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Additional information

This paper investigates how foreign direct investment (FDI) and different types of democracy influence a country's carbon intensity. The authors analyse data from 160 countries over 30 years (1990-2020), using advanced statistical methods to examine the impact of various democracy types on the relationship between FDI and carbon emissions. They found that FDI tends to reduce carbon intensity in countries with high carbon emissions. At the same time, different types of democracy, such as electoral or participatory, also play a significant role in shaping this relationship. The study supports the "halo effect hypothesis," suggesting that democr...

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Towards environmental impact of inward foreign direct investment: the moderating role of varieties of democracy

Inward foreign
direct
investment

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Abstract

Purpose – This paper aims to clarify the relationship between foreign direct investment (FDI), democracy and carbon intensity. This study examines the influence of types of democracy on the relationship between inward FDI and carbon intensity. For this purpose, it uses five varieties of democracy, including a composite democracy indicator as moderating variables.

Design/methodology/approach – This study applies the fixed-effects panel quantile regression approach that considers unobserved heterogeneity and distributional heterogeneity using panel data from 160 countries during 1990–2020. By taking into account sudden changes in the volume of inward FDI, an event study is conducted across various sub-samples of democracy to check the robustness of the results.

Findings – The results show that FDI has a significantly negative impact on carbon intensity of the host country in the upper quantiles. In general, different types of democracy have a significant positive impact on carbon intensity across different quantiles. After considering the other factors, including industry intensity, trade openness, green technology, fossil fuel dependency and International Environmental Agreements, there is evidence that all types of democracy moderate the relationship between FDI and carbon intensity, thereby supporting the halo effect hypothesis. In addition, the interaction effects have a significant negative impact on carbon intensity of low- and high-carbon-intensive countries.

Originality/value – This paper offers several contributions to the literature on the effect of FDI and democracy on carbon intensity. This study overcomes the limitations related to the conceptualization and measurement of democracy found in the literature. While prior research has predominately concentrated on how democracy promotes the selection of FDI host-country locations, this study seeks to answer the question of whether democracy type has any effect on inward FDI, thus contributing to improving carbon intensity. Furthermore, this paper analyses the interaction effect on carbon intensity in different countries with different carbon intensity levels separately.

Keywords FDI, Democracy, Carbon intensity, Halo effect hypothesis, Fixed-effects panel quantile, Event study, Foreign direct investment

Paper type Research paper



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1. Introduction

Greater concerns about global sustainable development and global environmental change have led international business scholars to highlight the role of multinational enterprises (MNEs) as part of the solution to these societal issues (Buckley *et al.*, 2022; Doh *et al.*, 2021; Kolk and Pinkse, 2008). There is a growing acknowledgement that climate change poses significant challenges to governments and firms (Kolk and Van Tulder, 2010; Wang *et al.*, 2018). MNEs are believed to play an essential role in solving global-scale issues, given their significant influence and engagement in the international transfer of capital and greener technological capabilities across national boundaries (Buckley *et al.*, 2017; Van Der Waal *et al.*, 2021; Van Tulder *et al.*, 2021). This paper aims to contribute to the research agenda that addresses several sustainability-related and contemporary challenges, extending research beyond economic factors to political and environmental concerns to clarify the consequences of MNE growth better (Jain *et al.*, 2022).

A large body of literature exists on how the choice of foreign direct investment (FDI) is facilitated in host-country locations benefiting from democratic regimes (Asiedu and Lien, 2011; Desbordes and Verardi, 2017; Li and Resnick, 2003; O'Neal, 1994). The literature also shows that MNEs generally result in environmental improvements within the host country, but findings still need to be exhaustive and conclusive in this area (Cole *et al.*, 2017). There is a research gap on the role of MNEs in aggravating or mitigating climate change in host markets. Moreover, FDI is a crucial channel for acquiring advanced green technology and enhancing carbon emission efficiency in host countries (Wang *et al.*, 2021a, 2021b). At the same time, the literature remains under-explored in terms of how the relationship between FDI and carbon intensity of the host country is influenced by the measures of polyarchy, namely, electoral, liberal, participatory, deliberative and egalitarian types of democracy.

In other words, the existing studies answer whether the increased level of democracy leads to more FDI. In contrast, this study seeks to answer whether democracy variety has any effect on inward FDI, thus contributing to improving the carbon intensity of the host country. Focusing on these issues aims to advance empirical knowledge about the environmental impact of FDI and democracy, specifically the interaction between FDI, democracy and carbon intensity. FDI is a crucial element of the global economy, and democratic political systems attract higher levels of FDI inflow across and within countries over time (Jensen, 2003; Lacroix *et al.*, 2021). Therefore, our research seeks to contribute to the debates on whether FDI and democracy are necessary to help governments meet their commitments to reaching the United Nations' Sustainable Development Goals (SDGs). Whether this is indeed the case remains an open question.

Researchers posit that increasing levels of democracy are crucial to helping nations achieve sustainable development (Pickering *et al.*, 2022). Neumayer (2002) shows that democracies will likely engage in international environmental negotiations and agreements. Democracies allow for public interest litigation, make citizens better informed and make states more responsive to demands for environmental protection (Farzin and Bond, 2006). Democratic leaders cannot afford to ignore voter concerns and are usually eager to please their voters to win elections (Li and Reuveny, 2006). It has been noted that public authorities are more likely to take action across diverse facets of environmental policy than autocracies (Clulow, 2019; Fredriksson *et al.*, 2005). Proponents of the benign impact of democracy on the natural environment contend that democracies are more cooperative concerning climate change mitigation efforts because they have a longer history of democratic institutions (Fredriksson and Neumayer, 2013).

In democratic governance systems, power is vested in the people, who can freely elect their leaders, influence government policies and hold public officials accountable through

fair and transparent elections (Jensen, 2003). This type of regime benefits from some mechanisms that consist of checks and balances to oversee the actions of elected officials, which largely mitigates arbitrary government intervention (North and Weingast, 1989). MNEs prefer to invest in politically more stable countries that protect property rights (Li, 2009; Li and Resnick, 2003). However, some researchers assume the opposite, arguing that autocratic governments often prioritize short-term gains over long-term benefits, resulting in adequate implementation and enforcement of climate action (Clarke and Stone, 2008). Hollyer *et al.* (2011) contend that political leaders in autocracies are less inclined to tolerate mass protests and environmental demonstrations.

Unlike a democracy, autocratic regimes could potentially enhance their ability to attract private investors by offering more robust incentive packages and ensuring protection against labour unions (Li and Resnick, 2003). MNEs can leverage their competitive advantages more effectively within autocratic regimes to pursue international nationalist objectives (Clegg *et al.*, 2018). In such circumstances, priorities for business interests often overshadow citizens' concerns (Carlitz and Povitkina, 2021). Regardless of the political system in place, lobbying groups advocating for environmental issues might prioritize individual benefits at the expense of collective environmental interests (Culhane and Roberts, 2021). Thus, the overall role of democracy in the relationship between FDI and the environment must be empirically determined.

Two interconnected strands of literature are significantly relevant to our topic and merit our attention. First, we contribute to the literature surrounding the FDI-environment relationship (Demena and Afesorgbor, 2020). We complement the existing scholarly works regarding the institutional determinants of FDI (Bénassy-Quéré *et al.*, 2007) and whether quality institutions and good governance matter in attracting FDI (Antonietti and Mondolo, 2023; Globerman and Shapiro, 2002). Second, we build on the set of international political economy literature that has advanced our understanding of the environmental implications of democratic institutions versus autocratic regimes (Kammerlander and Schulze, 2020; Midlarsky, 1998).

Despite its significance, the topic has received relatively limited attention in the literature, and only a few studies go beyond a narrow definition of democracy linked to elections and political participation (Coppedge and Pemstein, 2020). We seek to fill this research gap by empirically testing a hypothesis not examined in the literature: the correlation between FDI and the host-country environment is democracy-dependent, and FDI and different types of democracy, in tandem, affect the host-country carbon intensity.

This research aims to provide comprehensive and informative answers to the following research questions:

- RQ1.* How do inward FDI and democracy affect the carbon intensity of the host country?
- RQ2.* How do the varieties of democracy influence the relationship between inward FDI and the carbon intensity of the host country?
- RQ3.* Which democracy type matters more for inward FDI and carbon intensity?

We use a large data set of 160 countries from 1990 to 2020 to answer these research questions. As we use panel data with cross-sectional and time-series dimensions, we estimate panel quantile regression models with fixed effects that consider potential non-linearities in the impact of FDI. The results provide a detailed description throughout the conditional distribution of the dependent variable, especially in the countries with the most and least carbon intensity. This approach also accounts for unobserved individual

heterogeneity and conditional heterogeneity, issues not considered in previous studies, while helping us obtain a more complete picture of the factors associated with emission intensity.

Because the relationships between carbon intensity, FDI and democracy can be affected by other factors, we reinforce the contribution of this paper and adopt a multivariate approach to avoid omitted-variable bias. The empirical model includes potential channels, such as industry structure, trade openness, green technologies, fossil fuel dependency and International Environmental Agreements (IEA). For robustness checks, we also perform an event study to model the volatility of inward FDI to control for year-fixed effects that, if omitted, could bias the estimates. Moreover, this study overcomes the limitations related to the conceptualization and measurement of democracy found in the literature. Indeed, we use a more accurate measure considering different types of democracy. Our measures of democracy are founded on data from the Varieties of Democracy Project (V-Dem) that captures the complexity of the concept of institutionalized democracy (Coppedge *et al.*, 2011; Teorell *et al.*, 2019). The empirical analysis distinguishes between five varieties of democracy (electoral, liberal, deliberative, participatory and egalitarian). Additionally, this study uses a composite indicator of democracy, computed as a weighted average of the five underlying democracy varieties, using the principal component analysis (PCA) technique.

Overall, the research findings uncover that inward FDI has a significant negative impact on the carbon intensity of the host country. Thus, the direct effect of democracy on carbon intensity is significantly positive. Moreover, the findings show that the interaction between FDI and the democracy variables is homogenous and strongly supports the existence of the halo effect. Evidence shows that all types of democracy moderate the relationship between inward FDI and carbon intensity, implying that the interaction effect leads to an emission reduction effect. Taken as a whole, this result suggests that as long as a nation moves up the democratic ladder and attracts higher levels of FDI, the interplay between FDI and democracy helps to reduce carbon intensity.

The paper unfolds as follows. Beginning with an introduction in Section 2, the literature review and research hypothesis are expounded. Following this, Section 3 outlines the methodology and delves into the data and sources' intricacies. Moving forward, Section 4 is dedicated to presenting and discussing the empirical findings. Finally, Section 5 draws the study closer by offering insights into the policy implications arising from the research.

2. Literature review

2.1 *Foreign direct investment and carbon intensity*

The increasing importance of MNEs and their FDI activities is often considered to generate positive externalities for the host country (Alfaro *et al.*, 2010; Yao and Wei, 2007). MNEs are frequently referred to as a channel of international technology diffusion (Keller, 2002; Kokko, 1994). Relatively more advanced technology is one of the major benefits domestic firms can gain from MNEs in their country (Pfaffermayr, 1999; Veugelers and Cassiman, 2004; Xu, 2000). These positive externalities arise because foreign firms bring firm-specific assets that allow them to compete abroad (Markusen, 1995; Zaheer, 1995). MNEs operate on a larger scale to exploit market opportunities and ownership-specific advantages in capital, technological innovation and managerial skills (Dunning, 1980).

The competitive advantages inherent in MNEs are a prerequisite for global business, and these are exploited in response to the changing boundaries of the firm (Cantwell and Narula, 2001). Albornoz *et al.* (2014) have shown that MNEs with a greater capacity to assimilate new environmental technologies are more likely to adopt environmental actions. Owing to their absorptive capacity, foreign firms are more inclined to implement environmental management systems, mainly within formal and informal networks (Albornoz *et al.*, 2009;

Becker *et al.*, 2013). Foreign-owned plants are significantly more likely to adopt proactive corporate environmental practices than domestic ones (Barrios *et al.*, 2005; Zhu *et al.*, 2012).

The significant focus on the environmental implications of MNEs can be attributed to two competing hypotheses. The “halo effect”, known simply as the Porter hypothesis, contends that the entry of MNEs introduces efficient and low-polluting technologies into the host country, which are of benefit to the environment (Eiadat *et al.*, 2008; Porter and Van Der Linde, 1995). MNEs stimulate economic growth through technology transfer, spillover effects, productivity gains and managerial practices, which can translate into efficiency gains that could help improve environmental performance (Lee, 2013). FDI presence tends to encourage host countries to adopt stringent environmental regulations and well-designed policies (Stavropoulos *et al.*, 2018). Poelhekke and Van Der Ploeg (2015) find that the effects of FDI may be sector specific. A stricter and better-enforced environmental policy in the host country attracts more FDI, which may help their reputation for sustainable management and corporate social responsibility. In contrast, the “pollution haven hypothesis” posits that MNEs relocate their dirty production from countries with tighter environmental regulations to weakly regulated ones to take advantage of the lower production costs associated with these policies (Copeland and Taylor, 2004). Owing to the competition for FDI, a race to the bottom in environmental standards turns them into pollution havens (Bu *et al.*, 2023).

Table 1 summarizes cross-country evidence on the nexus between FDI and the environment, which validates either the halo effect or pollution haven hypothesis. Indeed, some studies confirm the halo effect hypothesis (Ben Kheder and Zugravu, 2012; Cole *et al.*, 2008; Kim and Adilov, 2012; Nguyen *et al.*, 2021; Pazienza, 2019; Zhu *et al.*, 2016), while other challenge its validity (Abdouli and Hammami, 2017; Blanco *et al.*, 2013; Demena and Afesorgbor, 2020; Doytch and Uctum, 2016; Omri *et al.*, 2014; Waqih *et al.*, 2019). Shao (2017) finds that FDI significantly negatively impacts the carbon intensity of high-income, middle-income and low-income countries.

Several studies have examined the relationship between FDI and the emissions level on the stringency of environmental regulations (Cole *et al.*, 2006). Eskeland and Harrison (2003) have reported no significant relationship between MNEs’ site location decisions and environmental regulation in host countries. The pollution haven hypothesis generally applies to developing nations and lax environmental regulations. In contrast, the halo effect hypothesis is often associated with developed countries and triggered by stringent regulations (Benzerrouk *et al.*, 2021). Chung (2014) has found strong evidence that polluting industries tend to invest more in countries with laxer environmental regulations. Zheng and Shi (2017) argue that the validity of the pollution haven hypothesis is jointly associated with the type of environmental policy and industrial characteristics. However, stringent environmental regulations in a host country discourage investments from MNEs with efficiency-seeking motives (Rezza, 2013). Wang *et al.* (2019), who examine the impact of environmental regulation on location choices of pollution-intensive firms, consistently confirm the Porter effect rather than the pollution haven effect.

Researchers have found that FDI inflows are associated with environmental improvements in countries with relatively low capital-labour ratios and relatively stringent regulations (Wang and Zhang, 2022). Zugravu-Soilita (2017) argue that average capital endowments and weak environmental regulations will attract cleaner and more labour-intensive FDI. Thus, Cole *et al.* (2017) point out that more regulated countries are generally more capital-intensive, whereas less regulated tend to be relatively labour-intensive. FDI, in general, helps reduce pollution emissions, contributing mainly to its technique effect (Bao *et al.*, 2011). These insights collectively lead to the formulation of the following hypothesis:

Table 1.
Overview of
reviewed literature

Study	Dependent variable	Variable of interest	Model	Method	Sample	Period	Finding
<i>A: FDI and the environment</i>							
Kim and Adilov (2012)	CO ₂ emissions	FDI per capita	–	FE	168 countries	1961–2004	Negative
Blanco <i>et al.</i> (2013)	CO ₂ per capita	FDI/GDP	–	Cointegration	18 countries	1980–2007	None
Omri <i>et al.</i> (2014)	CO ₂ per capita	FDI per capita	–	Cointegration	54 countries	1990–2011	Positive
Abdoul and Hammami (2017)	CO ₂ emissions	FDI per capita	–	Cointegration	17 MENA	1990–2012	Positive
Doytch and Uctum (2016)	CO ₂ emissions	FDI/GDP	EKC	GMM	163 countries	1984–2011	Mixed
Zhu <i>et al.</i> (2016)	CO ₂ per capita	FDI/GDP	EKC	Quantile	5 ASEAN	1981–2011	Negative
Sapkota and Bastola (2017)	CO ₂ per capita	FDI	EKC	FE	14 Latin America	1980–2010	Positive
Zagravu-Soilita (2017)	CO ₂ emissions	FDI	–	FE	4 countries	1995–2008	Negative
Shao (2017)	CO ₂ intensity	FDI	–	GMM	188 countries	1995–2013	Negative
Pazienza (2019)	CO ₂ emissions	FDI	EKC	FE	30 OECD	1990–2013	Negative
Waqih <i>et al.</i> (2019)	CO ₂ emissions	FDI/GDP	EKC	Cointegration	4 South Asia	1989–2016	Negative
Nguyen <i>et al.</i> (2021)	CO ₂ emissions	FDI/GDP	EKC	GMM	6 countries	1986–2014	None
Benzerrouk <i>et al.</i> (2021)	CO ₂ emissions	FDI	EKC	GMM	131 countries	1978–2014	Negative
						1980–2016	Mixed
<i>B: Democracy and the environment</i>							
Midlarsky (1998)	CO ₂ per capita	Polity	–	OLS	108 countries	1981–1990	Negative
Li and Reuveny (2006)	CO ₂ per capita	Polity	EKC	FE	143 countries	1961–1997	Negative
Farzin and Bond (2006)	CO ₂ emissions	Polity	EKC	FE	200 countries	1980–1998	Mixed
Hosseini and Kaneko (2013)	CO ₂ intensity	Polity	EKC	SUR	129 countries	1980–2007	Negative
Y You <i>et al.</i> (2015)	CO ₂ per capita	Polity	EKC	Quantile	98 countries	1997–2008	Negative
Polcaro (2016)	CO ₂ emissions	Dummy	–	OLS	47 transition	1950–2002	Negative
Sulemana <i>et al.</i> (2017)	CO ₂ emissions	Polity	EKC	FE	48 SSA; 34 OECD	1990–2010	None
Povtchina (2018)	CO ₂ per capita	V-Dem	–	FE	144 countries	1970–2011	Negative
Lægreid and Povtchina (2018)	CO ₂ per capita	V-Dem	EKC	Cointegration	210 countries	1950–2015	Negative
Adams and Klobodu (2018)	CO ₂ emissions	Polity	–	GMM	26 countries	1985–2011	None
Joshi and Beck (2018)	CO ₂ emissions	Heritage foundation	EKC	GMM	22 OECD; 87 non-OECD	1995–2010	None
Farzaneagan and Markwardt (2018)	CO ₂ per capita	Polity	EKC	GMM	17 MENA	1980–2005	Negative
Clulow (2019)	CO ₂ emissions	Freedom house	–	OLS	147 countries	1990–2002	Negative

Study	Dependent variable	Variable of interest	Model	Method	Sample	Period	Finding
Adams and Acheampong (2019)	CO ₂ emissions	Polity	EKC	GMM	46 SSA	1980–2015	Negative
Arvin and Lew (2009)	CO ₂ per capita	Freedom house	EKC	GLS	141 countries	1976–2003	Positive
Acheampong <i>et al.</i> (2022)	CO ₂ emissions	V-Dem	EKC	GMM	46 SSA	2000–2015	Negative
Selseng <i>et al.</i> (2022)	CO ₂ per capita	V-Dem	EKC	RE	127 countries	1992–2014	None
Povitkina and Jagers (2022)	CO ₂ intensity	V-Dem	–	OLS	34 countries	1990–2015	None

Notes: FE = fixed effects; RE = random effects; OLS = ordinary least squares; GLS = generalized least squares; GMM = general methods of moments; SUR = seemingly unrelated regressions; OECD = organisation for economic cooperation and development; MENA = middle eastern and North-Africa; SSA = sub-Saharan Africa; ASEAN = association of Southeast Asian Nations; EKC = environmental Kuznets curve; V-Dem = varieties of democracy

Source: Table by author

Inward foreign
direct
investment

Table 1.

2.2 Democracy and carbon intensity

Previous research on whether democracy benefits the environment has produced mixed results. The existing literature has assessed the performance of democratic countries compared to authoritarian regimes (Arvin and Lew, 2009; Clulow, 2019; Li and Reuveny, 2006; Policardo, 2016; Povitkina, 2018). Several studies have found that democracy is not conducive to environmental improvement (Adams and Klobodu, 2018; Joshi and Beck, 2018; Povitkina and Jagers, 2022; Selseng *et al.*, 2022; Sulemana *et al.*, 2017). Furthermore, recent studies have also highlighted specific elements that contribute to ensuring environmental protection, including high civil society participation, civil liberties, labour union strength and green parties' involvement (Bernauer and Koubi, 2009; Fredriksson and Neumayer, 2016; Neumayer, 2003). Moreover, evidence suggests that the moderating effects of democracy on emissions are stronger in countries with democratic and non-corrupt governments (Lægreid and Povitkina, 2018). In the presence of widespread corruption that reduces the capacity of democratic governments to limit emissions, democracies do not seem to do better than authoritarian regimes (Povitkina, 2018). Olson (1993) argues that political freedoms augment environmental protection because autocratic regimes will produce less environmental public goods. In democratic countries, most citizens can vote and express their environmental preferences. Furthermore, when people are well-informed about major problems, political decisions will likely be influenced (Page and Shapiro, 1983).

Despite these arguments, there appear to be inconsistencies when comparing the results of various studies and different indicators of democracy. Among the studies that use ratings from the Polity IV project, scholars find that more democracy, as a general rule, is associated with better environmental performance (Adams and Acheampong, 2019; Farzanegan and Markwardt, 2018; You *et al.*, 2015). Studies adopting freedom house scores provide inconclusive results (Arvin and Lew, 2009; Clulow, 2019). Moreover, recent studies using data from V-Dem have yielded mixed results. Acheampong *et al.* (2022), using a sample of 46 sub-Saharan countries, conclude that democracy mitigates carbon emissions. Researchers using larger cross-country data sets observe no substantial correlation between different types of democracy and the environmental indicator (Selseng *et al.*, 2022). Povitkina and Jagers (2022) argue that democracies with stronger deliberative features adopt more environmental policies, which are not necessarily stricter or more effective. In contrast, democracies with stronger social-liberal features tend to adopt stricter, more effective policies. Therefore, we hypothesize as follows:

H2. Increased democracy (as measured by the varieties and the composite indicator) reduces the carbon intensity of the host country.

2.3 Democracy and foreign direct investment

Assessing the impact of democracy on FDI depends on inherent structural differences between various types of FDI (Davies *et al.*, 2018). Mergers and acquisitions (M&As) exhibit opportunistic behaviours and are more affected by destination factors such as institutional quality. In contrast, the market potential of host countries matters in determining the location choice of investment (*op. cit.*). Cross-border investment involves the transfer of existing ownership and assets to achieve integration and market entry. Greenfield investment relies on firm-specific advantages and managerial strategies with strong control over affiliates (Zhao *et al.*, 2021). Recognizing the different effects that might link democracy

type and FDI along with the mechanisms that might apply to other types of FDI in varying degrees of democracy, i.e. electoral, liberal, participatory, deliberative and egalitarian democracy, is important to understand the rationale behind investment decisions in autocracies and democracies.

2.3.1 Electoral democracy. Democracies may have greater credibility in their dealings with MNEs in that they are better able to assure policy stability, even in the face of more frequent changes of government (Kucera and Principi, 2014). Democratic systems grant political rights to their constituents and have lower political risk levels because of the presence of checks and balances, which is considered an important factor in attracting FDI (Harms and Ursprung, 2002; Jensen and McGillivray, 2005). The number of veto players has been found to be associated with more FDI. Democratic leaders, who are more exposed to audience costs, because they hold different elections, are more likely to be held accountable for their commitments, not just to the electorate but also to MNEs (Jensen, 2003). As a form of government, autocracies can generate varying levels of audience costs but have typically narrower political groups (Weeks, 2008). Foreign investors often prefer to establish long-term relationships with autocratic officials, as their leadership tends to be more enduring (Bak and Moon, 2016). On the whole, greenfield investment will benefit, as most investment does, from enhancing policy stability via veto players leading to a reduction of policy uncertainty in the host country that mitigates perceived business risk by private actors (Bass and Chakrabarty, 2014; Clegg *et al.*, 2018). Therefore, we hypothesize as follows:

H3.1. The relationship between FDI and carbon intensity is moderated by electoral democracy in a way that this variety of democracy strengthens the role of FDI in reducing the carbon intensity of the host country.

2.3.2 Liberal democracy. Property rights protection and the avoidance of constraints resulting from state predatory behaviours are ensured in liberal democracies, reducing expropriation risks, which may align with investor preferences (Chandler *et al.*, 2023; Contractor *et al.*, 2021). According to Awokuse and Yin (2010), by providing sufficient economic freedom to attract foreign investors, liberal democracies may become more profitable destinations with better development prospects and lower expropriation risks for both vertical and horizontal FDI. On the positive side, these countries may have greater credibility in respecting stronger property rights, the rule of law and the enforcement of business contracts to keep MNEs safer from imitation and other damages to their property rights (Glass and Saggi, 2002). Greenfield investment is part of the MNE's supply chain and typically involves connections with domestic partners that help insulate MNEs from political pressure. Host governments are less likely to violate the property rights of firms that are more tightly linked with other firms in the host economy (Johns and Wellhausen, 2016). On the negative side, democracies may act to weaken MNEs' market power position and weaken public support for FDI, insofar as this adversely affects domestic companies (Li and Resnick, 2003). These democracies tend to have stronger antitrust regulation than autocracies and the policy-uncertainty elements of antitrust enforcement deter inward FDI (Clougherty and Zhang, 2023). Policymakers in autocratic governments are likely to be more concerned with rent extraction from industry than competitive market practices (Asiedu and Lien, 2011). In this context, greenfield investment is often shielded from antitrust policy and can effectively respond to government regulatory issues (Mariotti and Marzano, 2021). Conversely, cross-border acquisitions of domestic targets aimed at reducing market competition often draw regulatory scrutiny, potentially deterring future bids from foreign investors (Serdar and Erel, 2013). These insights collectively lead to the formulation of the following hypothesis:

H3.2. The relationship between FDI and carbon intensity is moderated by liberal democracy in a way that this variety of democracy strengthens the role of FDI in reducing the carbon intensity of the host country.

2.3.3 Participatory democracy. The direct involvement of citizens in decision-making, emphasis on grassroots movements and broad participation beyond just voting characterize participatory democracies (Coppedge *et al.*, 2016). Democratic politics empower workers that as median voters benefit from FDI more than anti-FDI local businesses, democracies are more open to all types of FDI (Sonnenfeld *et al.*, 2024). Furthermore, media openness also aids in attracting FDI by fostering transparency in public governance, while institutional problems typically serve to discourage foreign investors (Desbordes and Verardi, 2017; Kinda, 2010). Democracies may be more willing to embrace FDI because intergovernmental ties at subnational levels between home and host countries influence the intensity and location of FDI inflows (Hu *et al.*, 2021). However, when it comes to offering generous incentive packages to FDI, democratic governments are likely to face more opposition than their autocratic counterparts (Zheng, 2011). In general, extensive civil society activism and popular pressure can deter MNEs from investing, especially when there's uncertainty surrounding policy areas that are of importance to them (Li *et al.*, 2018). Dal *et al.* (2010) demonstrate that the effect of a policy on the level of cooperation is greater when it is chosen democratically than when it is exogenously imposed. Moreover, differences in governance practices can render it sub-optimal for MNEs to invest abroad (Aggarwal *et al.*, 2009). Citizens can voice their support for policies that favour FDI but sudden policy shifts can adversely affect long-term investment decisions (Bussy and Zheng, 2023). These insights collectively lead to the formulation of the following hypothesis:

H3.3. The relationship between FDI and carbon intensity is moderated by participatory democracy in a way that this variety of democracy strengthens the role of FDI in reducing the carbon intensity of the host country.

2.3.4 Deliberative democracy. Focusing on reasoned debate and discussion, searching for informed and reflective decision-making and inclusiveness in the deliberation process are the basis of deliberative democracies (Coppedge *et al.*, 2016). Democratic systems typically feature mechanisms that promote accessibility and transparency to a greater extent than autocratic governments (Henisz, 2000). In democracies with media openness, beneficiaries of FDI are in a position to hold democratically elected officials accountable if they fail to honour agreements with foreign investors (Elkins *et al.*, 2006). Democracies actively promote transparency of political decision-making and public engagement that involves the interests of stakeholders, civil society, local communities and business groups (Choi and Samy, 2008). These characteristics make economies in deliberative democracies promote more sustainable and socially responsible investment practices (Buckley and Liesch, 2023). Moreover, civil society groups often have a greater ability to lobby leaders effectively for the protection of domestic businesses from foreign competitors compared to those in autocracies (Zhang, 2022). Conversely, autocratic regimes, motivated by the economic advantages of FDI, are more inclined to shield MNEs from public pressures for increased wages and labour rights (Giuliani and Macchi, 2014). Greenfield investment typically lacks access to political networks and instead relies on its capabilities and organizational strength to succeed regardless of location (Hansen and Gwozdz, 2015). Reducing political and economic uncertainty increases the likelihood of shareholders and managers committing to brownfield investments within host countries (Meyer and Estrin, 2001). Therefore, we hypothesize as follows:

H3.4. The relationship between FDI and carbon intensity is moderated by deliberative democracy in a way that this variety of democracy strengthens the role of FDI in reducing the carbon intensity of the host country.

2.3.5 Egalitarian democracy. When power is more evenly distributed among different social groups, it guarantees fair access to decision-making processes and facilitates the promotion of policies that benefit a wider range of stakeholders, including foreign investors (Sigman and Lindberg, 2019; Staats and Biglaiser, 2012). Democracy plays a crucial role in national-level governance by safeguarding equal rights and promoting equitable wealth distribution among citizens, factors that are expected to contribute to economic growth (Trinugroho *et al.*, 2023). Foreign investors prioritize economic freedom concerning property rights, capital mobility and trade openness. However, developing country democracies frequently struggle to implement the reforms required to foster such freedoms (Mathur and Singh, 2013). Moreover, host country governments may become concerned about lost tax revenues and tax competition, which could potentially undermine welfare programs that many voters in democracies rely upon (Becker and Fuest, 2011). Under autocratic regimes, vertical and horizontal FDI may encounter fewer pressures from government bureaucrats, making autocracies more attractive targets for such investments (Clegg *et al.*, 2018). Therefore, we formulate the following hypothesis:

H3.5. The relationship between FDI and carbon intensity is moderated by egalitarian democracy in a way that this variety of democracy strengthens the role of FDI in reducing the carbon intensity of the host country.

3. Methodology and data

3.1 Fixed effect panel quantile regression

This study uses the fixed effect panel quantile regression model to examine the impact of FDI and democracy varieties on carbon emissions. Using a panel quantile regression approach, we can investigate the relationship between FDI and democracy across the conditional distribution of carbon emissions in countries with the lowest and highest emissions to provide a deeper understanding of the differences across different carbon emission levels. In general, the quality of democracy is a slow-moving variable, and in the absence of fixed effects, traditional regression techniques may produce biased estimates. Dynamic regression techniques, such as the general method of moments (GMM), suffer from weak instrument bias and do not integrate country-fixed effects but directly account for the lag value of emissions to capture the immediate impact of variation in FDI stocks (Bun and Windmeijer, 2010). The use of GMM might not be sufficient if the interaction term between FDI and democracy captures other long-term correlates of democracy. Therefore, quantile regressions might be better suited to model potential non-linearities in the effect of FDI. In addition, the quantile regression technique is more robust to outliers than least squares regression (Koenker and Bassett, 1978).

We use a panel quantile method with fixed effects, as proposed by Machado and Santos Silva (2019). This approach is a restricted version of regression quantiles that avoids the occurrence of crossing while maintaining sufficient modelling flexibility (He, 1997). Because this method is based on conditional means, it is particularly useful for panel data models with individual effects, thus controlling for unobserved individual heterogeneity and estimating conditional heterogeneous covariance effects of carbon emissions drivers. While providing information on how the regressors affect the entire conditional distribution, the inferential procedure facilitates the estimation of complex models. It has the essential feature

of being robust by leading to estimates of the regression quantiles that do not cross, a crucial requisite often ignored in empirical applications (Chernozhukov and Hansen, 2008). Moreover, this estimation method uses stronger model assumptions to overcome the incidental parameter problem of quantile regressions with fixed effects (Canay, 2011; Lamarche, 2010; Lancaster, 2000).

3.2 Empirical model

Applying fixed effect panel quantile regression, we specify the conditional quantiles function for quantile τ as follows:

$$Q_{\tau}(y_{it}|\alpha_i, x_{it}) = \alpha_i + x'_{it}\beta(\tau) \quad (1)$$

where the countries and time are indexed by subscripts i and t , respectively. y_{it} is the environmental indicator which refers to the carbon intensity at the country level. α_i is the time-invariant country-fixed effect. $\beta(\tau)$ is the parameter of interest varying with quantile $\tau \in (0,1)$. x'_{it} is the set of control variables. The individual regression coefficients of FDI and democracy, including the interaction between these two variables, are the parameters of interest in this study. The model is initially estimated using pooled ordinary least squares regression analysis to facilitate comparisons. Thus, we are more concerned with the results of the fixed-effects quantile regression method. The fixed effect panel quantile regression model is first estimated without the control variables. Their coefficients may not be directly interpretable, *ceteris paribus*, but are informative of what could be observed generally. Then, we interpret the coefficients of the level of democracy and FDI, including the interaction between both variables, by augmenting the model with a vector of supplementary explanatory variables to control for omitted variable bias.

The time dimension of the long-term correlates of democracy could be of first importance. The estimates may be biased if time-fixed effects are neglected. Therefore, we ascertain if the main model results are sensitive to the impact of the volatility of FDI through robustness checks defining years of sudden FDI massive inflows in a country and generate a dummy variable that takes the value 1 for peak years and 0 otherwise. We apply the Bry and Boschan (1971) procedure where a peak is defined as strictly greater than the two previous and the following values. We run an event study in different sub-samples by interacting FDI with the democracy varieties. Table 2 summarizes all variables and their expected sign change from lower to higher quantiles.

3.2.1 Dependent variable. Carbon intensity is the dependent variable measured by its actual carbon emissions normalized by the real national output. Following Zhu *et al.* (2016), Doytch and Uctum (2016), we quantify the environmental impact of economic activity by referring to the amount of carbon emissions produced per unit of economic output. Carbon dioxide emissions are considered the primary greenhouse gas responsible for global warming. Gross domestic product (GDP) data is adjusted for inflation and differences in living costs between countries.

3.2.2 Independent variables. As is standard in the literature, our first variable of interest is calculated as the inward FDI stock divided by the GDP to discern the effects of multinational enterprise investments on host countries (Asiedu and Lien, 2011; Paul and Feliciano-Cestero, 2021). The emissions indicator and FDI are scaled by GDP to measure intensities for these variables at the country level. These estimators help to examine whether the economy's structure (FDI stocks measured as a share of GDP) predicts the nature of production (emissions per GDP units). Lower emissions could, however, be explained by other mechanisms beyond greener production, such as lower production or more pollution

Variable name	Definition	Units of measurement	Source	Expected sign
Carbon intensity	Carbon dioxide emissions per unit of GDP	Kilogram per 2015 US\$	World development indicators	(Not applicable)
FDI intensity	Inward FDI stock as a share of GDP	Percentage	UNCTAD	(−)
Industrial intensity	Manufacturing value added as a share of GDP	Percentage	UNCTAD	(+)
Trade openness	Sum of exports and imports as a share of GDP	Percentage	World development indicators	(±)
Green technology	Renewable energy consumption by end-users share in total	Percentage	World development indicators	(−)
Fossil fuel dependency	Fossil fuel energy consumption share in total	Percentage	World development indicators	(+)
Environmental agreements	Ratified international environmental agreements	Count	Bellelli et al. (2023)	(±)
Democracy	Composite index of all five democracy varieties	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)
Electoral	Electorate democracy index	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)
Liberal	Liberal democracy index	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)
Participatory	Participatory democracy index	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)
Deliberative	Deliberative democracy index	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)
Egalitarian	Egalitarian democracy index	Scale 0 to 1	Varieties of democracy (V-Dem)	(−)

Note: All of the data are annual over the period 1990–2020

Source: Table by authors

Inward foreign
direct
investment

Table 2.
Description of
variables and
expected signs
across quantiles

import (Cherniwchan *et al.*, 2017). Multinationals play a pivotal role in facilitating the diffusion of environmentally-efficient innovations and enhancing the quality of the environment through their foreign operations (Pisani *et al.*, 2019). In contrast to the study conducted by Abdouli and Hammami (2017), our research focuses on exploring the interaction between democracy and FDI, our main variables of interest, rather than solely on the direct impact of FDI on the environment.

Other variables of interest capture different dimensions of democracy that represent different channels through which democracy might mitigate the environmental impact of FDI. We use a composite democracy variable using the PCA with five different measures of democracies to understand better the one that matters. The democracy variables are adjusted to range between 0 and 1 on a rescaled scale. A higher value indicates greater democracy, while a lower value suggests less democracy. The interaction of FDI and democracy varieties on carbon intensity is the critical focus of this study. We hypothesize that democracy complements FDI in mitigating carbon intensity in host countries, *ceteris paribus*. Countries with more democratic systems tend to offer stronger and more trustworthy property rights, which reduces risks and transaction costs for foreign investors (Li *et al.*, 2018). At the same time, enhanced levels of democracy attract horizontal and vertical FDI inflows because host countries can safeguard individual rights and curb state exploitation, fostering enhanced growth opportunities while mitigating concerns regarding expropriation (Doces, 2010).

3.2.3 Control variables. Because the relationship among carbon intensity, FDI intensity and democracy varieties can be affected by other factors, it is appropriate to adopt a multivariate approach to avoid omitted-variable bias (Perkins and Neumayer, 2009). Therefore, we further explore potential channels that connect changes in carbon intensity to changes in industrial intensity, trade openness, green technology innovations, fossil fuel dependency and participation in international environmental treaties at the national levels. The share of the industry value-added to GDP measures the industrial intensity. The industry-intensive economies often need to be more carbon-efficient (Perkins and Neumayer, 2012). Therefore, the country's industrial intensity is positively associated with the country's carbon intensity.

Since the dependent variable does not include the emissions from international trade, we use the combined value of imports and exports as the proportion of GDP as a measure of trade openness. The environmental impact of trade liberalization in any country could be influenced by how policy changes affect the overall scale of economic activity, the intersectoral composition and the technologies employed in production (Grossman and Krueger, 1991). Following the literature, we hypothesize a mixed effect between trade openness and our dependent variable (Kim *et al.*, 2019).

Owing to technological progress, reductions in carbon emissions may result from decreased production activities or from more efficient production processes that emit less carbon per unit of output. Green technology innovations are critical in affecting carbon emissions through various mechanisms, such as adopting renewable energy sources. Advancements in energy production technologies, such as solar, wind and hydroelectric power, offer greener alternatives to conventional fossil fuel-based energy generation (Aziz *et al.*, 2023). This paper uses the share of renewables to represent this variable, calculated using the proportion of renewable energy consumption to total final energy consumption. We hypothesize that a higher percentage of renewable energy consumption in total energy consumption by end-users, including households, transportation and industry, yields environmental improvements. Thus, the carbon emissions from fossil fuels are higher than those from non-fossil energy sources (Perkins and Neumayer, 2009). Hence, we introduce a

variable to quantify the reliance on fossil fuels within the economy, proxied by the proportion of fossil fuel consumption in total energy consumption. All else remaining equal, the expected sign of the coefficient for the share of fossil fuel dependency is positive.

Evidence suggests that while some countries may lack resources to produce significant outcomes from climate agreements, the carbon intensity rate tends to decline in other countries once they surpass a certain threshold at the top of the income ladder (Okorie and Wesseh, 2023). Since the endorsement of IEA is likely associated with reductions in carbon emissions, it can lead to outcomes consistent with climate justice (Hargrove *et al.*, 2019). This paper uses an explanatory variable that counts the number of ratified international agreements strictly related to the environment in any country. We hypothesize that the effect of this indicator on carbon intensity is ambiguous.

3.3 Sample

This paper aims to examine how FDI and democracy influence carbon emissions intensity with the economy by using panel data covering 160 host countries over the period 1990–2020 (see Table A1 in the Appendix for the list of countries included). Our data are collected from the World Development Indicators of the World Bank and the United Nations Conference on Trade and Development (UNCTAD). Our analysis includes annual carbon dioxide emissions from fossil fuels and industry but not land-use change emissions. The data for the measures of international treaties come from the IEA data set compiled by Bellelli *et al.* (2023). It collects information on the ratification status for 263 IEA and identifies the countries that can potentially ratify every agreement [1].

The democracy indicators are sourced from V-Dem version 12, conducted by the University of Gothenburg [2]. This data set outperforms commonly available democracy indices and provides conceptually unique measures of democracy (Boese, 2019). An extensive set of indicators conciliates five multidimensional democracy indices (electoral, liberal, participatory, deliberative, egalitarian). Data is obtained from an expert survey of over 3,000 country experts worldwide in measuring democracy, institutions and governance. Data collection uses five independent experts annually in each country to code each available indicator. This ensures that the data is available and maintains high standards of quality and reliability, elevating its overall quality compared to alternative sources.

Table 3 presents an overview of the variables' descriptive statistics. The mean carbon intensity is about 0.6 kilograms of carbon emissions emitted per dollar of GDP. The mean value of the composite democracy variable is about 0.45, indicating that, on average, the democracy level in our sampled countries is relatively low. Excluding electoral democracy, all forms of democracy have mean values below 0.5, showing low democracy as portrayed by the composite democracy variable. The distributions of all variables are skewed, and the kurtosis values show that the series distributions are more concentrated than the normal distribution with longer tails. The Jarque–Bera statistical test strongly rejects the null hypothesis of normality, indicating the non-normality of all variables' unconditional distribution. The correlation matrix depicted in Table 4 suggests that the democracy varieties are highly correlated (0.95), one with another.

4. Results and discussion

This paper reports the empirical results for the 10th, 25th, 50th, 75th, 90th and 99th quantiles of the conditional emissions distribution for each measure of democracy. The baseline results indicate that the interplay between inward FDI and democracy is negative and statistically significant across different quantiles (Table 5). After including the control

Table 3.
Descriptive statistics

Variable	Mean	Std. dev.	Minimum	Maximum	Percentile (25th)	Percentile (75h)	Skewness	Kurtosis	Jarque-Bera p -value
Carbon intensity	-0.894	0.797	-3.042	1.644	-1.435	-0.403	0.418	3.099	0.000
FDI intensity	2.980	1.354	-10.82	7.631	2.317	3.782	-0.737	7.054	0.000
Industrial intensity	2.492	0.554	-1.458	3.910	2.200	2.862	-1.172	5.968	0.000
Trade openness	4.249	0.578	-3.863	6.093	3.910	4.592	-1.564	24.332	0.000
Green technology	2.813	1.738	-4.605	4.588	2.045	4.159	-1.541	5.598	0.000
Fossil fuel dependency	4.056	0.696	0.495	4.605	3.895	4.507	-2.016	7.182	0.000
Environmental agreements	1.260	1.472	0	11	0	2	1.971	8.819	0.000
Democracy	0.449	0.299	0	1	0.179	0.721	0.285	1.715	0.000
Electoral	0.544	0.299	0	1	0.278	0.832	-0.017	1.663	0.000
Liberal	0.442	0.308	0	1	0.160	0.719	0.322	1.696	0.000
Participatory	0.398	0.263	0	1	0.159	0.614	0.289	1.816	0.000
Deliberative	0.453	0.299	0	1	0.197	0.724	0.240	1.735	0.000
Egalitarian	0.425	0.288	0	1	0.184	0.686	0.507	1.884	0.000

Note: All variables are transformed into logarithmic form prior to empirical analysis, except for the variables that measure international treaties and the varieties of democracy

Source: Table by authors

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Carbon intensity	1.000												
(2) FDI intensity	-0.062***	1.000											
(3) Industrial intensity	0.159***	-0.133***	1.000										
(4) Trade openness	0.138***	0.518***	0.042***	1.000									
(5) Green technology	-0.475***	-0.079***	-0.080***	-0.233***	1.000								
(6) Fossil fuel dependency	0.469***	0.101***	0.235***	0.140***	-0.625***	1.000							
(7) Environmental agreements	0.032*	-0.088***	0.162***	-0.005	-0.094***	0.091***	1.000						
(8) Democracy	-0.267***	0.223***	0.178***	0.091***	0.000	0.199***	0.217***	1.000					
(9) Electoral	-0.257***	0.220***	0.177***	0.067***	0.042***	0.185***	0.198***	0.986***	1.000				
(10) Liberal	-0.264***	0.222***	0.172***	0.096***	-0.019	0.203***	0.217***	0.994***	0.975***	1.000			
(11) Participatory	-0.301***	0.220***	0.187***	0.052***	0.055***	0.172***	0.208***	0.985***	0.973***	0.971***	1.000		
(12) Deliberative	-0.279***	0.212***	0.163***	0.074***	0.000	0.182***	0.210***	0.988***	0.970***	0.981***	0.963***	1.000	
(13) Egalitarian	-0.228***	0.214***	0.174***	0.134***	-0.076***	0.226***	0.234***	0.980***	0.947***	0.974***	0.951***	0.960***	1.000

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Source: Table by authors

Table 4.
Correlation matrix

Table 5.
Baseline panel
quantile regression
results

	OLS	10th	25th	Quantiles 50th	75th	90th	99th
<i>A: Composite democracy</i>							
FDI intensity	0.095*** (0.017)	0.041** (0.018)	0.035*** (0.013)	0.027*** (0.009)	0.019 (0.012)	0.014 (0.016)	0.003 (0.026)
Democracy	0.006 (0.109)	1.240*** (0.127)	1.136*** (0.090)	1.002*** (0.066)	0.874*** (0.087)	0.790*** (0.116)	0.618*** (0.186)
FDI intensity × democracy	-0.222*** (0.032)	-0.280*** (0.031)	-0.272*** (0.022)	-0.261*** (0.016)	-0.251*** (0.021)	-0.244*** (0.028)	-0.230*** (0.045)
<i>B: Electoral democracy</i>							
FDI intensity	0.121*** (0.019)	0.053*** (0.020)	0.049*** (0.014)	0.043*** (0.010)	0.038*** (0.014)	0.034* (0.018)	0.027 (0.030)
Electoral	0.037 (0.105)	0.990*** (0.115)	0.945*** (0.082)	0.885*** (0.060)	0.830*** (0.079)	0.794*** (0.103)	0.714*** (0.170)
FDI intensity × electoral	-0.230*** (0.032)	-0.242*** (0.031)	-0.242*** (0.022)	-0.241*** (0.016)	-0.241*** (0.021)	-0.240*** (0.027)	-0.239*** (0.045)
<i>C: Liberal democracy</i>							
FDI intensity	0.087*** (0.017)	0.031* (0.017)	0.025** (0.012)	0.018** (0.009)	0.012 (0.012)	0.007 (0.016)	-0.002 (0.025)
Liberal	0.005 (0.107)	1.187*** (0.125)	1.089*** (0.090)	0.956*** (0.066)	0.830*** (0.087)	0.749*** (0.115)	0.577*** (0.186)
FDI intensity × liberal	-0.211*** (0.032)	-0.265*** (0.030)	-0.259*** (0.022)	-0.249*** (0.016)	-0.240*** (0.021)	-0.235*** (0.028)	-0.223*** (0.044)
<i>D: Participatory democracy</i>							
FDI intensity	0.078*** (0.016)	0.049*** (0.018)	0.038*** (0.013)	0.024** (0.009)	0.010 (0.012)	0.001 (0.017)	-0.017 (0.027)
Participatory	-0.259** (0.123)	1.499*** (0.147)	1.352*** (0.105)	1.161*** (0.077)	0.978*** (0.101)	0.858*** (0.135)	0.609*** (0.217)
FDI intensity × participatory	-0.200*** (0.036)	-0.345*** (0.035)	-0.325*** (0.025)	-0.299*** (0.018)	-0.275*** (0.024)	-0.258*** (0.032)	-0.225*** (0.052)
<i>E: Deliberative democracy</i>							
FDI intensity	0.094*** (0.017)	0.026 (0.018)	0.019 (0.013)	0.010 (0.010)	0.000 (0.013)	-0.006 (0.017)	-0.019 (0.028)
Deliberative	-0.050 (0.109)	1.032*** (0.124)	0.928*** (0.089)	0.789*** (0.066)	0.655*** (0.088)	0.568*** (0.116)	0.384*** (0.188)
FDI intensity × deliberative	-0.215*** (0.032)	-0.237*** (0.031)	-0.228*** (0.023)	-0.216*** (0.017)	-0.205*** (0.022)	-0.197*** (0.029)	-0.182*** (0.048)
<i>F: Egalitarian democracy</i>							
FDI intensity	0.119*** (0.017)	0.061*** (0.017)	0.055*** (0.012)	0.047*** (0.009)	0.039*** (0.012)	0.034** (0.016)	0.024 (0.025)
Egalitarian	0.314*** (0.113)	1.609*** (0.142)	1.471*** (0.102)	1.284*** (0.074)	1.102*** (0.097)	0.986*** (0.129)	0.745*** (0.207)
FDI intensity × egalitarian	-0.292*** (0.033)	-0.333*** (0.031)	-0.324*** (0.023)	-0.312*** (0.016)	-0.300*** (0.022)	-0.292*** (0.029)	-0.276*** (0.046)

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$
Source: Table by authors

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Source: Table by authors

variables, it can be seen that the interaction term strongly reduces carbon intensity, supporting the existence of the “halo effect” hypothesis (Tables 6–11). Moreover, the findings generally remain robust across the models, which lends further credence to the validity of the “green halo effect” (Table 12).

We can observe that the impact of FDI on carbon intensity is heterogeneous while validating *H1* (Tables 6–11). For instance, at the 10th quantile, the coefficient of FDI is positive but insignificant at the 1% level. The positive coefficient of FDI does not support the “pollution haven” hypothesis in low-carbon-intensive countries. However, other coefficients are negative and become significant at the higher quantiles, implying that the influence of FDI on carbon intensity is negative and the effect is more important in high-carbon-intensive countries. These findings support the “halo effect” hypothesis in countries with higher carbon intensity levels. Thus, FDI has an insignificant impact at lower quantiles, meaning that most FDI is likely directed towards non-polluting sectors in countries with low carbon intensity. Altogether, the results suggest favourable spillover effects of the activities of MNEs on the host nation encouraged by MNEs’ local environmentally responsible management practices (Choi and Park, 2014). They align with the finding of Liu *et al.* (2024), who argue that policymakers should encourage clean technology through FDI. Foreign companies employ improved environmental management practices and possess environmentally conscious manufacturing processes that minimize negative environmental impacts and help the host country to become more carbon efficient (Copeland and Taylor, 1994; Demena and Afesorgbor, 2020; Perkins and Neumayer, 2008). Moreover, the results do not support the conventional wisdom that FDI arises from relocating environmentally harmful production processes in response to strict environmental regulations (Doytch and Uctum, 2016; Kearsley and Riddell, 2010; Mani and Wheeler, 1998).

In contrast, regarding democracy, we infer that the impact of democracy on carbon intensity is homogeneous. The coefficients of the democracy variables are usually positive and statistically significant for the 10th, 25th, 50th, 75th and 90th quantiles at the 1% level. Therefore, the result does not validate *H2*. This aligns with the finding of Acheampong *et al.* (2022), who argue that democracy positively impacts the environment. This result is not consistent with the finding of Selseng *et al.* (2022), who infer that democracy has generally no effect on the environment.

Moreover, our finding contradicts Pickering *et al.*’s (2022) argument that democratic practices can advance the nation’s ability to foster sustainable transformations. This might be because distrust in public administrators hinders the development of democratic governance (Jun and Kim, 2002). Furthermore, the results suggest that inside lobbying, prioritizing economic competitiveness over emissions mitigation, could wield significant political influence (Vesa *et al.*, 2020).

The interplay between FDI and democracy on carbon intensity is homogeneous, and our findings support *H3.1–H3.5*. We find the coefficient of the interaction term to be negative and statistically significant across various quantiles at the 1% level, which decreases along with the increase in the interaction term. Our findings support claims that different dimensions of democracy represent different channels through which democracy interacts with FDI to decrease the carbon intensity of the host country. Consequently, there seems to be little evidence that any of the five varieties of democracy matter more than others to FDI when the level of democracy is high. Arguably, these findings imply that various aspects of democratic institutions attract foreign capital that improves the carbon intensity of the host country. In other words, FDI is not exclusively attracted by a particular type of democracy but the variance in inflows of FDI to different varieties of democracy matters.

Table 6.
Panel quantile
regression results for
composite democracy

	OLS	Quantiles					
		10th	25th	50th	75th	90th	99th
FDI intensity	-0.068*** (0.025)	0.012 (0.025)	0.002 (0.019)	-0.015 (0.013)	-0.031* (0.018)	-0.042* (0.024)	-0.060* (0.037)
Democracy	-0.843*** (0.138)	0.408*** (0.131)	0.360*** (0.098)	0.286*** (0.070)	0.210** (0.095)	0.163 (0.127)	0.078 (0.193)
FDI intensity × democracy	-0.085** (0.042)	-0.118*** (0.039)	-0.104*** (0.029)	-0.083*** (0.021)	-0.061** (0.028)	-0.047 (0.038)	-0.023 (0.057)
Industrial intensity	0.046 (0.030)	0.173*** (0.048)	0.166*** (0.036)	0.156*** (0.026)	0.145*** (0.035)	0.139*** (0.047)	0.127* (0.071)
Trade openness	0.202*** (0.030)	-0.019 (0.042)	-0.023 (0.032)	-0.028 (0.023)	-0.034 (0.031)	-0.037 (0.041)	-0.043 (0.062)
Green technology	-0.009 (0.011)	-0.212*** (0.025)	-0.208*** (0.019)	-0.201*** (0.013)	-0.195*** (0.018)	-0.190*** (0.024)	-0.183*** (0.037)
Fossil fuel dependency	0.603*** (0.026)	0.605*** (0.069)	0.584*** (0.051)	0.552*** (0.037)	0.519*** (0.050)	0.498*** (0.066)	0.462*** (0.101)
Environmental agreements	-0.010 (0.009)	0.012*** (0.004)	0.011*** (0.003)	0.008*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.002 (0.007)

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Source: Table by authors

	OLS	10th	25th	Quantiles 50th	75th	90th	99th
FDI intensity	-0.057* (0.030)	0.028 (0.029)	0.016 (0.022)	-0.002 (0.016)	-0.021 (0.021)	-0.032 (0.028)	-0.052 (0.043)
Electoral	-0.792*** (0.145)	0.399*** (0.127)	0.363*** (0.095)	0.308*** (0.068)	0.252*** (0.092)	0.216* (0.123)	0.155 (0.185)
FDI intensity × electoral	-0.099** (0.044)	-0.122*** (0.040)	-0.109*** (0.030)	-0.088*** (0.022)	-0.068** (0.029)	-0.055 (0.039)	-0.032 (0.059)
Industrial intensity	0.048 (0.031)	0.171*** (0.048)	0.165*** (0.036)	0.155*** (0.026)	0.145*** (0.035)	0.138*** (0.047)	0.127* (0.070)
Trade openness	0.202*** (0.030)	-0.019 (0.042)	-0.024 (0.032)	-0.030 (0.023)	-0.037 (0.030)	-0.041 (0.041)	-0.048 (0.061)
Green technology	0.002 (0.011)	-0.213*** (0.025)	-0.208*** (0.019)	-0.201*** (0.013)	-0.193*** (0.018)	-0.189*** (0.024)	-0.181*** (0.036)
Fossil fuel dependency	0.615*** (0.027)	0.608*** (0.069)	0.587*** (0.051)	0.553*** (0.037)	0.520*** (0.049)	0.498*** (0.066)	0.462*** (0.100)
Environmental agreements	-0.016* (0.009)	0.012*** (0.004)	0.011*** (0.003)	0.008*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.002 (0.006)

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$, *** $p < 0.01$
Source: Table by authors

Table 7.
Panel quantile
regression results for
electoral democracy

Table 8.
Panel quantile
regression results for
liberal democracy

	OLS	10th	25th	Quantiles			90th	99th
				50th	75th			
FDI intensity	-0.079*** (0.024)	0.013 (0.024)	0.002 (0.018)	-0.015 (0.013)	-0.033* (0.018)	-0.044* (0.024)	-0.064* (0.036)	
Liberal	-0.891*** (0.135)	0.375*** (0.127)	0.322*** (0.094)	0.242*** (0.068)	0.159* (0.091)	0.107 (0.122)	0.015 (0.186)	
FDI intensity \times liberal	-0.063 (0.041)	-0.121*** (0.038)	-0.105*** (0.028)	-0.082*** (0.020)	-0.058*** (0.027)	-0.042 (0.037)	-0.015 (0.056)	
Industrial intensity	0.042 (0.030)	0.173*** (0.048)	0.167*** (0.036)	0.156*** (0.026)	0.146*** (0.035)	0.139*** (0.047)	0.127* (0.071)	
Trade openness	0.197*** (0.030)	-0.019 (0.042)	-0.022 (0.032)	-0.027 (0.023)	-0.032 (0.031)	-0.036 (0.041)	-0.041 (0.062)	
Green technology	-0.012 (0.011)	-0.213*** (0.025)	-0.209*** (0.019)	-0.202*** (0.013)	-0.195*** (0.018)	-0.191*** (0.024)	-0.184*** (0.037)	
Fossil fuel dependency	0.602*** (0.026)	0.609*** (0.069)	0.588*** (0.051)	0.555*** (0.037)	0.522*** (0.050)	0.500*** (0.067)	0.463*** (0.101)	
Environmental agreements	-0.008 (0.009)	0.012*** (0.004)	0.011*** (0.003)	0.008*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.001 (0.007)	

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Source: Table by authors

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$
Source: Table by authors

	OLS	10th	25th	Quantiles 50th	75th	90th	99th
FDI intensity	-0.104*** (0.024)	0.008 (0.025)	-0.002 (0.019)	-0.016 (0.013)	-0.030* (0.018)	-0.039* (0.024)	-0.055 (0.036)
Participatory	-1.283*** (0.157)	0.527*** (0.159)	0.447*** (0.119)	0.319*** (0.085)	0.191* (0.114)	0.111 (0.152)	-0.033 (0.233)
FDI intensity \times participatory	0.003 (0.047)	-0.131*** (0.044)	-0.117*** (0.033)	-0.095*** (0.024)	-0.072** (0.032)	-0.058 (0.042)	-0.033 (0.065)
Industrial intensity	0.065** (0.030)	0.176*** (0.049)	0.168*** (0.037)	0.157*** (0.026)	0.145*** (0.035)	0.138*** (0.047)	0.124* (0.071)
Trade openness	0.177*** (0.030)	-0.017 (0.043)	-0.020 (0.032)	-0.024 (0.023)	-0.028 (0.031)	-0.031 (0.041)	-0.035 (0.063)
Green technology	0.005 (0.011)	-0.212*** (0.025)	-0.208*** (0.019)	-0.202*** (0.013)	-0.196*** (0.018)	-0.193*** (0.024)	-0.186*** (0.037)
Fossil fuel dependency	0.616*** (0.026)	0.597*** (0.069)	0.578*** (0.052)	0.548*** (0.037)	0.518*** (0.050)	0.499*** (0.066)	0.466*** (0.101)
Environmental agreements	-0.008 (0.009)	0.012*** (0.005)	0.011*** (0.003)	0.008*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.001 (0.007)

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Source: Table by authors

Inward foreign
direct
investment

Table 9.
Panel quantile
regression results for
participatory
democracy

Table 10.
Panel quantile
regression results for
deliberative
democracy

	OLS	Quantiles					90th	99th
		10th	25th	50th	75th			
FDI intensity	-0.050** (0.025)	0.005 (0.026)	-0.008 (0.019)	-0.029** (0.014)	-0.049*** (0.018)	-0.062** (0.025)	-0.083** (0.037)	
Deliberative	-0.746*** (0.136)	0.368*** (0.128)	0.317*** (0.097)	0.235*** (0.069)	0.155* (0.092)	0.104 (0.122)	0.017 (0.184)	
FDI intensity \times deliberative	-0.120*** (0.042)	-0.101** (0.039)	-0.084*** (0.029)	-0.056*** (0.021)	-0.028 (0.028)	-0.011 (0.037)	0.018 (0.056)	
Industrial intensity	0.035 (0.030)	0.175*** (0.049)	0.169*** (0.037)	0.159*** (0.026)	0.150*** (0.035)	0.144*** (0.046)	0.134* (0.069)	
Trade openness	0.195*** (0.030)	-0.017 (0.043)	-0.022 (0.032)	-0.030 (0.023)	-0.037 (0.030)	-0.042 (0.041)	-0.050 (0.061)	
Green technology	-0.011 (0.011)	-0.216*** (0.025)	-0.212*** (0.019)	-0.205*** (0.013)	-0.199*** (0.018)	-0.194*** (0.024)	-0.187*** (0.036)	
Fossil fuel dependency	0.595*** (0.026)	0.607*** (0.069)	0.587*** (0.052)	0.554*** (0.037)	0.523*** (0.049)	0.502*** (0.066)	0.468*** (0.098)	
Environmental agreements	-0.011 (0.009)	0.013*** (0.004)	0.011*** (0.003)	0.009*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.002 (0.006)	

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Source: Table by authors

	OLS	10th	25th	Quantiles 50th	75th	90th	99th
FDI intensity	-0.040 (0.025)	0.015 (0.024)	0.006 (0.018)	-0.008 (0.013)	-0.021 (0.017)	-0.030 (0.023)	-0.045 (0.035)
Egalitarian	-0.536*** (0.139)	0.396*** (0.139)	0.364*** (0.104)	0.314*** (0.075)	0.265*** (0.099)	0.232* (0.135)	0.179 (0.201)
FDI intensity \times egalitarian	-0.169*** (0.043)	-0.122*** (0.039)	-0.113*** (0.029)	-0.098*** (0.021)	-0.082*** (0.028)	-0.072* (0.038)	-0.055 (0.056)
Industrial intensity	0.028 (0.030)	0.172*** (0.048)	0.165*** (0.036)	0.154*** (0.026)	0.144*** (0.035)	0.137*** (0.047)	0.126* (0.070)
Trade openness	0.243*** (0.030)	-0.023 (0.042)	-0.026 (0.031)	-0.030 (0.023)	-0.033 (0.030)	-0.036 (0.041)	-0.040 (0.061)
Green technology	-0.033*** (0.011)	-0.207*** (0.025)	-0.203*** (0.019)	-0.196*** (0.014)	-0.190*** (0.018)	-0.185*** (0.025)	-0.178*** (0.037)
Fossil fuel dependency	0.572*** (0.026)	0.604*** (0.070)	0.583*** (0.052)	0.549*** (0.037)	0.515*** (0.050)	0.492*** (0.068)	0.456*** (0.101)
Environmental agreements	-0.010 (0.009)	0.012*** (0.004)	0.011*** (0.003)	0.008*** (0.002)	0.006* (0.003)	0.004 (0.004)	0.002 (0.006)

Notes: Standard errors in parentheses; all regressions include country-fixed effects; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$
Source: Table by authors

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Table 11.
Panel quantile
regression results for
egalitarian
democracy

Table 12.
Panel quantile
regression results for
event study

	OLS	10th	25th	Quantiles 50th	75th	90th	99th
<i>A: Composite democracy</i>							
FDI intensity	-0.067*** (0.025)	0.012 (0.025)	0.002 (0.019)	-0.014 (0.013)	-0.029 (0.018)	-0.039 (0.024)	-0.057 (0.037)
Democracy	-0.841*** (0.138)	0.404*** (0.131)	0.359*** (0.099)	0.286*** (0.070)	0.218** (0.094)	0.172 (0.126)	0.090 (0.195)
FDI intensity × democracy	-0.086** (0.042)	-0.117*** (0.039)	-0.104*** (0.029)	-0.082*** (0.021)	-0.062** (0.028)	-0.048 (0.038)	-0.024 (0.058)
<i>B: Electoral democracy</i>							
FDI intensity	-0.057* (0.030)	0.028 (0.030)	0.016 (0.022)	-0.001 (0.016)	-0.018 (0.021)	-0.049 (0.043)	-0.057* (0.030)
Electoral	-0.791*** (0.145)	0.398*** (0.128)	0.364*** (0.096)	0.310*** (0.068)	0.258*** (0.091)	0.166 (0.185)	-0.791*** (0.145)
FDI intensity × electoral	-0.099** (0.044)	-0.122*** (0.041)	-0.109*** (0.030)	-0.088*** (0.022)	-0.069** (0.029)	-0.034 (0.059)	-0.099 (0.104)
<i>C: Liberal democracy</i>							
FDI intensity	-0.078*** (0.024)	0.013 (0.024)	0.002 (0.018)	-0.015 (0.013)	-0.031* (0.017)	-0.042* (0.024)	-0.062* (0.037)
Liberal	-0.890*** (0.135)	0.371*** (0.127)	0.321*** (0.095)	0.242*** (0.068)	0.167* (0.090)	0.116 (0.123)	0.024 (0.190)
FDI intensity × liberal	-0.063 (0.041)	-0.120*** (0.038)	-0.105*** (0.028)	-0.081*** (0.020)	-0.059** (0.027)	-0.043 (0.037)	-0.015 (0.057)
<i>D: Participatory democracy</i>							
FDI intensity	-0.104*** (0.024)	0.007 (0.025)	-0.001 (0.019)	-0.015 (0.013)	-0.028 (0.017)	-0.037 (0.023)	-0.053 (0.036)
Participatory	-1.283*** (0.157)	0.520*** (0.160)	0.441*** (0.119)	0.317*** (0.085)	0.201* (0.112)	0.122 (0.151)	-0.020 (0.235)
FDI intensity × participatory	0.003 (0.047)	-0.130*** (0.044)	-0.116*** (0.033)	-0.094*** (0.024)	-0.073** (0.031)	-0.059 (0.042)	-0.034 (0.065)
<i>E: Deliberative democracy</i>							
FDI intensity	-0.049* (0.025)	0.005 (0.026)	-0.008 (0.019)	-0.028** (0.014)	-0.047** (0.018)	-0.059** (0.025)	-0.082** (0.038)
Deliberative	-0.745*** (0.136)	0.365*** (0.129)	0.316*** (0.097)	0.237*** (0.069)	0.161* (0.092)	0.112 (0.123)	0.023 (0.189)
FDI intensity × deliberative	-0.120*** (0.042)	-0.100** (0.039)	-0.083*** (0.029)	-0.055*** (0.021)	-0.029 (0.028)	-0.012 (0.037)	0.020 (0.058)
<i>F: Egalitarian democracy</i>							
FDI intensity	-0.039 (0.025)	0.015 (0.024)	0.006 (0.018)	-0.007 (0.013)	-0.019 (0.017)	-0.027 (0.023)	-0.041 (0.035)
Egalitarian	-0.535*** (0.139)	0.394*** (0.140)	0.364*** (0.104)	0.317*** (0.075)	0.273*** (0.100)	0.243* (0.134)	0.192 (0.203)
FDI intensity × egalitarian	-0.169*** (0.043)	-0.123*** (0.039)	-0.113*** (0.029)	-0.098*** (0.021)	-0.083*** (0.028)	-0.074** (0.037)	-0.057 (0.057)

Notes: Standard errors in parentheses; all regressions include country-fixed effects and time-fixed effects; control variables are not reported to save space; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$
Source: Table by authors

The impact of the varieties of democracy remains relatively similar and the findings are robust to the possibility that FDI inflows are volatile. The robustness check results reported in Table 12 validate the halo hypothesis in low- and high-carbon-intensive countries. It is likely that more democracy encourages FDI to reduce carbon intensity through green technology improvement (Wang *et al.*, 2021a, 2021b). MNEs internalize the negative environmental impacts linked to industrial production by facilitating the transfer of technology and the dissemination of technical knowledge from their foreign operations (Narula and Driffield, 2012). On top of that, democratic nations typically demonstrate better environmental performance than non-democratic counterparts, mainly because they tend to invest more in environmental technologies and climate governance (Bernauer and Koubi, 2009; Fredriksson and Wollscheid, 2007). Our findings suggest that host countries benefit from the technological development and innovation capacity of MNEs through “green FDI” (Kayalvizhi and Thenmozhi, 2018; Luo *et al.*, 2020; Narula and Dunning, 2000). Evidence shows that improving the democratization process in host countries favours environmental protection through high levels of foreign investments (Dryzek and Pickering, 2017; Pickering *et al.*, 2022). These results highlight that environmental governance and institutional quality in host countries are recognized as important factors in attracting FDI (Kolk and Fortanier, 2013). At the same time, economic stability, growth and strength of the economy can be linked to strong and inclusive democratic institutions in the host country (Acemoglu *et al.*, 2018). Political inclusive institutions protect all citizens and property rights avoiding that only a few people have access to resources. This leads to inclusive growth and social development, and the combination of market capitalism and democracy can complement each other to attract capital and investment in innovation (Jakobsen and De Soysa, 2006). In this context, new business opportunities are expected to drive MNEs to adopt successful corporate environmental practices and raise their environmental performance to achieve the SDGs (Kolk and Pinkse, 2008; Reid and Toffel, 2009; Sinkovics *et al.*, 2021).

Market capitalism and democracy follow different logic: profit-oriented trade within capitalism in contrast to the search for the common good within democracy (Merkel, 2014). But democracy does not exist without some form of free markets, hence navigating the right balance between global capitalism and democracy remains a critical task (Milner and Kubota, 2005). On top of that, MNEs use self-selection of markets to succeed and generate long-term value for their shareholders. In other words, although various forms of FDI seek out large markets with low international barriers, we expect differential effects regarding the type of FDI because they do not share the same determinants (Davies *et al.*, 2018). M&A's respond more to local institutional quality, whereas greenfield investments may be subject to selection into pollution havens and destination taxes. Moreover, it involves the transfer of ownership and assets for integration reasons, while greenfield FDI relies on firms' capacities and international expertise (Andersson and Svensson, 1994). The interplay between local government policies and foreign investors will likely shift in response to initiatives to attract FDI. Stricter regulations reduce new greenfield projects in polluting industries but have a much smaller impact on M&As (Bialek and Weichenrieder, 2021). Generally, economic interest and FDI profitability are present behind most, if not, all MNEs decisions to support foreign leaders and the political interests they represent (Aidt and Alborno, 2011).

Despite these limitations, the findings present evidence to claim that democratic political systems, that rest on a foundation of political equality among citizens and political legitimacy from public support, could help to accelerate a climate transformation (Pickering *et al.*, 2022). Indeed, political factors play a crucial role in the investment location decisions of

MNEs (Wisniewski and Pathan, 2014). In broad terms, countries that have ineffective governments, and do not promote free and transparent markets, usually receive less FDI (Globerman and Shapiro, 2003). Political freedom promotes market-oriented FDI, particularly through the channel of improving labour skills (Feng, 2001). Candidate-centred electoral systems increase political access for voters and industries supportive of FDI inflows (Garland and Biglaiser, 2008). Political hazards may affect the choice of market entry mode across MNEs based on the extent to which they face expropriation hazards from their contractual partners in the host country (Henisz, 2000). At the same time, the autonomy of regulatory agencies and legal institutions are important explanations for FDI (Raustiala, 1997). More democratic countries design electoral incentives to attract foreign investors as long as the median voter benefits from FDI (Basu *et al.*, 2023). Consequently, the non-interventionist principle of a free-market economy reduces the ability of governments to use the radical stance that is hostile to all FDI as a strategy for building political support (Milner and Kubota, 2005).

The results for the control variables included in the model are also informative. The coefficient of industry intensity and fossil fuel dependency are significant and positive across different quantiles. In contrast, trade openness has a negative coefficient but is never significant at the 5% level. These findings are consistent with those of Thombs (2022), Wei and Zhang (2020) and Dong *et al.* (2020) while in sharp contrast with those reported by earlier empirical studies (Dou *et al.*, 2021; Le *et al.*, 2016). As expected, green technology has the correct sign and is statistically significant at the 5% level in the lower and upper quantiles. An improvement in green technology leads to a reduction in carbon intensity, *ceteris paribus*. Overall, these findings suggest that investments in renewable energy, and economic activities increasingly disconnected from fossil fuel dependency, could enhance the transformative capacity of democracy towards a low-carbon future (Ghosh *et al.*, 2023; Lindvall and Karlsson, 2023). However, the coefficient of environmental agreements is positive and statistically significant at the 1% level in different quantiles. This is not consistent with our expectations and indicates that countries fail to comply with regulatory requirements and policy (Bratberg *et al.*, 2005; Finus and Tjøtta, 2003).

5. Conclusions and policy implications

This research aimed to explore the environmental effects of FDI and democracy on the carbon intensity of 160 host countries from 1980 to 2020. While prior research has predominantly concentrated on how democracy exerts a positive impact on FDI inflows, this paper highlights the influence of different democracy varieties on the relationship between inward FDI and the carbon intensity of the host country. This study explores the relationship between foreign investors and democracy, and the empirical evidence strongly supports the halo effect hypothesis. It has been found that various democracy types and FDI work together to decrease the carbon intensity of a host country, regardless of whether it is high or low in carbon intensity. This suggests that FDI, combined with promoting renewable energy and enhancing democratic institutions, could play a crucial role in achieving a future with lower carbon intensity.

The strength of these results has important implications for governments, foreign investors and international organizations. While empirical evidence shows that FDI and democracy can promote decarbonization, aspects such as green technology promotion can influence the outcome of environmental policy. Therefore, countries must strive to become more attractive destinations for FDI by improving the efficiency of the investment strategy to secure the long-term benefits of MNEs presence. Countries must design policies that enhance their effectiveness in attracting FDI across sectors with high potential for green

innovation while governments can catalyze the development and adoption of renewable energy technologies.

Scholars can further explore the differences between various types of democracies, which could have significant implications for foreign investors, by breaking down different forms of democracy into their constituent elements. This could help address an apparent gap in the literature on political risk related to FDI and different types of democracies. It could also provide insights into whether types of democracy matter more for FDI than other factors such as property rights and institutional factors. Furthermore, since the current study was limited by firm-level data availability, future empirical research can use more detailed types of FDI and MNEs to understand better firms' motivations and interactions with host institutions and foreign subsidiaries. Such research can help to understand the mechanisms behind cross-border transfer of environmentally sound technologies.

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Notes

1. The data is available at <https://fbellelli.com/ratification-data.html>
2. The data is available at www.v-dem.net/data/the-v-dem-dataset/

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Afghanistan	Georgia	North Korea
Albania	Germany	North Macedonia
Algeria	Ghana	Norway
Angola	Greece	Oman
Argentina	Guatemala	Pakistan
Armenia	Guinea	Panama
Australia	Guinea-Bissau	Paraguay
Austria	Honduras	Peru
Azerbaijan	Hong Kong	Philippines
Bahrain	Hungary	Poland
Bangladesh	Iceland	Portugal
Belarus	India	Qatar
Belgium	Indonesia	Romania
Benin	Iran	Russia
Bhutan	Iraq	Rwanda
Bolivia	Ireland	Sao Tome And Principe
Bosnia And Herzegovina	Israel	Saudi Arabia
Botswana	Italy	Senegal
Brazil	Jamaica	Serbia
Bulgaria	Japan	Sierra Leone
Burkina Faso	Jordan	Singapore
Burundi	Kazakhstan	Slovakia
Cambodia	Kenya	Slovenia
Cameroon	Kuwait	Somalia
Canada	Kyrgyzstan	South Africa
Cape Verde	Laos	South Korea
Central African Republic	Latvia	Spain
Chad	Lebanon	Sri Lanka
Chile	Lesotho	Sudan
China	Liberia	Sweden
Colombia	Libya	Switzerland
Comoros	Lithuania	Syria
Congo	Luxembourg	Tajikistan
Costa Rica	Madagascar	Tanzania
Cote d'Ivoire	Malawi	Thailand
Croatia	Malaysia	Togo
Cyprus	Mali	Trinidad And Tobago
Czech Republic	Malta	Tunisia
Democratic Republic of Congo	Mauritania	Turkey
Denmark	Mauritius	Turkmenistan
Dominican Republic	Mexico	Uganda
Ecuador	Moldova	Ukraine
Egypt	Mongolia	United Arab Emirates
El Salvador	Montenegro	United Kingdom
Equatorial Guinea	Morocco	USA
Eritrea	Mozambique	Uruguay
Estonia	Myanmar	Uzbekistan
Eswatini	Namibia	Venezuela
Ethiopia	Nepal	Vietnam
Fiji	The Netherlands	Yemen
Finland	New Zealand	Zambia
France	Nicaragua	Zimbabwe
Gabon	Niger	
Gambia	Nigeria	

Table A1.
List of countries

Source: Table by authors