283–303.
- Fatica, S., & Panzica, R. (2021). Green bonds as a tool against climate change? *Business Strategy and the Environment*, 30, 2688–2701.
- Fidelity International. (2021). *Green government bonds: The promise and the pitfalls*. <https://www.fidelityinternational.com/editorial/article/green-government-bonds-the-promise-and-the-pitfalls-315705-en5/>
- Flammer, C. (2020). *Green bonds: Effectiveness and implications for public policy*. National Bureau of Economic Research, No. 978-0-226-71117-1.
- Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2), 499–516.

- Geng, P., & Tan, Q. (2021). Cultural values, economic growth, and international IPO underpricing: Evidence from Chinese companies. *Journal of Business Economics and Management*, 22(2), 537–556.
- Gianfrate, G., & Peri, M. (2019). The green advantage: Exploring the convenience of issuing green bonds. *Journal of Cleaner Production*, 219, 127–135.
- Glac, K. (2012). The impact and source of mental frames in socially responsible investing. *Journal of Behavioral Finance*, 13, 184–198.
- Glomsrød, S., & Wei, T. (2018). Business as unusual: The implications of fossil divestment and green bonds for financial flows, economic growth and energy market. *Energy for Sustainable Development*, 44, 1–10.
- Greene, W. H. (2012). *Econometric analysis* (7th ed.). Pearson.
- Griffin, D., Guedhami, O., Li, K., & Lu, G. (2021). National culture and the value implications of corporate environmental and social performance. *Journal of Corporate Finance*, 71, 102123.
- Grosse-Rueschkamp, B., Steffen, S., & Streitz, D. (2019). A capital structure channel of monetary policy. *Journal of Financial Economics*, 13392, 357–378.
- Guiso, L., Sapienza, P., & Zingales, L. (2006). Does culture affect economic outcomes? *Journal of Economic Perspectives*, 20, 23–48.
- Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., van den Brink, M., Jong, P., Nootboom, S., & Bergsma, S. (2010). The adaptive capacity wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. *Environmental Science & Policy*, 13(6), 459–471.
- Hale, G., & Santos, J. A. C. (2008). The decision to first enter the public bond market: The role of firm reputation, funding choices, and bank relationships. *Journal of Banking & Finance*, 32, 1928–1940.
- Hawkins, J. (2002). Bond markets and banks in emerging economies. In Bank for International Settlements. (ed.), *The development of bond markets in emerging economies* (Vol. 11, pp. 42–48). Bank for International Settlements (BIS Papers chapter).
- Hill, R. P., Ainscough, T., Shank, T., & Manullang, D. (2007). Corporate social responsibility and socially responsible investing: A global perspective. *Journal of Business Ethics*, 70, 165–174.
- Ho, F. N., Wang, H. M. D., & Vitell, S. J. (2012). A global analysis of corporate social performance: The effects of cultural and geographic environment. *Journal of Business Ethics*, 107, 423–433.
- Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Sage.
- Hofstede, G. (1983). The cultural relativity of organizational practices and theories. *Journal of International Business Studies*, 14, 75–89.
- Hofstede, G. (2001). *Culture's consequences—second edition: Comparing values, behaviors, institutions and organizations across Nations*. Sage.
- Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. online read. *Psychology and Culture*, 2(1), 12–24.
- Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind* (3rd ed.). McGraw-Hill.
- Hsu, P.-H., Tian, X., & Xu, Y. (2014). Financial development and innovation: cross-country evidence. *Journal of Financial Economics*, 112(1), 116–135.
- Husted, B. W. (2005). Culture and ecology: A cross-national study of the determinants of environmental sustainability. *Management International Review*, 45(3), 349–371.
- Immel, M., Hachengerg, B., Kiesel, F., & Schiereck, D. (2022). Green bonds: Shades of green and brown. In M. de Jong & D. di Bartolomeo, (Eds.), *Risks related to Environmental, Social and Governmental issues*. Palgrave MacMillan.
- Inglehart, R., & Baker, W. E. (2000). Modernization, cultural change, and the persistence of traditional values. *American Sociological Review*, 65(1), 19–51.
- Jin, Y. (2016). The issue of gender equality in Confucian culture. LSE Blog. <https://blogs.lse.ac.uk/gender/2016/01/18/the-issue-of-gender-equality-in-confucian-culture/>
- Johnson, S. A. (1997). An empirical analysis of the determinants of corporate debt ownership structure. *Journal of Financial and Quantitative Analysis*, 32, 47–69.
- Katz, J. P., Swanson, D. L., & Nelson, L. K. (2001). Culture-based expectations of corporate citizenship: A propositional framework and comparison of four cultures. *The International Journal of Organizational Analysis*, 9(2), 149–171.

- Keswani, A., Miguel, A., & Ramos, S. (2016). *Lazy investors, lazy fund managers, lousy performance: National culture and mutual fund management*. Paper presented at Financial Management Conference, Paris.
- Ketterer, J. A., Andrade, G., Netto, M., & Haro, M. I. (2019). *Transforming green bond markets. Using financial innovation and technology to expand green bond issuance in Latin America and the Caribbean*. Monograph No. 751. Inter-American Development Bank.
- Kutan, A., Laique, U., Qureshi, F., Rehman, I. U., & Shahzad, F. (2021). A survey on national culture and corporate financial decisions: Current status and future research. *International Journal of Emerging Markets*, 16(7), 1234–1258.
- Labidi, C., Laribi, D., & Ureche-Rangau, L. (2021). National culture and socially responsible fund flows. *Emerging Markets Review*, 46, 100751.
- Lahuerta-Otero, E., & González-Bravo, M. I. (2018). Can national culture affect the implementation of common sustainable policies? A European response. *Cross-Cultural Research*, 52(5), 468–495.
- Li, B., Sjöström, J., & Ding, B. (2022). Education for sustainability meets Confucianism in science education. *Science & Education*. <https://doi.org/10.1007/s11191-022-00349-9>
- Li, K., Griffin, D., Yue, H., & Zhao, L. (2011). National culture and capital structure decisions: Evidence from foreign joint ventures in China. *Journal of International Business Studies*, 42, 477–503.
- Liu, X., & Liu, F. (2022). Environmental regulation and corporate financial asset allocation: A natural experiment from the new environmental protection law in China. *Finance Research Letters*, 47(A), 102974.
- Luchman, J. N. (2021). Determining relative importance in Stata using dominance analysis: Domin and domme. *The Stata Journal: Promoting Communications on Statistics and Stata*, 21(2), 510–538.
- Luchman, J. N., Lei, X., & Kaplan, S. (2020). Relative importance analysis with multivariate models: Shifting the focus from independent variables to parameter estimates. *Journal of Applied Structural Equation Modeling*, 4, 1–20.
- MacAskill, S., Roca, E., Liu, B., Stewart, R. A., & Sahin, O. (2021). Is there a green premium in the Green Bond market? Systematic literature review revealing premium determinants. *Journal of Cleaner Production*, 280, 124491.
- Mamman, A., & Saffu, K. (1998). Short-termism, control, quick-fix and bottom line: Toward explaining the Western approach to management. *Journal of Managerial Psychology*, 13(5–6), 291–308.
- Margaretic, P., & Pouget, S. (2018). Sovereign bonds spread and extra-financial performance: An empirical analysis of emerging markets. *International Review of Economics & Finance*, 58, 340–355.
- Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, 98, 224–253.
- Martins, M. M., & Lopes, I. T. (2016). Culture and profitability: Empirical evidence at a European level. *Corporate Ownership & Control*, 13(2), 579–586.
- McGrath, R. G., MacMillan, I. C., & Scheinberg, S. (1992). Elitists, risk-takers, and rugged individualists: An exploratory analysis of cultural-differences between entrepreneurs and non-entrepreneurs. *Journal of Business Venturing*, 7(2), 115–135.
- Mertzanis, C. (2021). Epidemiological susceptibility risk, adaptive management and firm performance. *British Journal of Management*, 32, 1242–1264. <https://doi.org/10.1111/1467-8551.12529>
- Mihet, R. (2013). Effects of culture on firm risk-taking: A cross-country and cross-industry analysis. *Journal of Cultural Economics*, 37, 109–151.
- Moulton, B. R. (1990). An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *The Review of Economics and Statistics*, 72(2), 334–338.
- Murray, D. R., & Schaller, M. (2010). Historical prevalence of infectious diseases within 230 geopolitical regions: A tool for investigating origins of culture. *Journal of Cross-Cultural Psychology*, 41(1), 99–108.
- Nagy, S., & Konya, C. M. (2018). The effects of Hofstede's cultural dimensions on pro-environmental behaviour: How culture influences environmentally conscious behaviour. *Theory, Methodology, Practice*, 14(1), 27–36. <https://doi.org/10.18096/TMP.2018.01.03>
- Nakata, C., & Sivakumar, K. (1996). National culture and new product development: An integrative review. *Journal of Marketing*, 60(1), 61–72.
- Ng, A. W. (2018). From sustainability accounting to a green financing system: Institutional legitimacy and market heterogeneity in a global financial centre. *Journal of Cleaner Production*, 195, 585–592.

- Nguyen, A. H., Hoang, T. G., Nguyen, D. T., Nguyen, L., & Doan, D. T. (2023). The development of green bond in developing countries: Insights from Southeast Asia market participants. *The European Journal of Development Research*, 35, 196–218. <https://doi.org/10.1057/s41287-022-00515-3>
- Nickel, C., Rother, P., & Ruelke, J.-C. (2011). Fiscal variables and bond spreads-evidence from Eastern European countries and Turkey. *Applied Financial Economics*, 21, 1291–1307.
- North, D. C. (1990). *Institutions, institutional change, and economic performance*. Cambridge University Press.
- Ntsama, U. Y. O., Yan, C., Nasiri, A., & Mboungam, H. A. M. (2021). Green bonds issuance: Insights in low- and middle-income countries. *International Journal of Corporate Social Responsibility*, 6, 1–9.
- Onel, N., & Mukherjee, A. (2014). The effects of national culture and human development on environmental health. *Environment, Development and Sustainability*, 16(1), 79–101.
- Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business & Economic Statistics*, 37(2), 187–204. <https://doi.org/10.1080/07350015.2016.1227711>
- Palley, M. L., & Gelb, J. (1992). *Women of Japan and Korea: Continuity and change*. Temple University Press.
- Palmer, K., Oates, W. E., & Portney, P. R. (1995). Tightening environmental standards: The benefit–cost or the no-cost paradigm? *Journal of Economic Perspectives*, 9(4), 119–132.
- Park, H., Russell, C., & Lee, J. (2007). National culture and environmental sustainability: A cross-national analysis. *Journal of Economics and Finance*, 31(1), 104–121.
- Peng, Y.-S., & Lin, S.-S. (2009). National culture, economic development, population growth and environmental performance: The mediating role of education. *Journal of Business Ethics*, 90(2), 203–219.
- Peszko, G., van der Mensbrughe, D., Golub, A., Ward, J., Zenghelis, D., Marijs, C., Schopp, A., & Rogers, J. A. (2020). *Preparedness for a low-carbon transition*. World Bank. https://doi.org/10.1596/978-1-4648-1340-5_ch5
- Petruzzella, F., Salvi, A., & Giakoumelou, A. (2017). The impact of national culture on corporate environmental performance: How much does your origin say about how green you are? *Journal of Environmental Sustainability*, 5(1), 1–25.
- Piñeiro-Chousa, J., López-Cabarcos, M. Á., Caby, J., & Šević, A. (2021). The influence of investor sentiment on the green bond market. *Technological Forecasting and Social Change*, 162, 120351.
- Polbennikov, S., Desclée, A., Dynkin, L., & Maitra, A. (2016). ESG ratings and performance of corporate bonds. *The Journal of Fixed Income*, 26(1), 21–41.
- Prajapati, D., Paul, D., Malik, S., & K. Mishra, D. (2021). Understanding the preference of individual retail investors on green bond in India: An empirical study. *Investment Management and Financial Innovations*, 18, 177–189.
- Presbitero, A. F., Ghura, D., Adediji, O. S., & Njie, L. (2016). Sovereign bonds in developing countries: Drivers of issuance and spreads. *Review of Development Finance*, 6(1), 1–15.
- Prim, A. L., Filho, L., Zamur, G., & Di Serio, L. (2017). The relationship between national culture dimensions and degrees of innovation. *International Journal of Innovation Management*, 20(1), 1730001.
- Quatrini, S. (2021). Challenges and opportunities to scale up sustainable finance after the COVID-19 crisis: Lessons and promising innovations from science and practice. *Ecosystem Services*, 48, 101240.
- Reboredo, J. C. (2018). Green bond and financial markets: Comovement, diversification and price spillover effects. *Energy Economics*, 74, 38–50.
- Reboredo, J. C., & Ugolini, A. (2020). Price connectedness between green bond and financial markets. *Economic Modelling*, 88, 25–38.
- Ringov, D., & Zollo, M. (2007). The impact of national culture on corporate social performance. *Corporate Governance: The International Journal of Business in Society*, 7(4), 476–485.
- Ronen, S., & Shenkar, O. (2013). Mapping world cultures: Cluster formation, sources and implications. *Journal of International Business Studies*, 44(9), 867–897.
- Roodman, D. (2011). Fitting fully observed recursive mixed-process models with cmp. *The Stata Journal: Promoting Communications on Statistics and Stata*, 11(2), 159–206.
- Rusike, T. G., & Alagidede, I. P. (2021). The impact of sovereign credit ratings on Eurobond yields: Evidence from Africa. *Research in International Business and Finance*, 58(1–27), 101475.
- Sangiorgi, I., & Schopohl, L. (2021). Why do institutional investors buy green bonds: Evidence from a survey of European asset managers. *International Review of Financial Analysis*, 75, 101738.

- Siegel, J. I., Licht, A. N., & Schwartz, S. H. (2011). Egalitarianism and international investment. *Journal of Financial Economics*, 102(3), 621–642. <https://doi.org/10.1016/j.jfineco.2011.05.010>
- Sievänen, R., Rita, H., & Scholtens, B. (2013). The drivers of responsible investment: The case of European pension funds. *Journal of Business Ethics*, 117(1), 137–151.
- Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance*, 61, 101427.
- Tang, L., & Koveos, P. E. (2008). A framework to update Hofstede's cultural value indices: Economic dynamics and institutional stability. *Journal of International Business Studies*, 39(6), 1045–1063.
- The Climate Bond Initiative (CBI). (2019). *Green bonds global state of the market 2019*. https://www.climatebonds.net/system/tdf/reports/cbi_sotm_2019_vol1_04d.pdf?file=1&type=node&id=47577&force=0
- The Climate Bonds Initiative (CBI). (2022). *\$500bn Green issuance 2021: Social and sustainable acceleration*. <https://www.climatebonds.net/2022/01>
- The European Commission (EC). The European green Deal. (2019). <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>
- The Green Finance Study Group (GFSG). (2016). *G20 green finance synthesis report*. http://unepinquiry.org/wp-content/uploads/2016/09/Synthesis_Report_Full_EN.pdf
- Thornhill, R., & Fincher, C. L. (2014). *The parasite-stress theory of values and sociality: Infectious disease, history and human values worldwide*. Springer.
- The International Capital Market Association (ICMA). (2018). *Green bond principles voluntary process guidelines for issuing green bonds*. <https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Green-Bonds-Principles-June-2018-270520.pdf>
- The United Nations Framework Convention on Climate Change (UNFCCC). (2015). *Adoption of the Paris Agreement*. United Nations.
- Tolliver, C., Keeley, A. R., & Managi, S. (2020). Drivers of green bond market growth: The importance of nationally determined contributions to the Paris Agreement and implications for sustainability. *Journal of Cleaner Production*, 244, 118643.
- Tu, C. A., Sarker, T., & Rasoulinezhad, E. (2020). *Revisiting development of the green bond market: Evidence of the AHP approach* [ADB Working Paper, No. 1082]. Asian Development Bank Institute.
- Vachon, S. (2010). International operations and sustainable development: Should national culture matter? *Sustainable Development*, 18(6), 350–361.
- Veys, A. (2010). *The sterling bond markets and low carbon or green bonds*. E3G.
- Waldman, D. A., Sully de Luque, M., Washburn, N., House, R. J., Adetoun, B., Barrasa, A., Bobina, M., Bodur, M., Chen, Y. J., Debbarma, S., Dorfman, P., Dzuvichu, R. R., Evcimen, I., Fu, P., Grachev, M., Gonzalez Duarte, R., Gupta, V., Den Hartog, D. N., de Hoogh, A. H. B., ... Wilderom, C. P. M. (2006). Cultural and leadership predictors of corporate social responsibility values of top management: A GLOBE study of 15 countries. *Journal of International Business Studies*, 37, 823–837.
- Wang, J., Chen, X., Li, X., Yu, J., & Zhong, R. (2020). The market reaction to green bond issuance: Evidence from China. *Pacific-Basin Finance Journal*, 60, 101294.
- Wang, S., & Wang, D. (2022). Exploring the relationship between ESG performance and green bond issuance. *Frontiers in Public Health*, 10, 897577.
- Weber, O., & Saravade, V. (2019). *Green bonds: Current development and their future* [CIGI Paper No. 210]. Center for International Governance and Innovation.
- Weber, Y., Shenkar, O., & Raveh, A. (1996). National and corporate cultural fit in mergers/acquisitions: An exploratory study. *Management Science*, 42, 1215–1227.
- Wolfe, N., Dunavan, C., & Diamond, J. (2007). Origins of major human infectious diseases. *Nature*, 447, 279–283.
- Yamahaki, C., Vendramini Felsberg, A., Köberle, A., Costa Gurgel, A., & Stewart-Richardson, J. (2020). Structural and specific barriers to the development of a green bond market in Brazil. *Journal of Sustainable Finance & Investment*, 10, 1–18.
- Zheng, X., El Ghoul, S., Guedhami, O., & Kwok, C. C. Y. (2012). National culture and corporate debt maturity. *Journal of Banking & Finance*, 36(2), 468–488.

How to cite this article: Mertzanis, C., & Tebourbi, I. (2023). National culture and green bond issuance around the world. *European Financial Management*, 1–56.
<https://doi.org/10.1111/eufm.12419>

APPENDIX: DEFINITION OF VARIABLES

The appendix provides the definition of all variables and the source of the data.

Variable	Definition and data source
GRBND	Value of green bond issuance (USD billion), inclusive of both corporate and government green bonds, from the International Monetary Fund's (IMF's) Climate database
PDI	Hofstede's (2001, 2011) measure of power distance
IDV	Hofstede's (2001, 2011) measure of individualism versus collectivism
MAS	Hofstede's (2001, 2011) measure of masculinity versus femininity
UAI	Hofstede's (2001, 2011) measure of uncertainty avoidance
LTO	Hofstede's (2001, 2011) measure of long-term versus short-term orientation
IVR	Hofstede's (2001, 2011) measure of indulgence versus restraint
EPI	The environmental performance index. It provides a data-driven summary of the state of sustainability around the world using 40 indicators on climate change performance, environmental health and ecosystem vitality. Higher index values indicate better environmental performance (Yale and Columbia Universities)
COMTECH	Index of comparative advantage in low-carbon technology products per country, from the IMF's Climate database. Higher values indicated a higher comparative advantage of countries in advancing low-carbon technology
FSCALB	Fiscal balance of the state (%GDP), from the IMF's Financial Statistics
RATING	Dummy variable that takes the value of 1 if Moody's sovereign rating is investment grade and 0 otherwise. From Moody's credit rating services
GDPCAP	Gross domestic product per capita (constant USD) (logarithm), from the World Development Indicators
CREDIT	Total credit in the economy (%GDP), from the World Development Indicators
INFL	Consumer price index (annual), from the World Development Indicators
CRINFO	Credit coverage information index, from the World Bank's Doing Business Report (1–8 higher). It measures the coverage, scope and accessibility of credit information available through credit reporting service providers
TEMP	Average temperature per country (annual), from the World Bank's Climate Change Knowledge Portal
CARPREP	The country preparedness for low-carbon transition index, from Peszko et al. (2020), World Bank. It measures the extent to which a country is prepared to transition towards a low-carbon economy (0–1 higher)

(Continues)

Variable	Definition and data source
FAMTIES	The index of the strength of family ties in a country, from Alesina and Giuliano (2010) (0–100 highest). Higher index values imply stronger family ties
PRVDIS	Index of the prevalence of nine infectious diseases per country, from Murray and Schaller (2010) (1–4 higher). Higher values of the index imply higher exposure (reporting) of prevalent diseases. The variable is used as an instrument in IV analysis