

# **Ambidextrous Corporate Venture Capital and Green Innovation: Pathways to Environmental Performance**

**Fatima Shuwaikh**

**De Vinci Higher Education**

**De Vinci Research Center**

**Paris, France**

**fatima.shuwaikh@devinci.fr**

**ORCID: 0000-0001-7159-5898**

## **ABSTRACT**

This paper examines the influence of various ambidexterity tactics on green innovation among corporate investors. It explores how these investors might improve their environmental performance by acquiring green innovation through ambidextrous Corporate Venture Capital (CVC) investments. The study reveals that American corporate investors, totalling 126, can successfully leverage green innovation by making ambidextrous investments with entrepreneurial enterprises. Although static ambidexterity has negative effects, corporate investors who pursue dynamic ambidexterity or a combination of dynamic and static ambidexterity show enhanced outcomes in green innovation. The research demonstrates a clear connection between the green innovation of corporate investors and their enhanced environmental performance, particularly in terms of reducing greenhouse gas (GHG) emissions. The study contends that ambidextrous CVC investments serve as a gateway for corporate investors to elevate their environmental performance through the strategic acquisition of green innovation. Crucially, the results highlight that companies can enhance their environmental and Environmental, Social, and Governance (ESG) ratings by proactively adopting green innovation. This research provides significant insights for company managers, regulators, and government bodies, delivering practical knowledge for establishing environmentally friendly practices in corporate investment strategies.

**Keywords:** Exploitation, Exploration, Corporate Venture Capital, Static Ambidexterity, Dynamic Ambidexterity, Green Innovation, Environmental Performance

## INTRODUCTION

Numerous regions across the globe are currently facing the negative consequences of climate change, which are mainly caused by human activity. Between 2011 and 2020, there was a significant rise in the average global surface temperature of 1.1°C compared to the period from 1850 to 1900, which is a cause for concern (IPCC, 2023). In 2015, 196 countries came together to support the Paris Agreement, a collaborative commitment designed to strengthen the worldwide efforts to address climate change (The Paris Agreement | UNFCCC, 2021). Organizations have been increasingly pushed to prioritize environmental and social factors due to growing demand from institutions and consumers (Asiaei et al., 2023). The principal causes of global warming are the increasing levels of greenhouse gas (GHG) emissions worldwide, which result from poor energy use, harmful consumer behaviours, and excessive manufacturing. This conclusion was reached by the Intergovernmental Panel on Climate Change (IPCC) in 2023. As a result, firms have made commitments to reduce their GHG emissions, improve their environmental performance, and address the negative effects of this worrying trend shown in recent decades.

The concept of green innovation emerges as a proactive measure to tackle the environmental consequences of pollution (Chen, 2008). Green innovation refers to the specific actions taken by organizations to adopt product, marketing, and organizational innovations that have a good impact on the environment (Woo et al., 2014). This can be demonstrated by actions such as conserving energy or reducing material use (Dangelico, 2016). Kraus et al. (2020) suggest that green innovation can enhance enterprises' environmental performance by a maximum of 27%. Moreover, Yang et al. (2022) highlight that green innovation plays a crucial role in promoting a sustainable economy. In addition to the positive environmental effects of implementing green business strategies (H. Lin et al., 2021), green innovation is acknowledged as a feasible approach to improve firms' financial performance (Benkraiem et al., 2023, Shuwaikh et al. 2023). This comprehensive strategy not only tackles environmental issues but also enhances the long-term financial viability and competitiveness of firms in the modern context.

Prior studies have defined ambidexterity as a company's ability to participate in both exploratory and exploitative endeavours (Lavie et al., 2010; O'Reilly and Tushman, 2013). Exploration encompasses groundbreaking innovation (Tushman & O'Reilly, 1996) and the process of experimentation (Baum et al., 2000), whereas exploitation is associated with gradual innovation (Tushman & O'Reilly, 1996) and the act of refinement (Baum et al., 2000). Exploitation leads to the improvement of expertise, skills, productivity, and cash flows, while exploration is linked to research, innovation, experiments, and creativity, which contribute to long-term financial advantages (March, 1991; Mazzelli et al., 2018).

The implementation of these strategies necessitates a trade-off, as they demand distinct resources, knowledge, and capabilities (He & Wong, 2004; March, 1991; Turner et al., 2013). When confronted with limited resources, companies must make judicious choices regarding the allocation and distribution of these resources. Hence, the careful consideration of the strategic decision between exploration and exploitation is imperative. Literature on ambidexterity considers it a key strategy to guide firms towards success (Rossi et al., 2021), functioning as a means to capture innovation (Roth & Corsi, 2023), while simultaneously improving corporate environmental performance (L.-H. Lin & Ho, 2016).

Although there is a widespread agreement regarding the beneficial effects of ambidexterity on the performance of companies, there is still an ongoing debate in the literature about the most effective form of ambidexterity, with no clear consensus (Jansen et al., 2006)). The absence of agreement among experts has resulted in a situation where companies do not have clear instructions on how to strike the right balance between exploration and exploitation (Lubatkin et al., 2006). As a result, they have resorted to implementing different forms of ambidexterity, which may restrict the complete range of advantages it can provide (Shuwaikh et al., 2022). Historically, the main emphasis has been on achieving balanced or static ambidexterity, as discussed by Gupta et al. (2006), Levinthal and March (1993), and Raisch and Birkinshaw (2008). More recently, the concept of dynamic ambidexterity has been introduced, as highlighted by Shuwaikh et al., (2022) who enhance the ongoing discussion by examining various manifestations of ambidexterity, providing insight into the debate surrounding the most effective form.

This study is groundbreaking because it is the first to investigate the connection between ambidexterity, green innovation, and environmental performance in the specific context of

Corporate Venture Capital (CVC) investments. The fundamental idea is based on the belief that corporations can utilize ambidexterity strategies to "acquire" green innovation by implementing CVC programs and making investments in entrepreneurial ventures. As a result, these "acquired" green innovations can be utilized to improve the environmental performance of the parent companies, making them more sustainable, in line with customer expectations, and compliant with environmental and social regulations.

Customers across various industries and markets are increasingly expecting more innovative products and services from companies. Additionally, the competitive landscape requires companies to improve their operational efficiency (Turner et al., 2013). CVC investments enable corporate investors to access and benefit from innovation (Maula et al., 2013; Shuwaikh & Dubocage, 2022; Wadhwa et al., 2016). Additionally, these investments "open the gates" and provide an opportunity for companies to enhance their environmental performance by reducing GHG emissions (Battisti et al., 2022; Benkraiem et al., 2023, Shuwaikh et al. 2023). Since 1960, this form of investment has consistently gained prominence in the venture capital industry (Chemmanur et al., 2014). CVC refers to the practice of established companies making long-term equity investments in start-ups (Shuwaikh et al. 2023). CVCs are distinguished by the lack of performance-based compensation schemes (Jeon & Maula, 2022).

Unlike Independent Venture Capital funds, which are limited partnerships focused solely on financial returns and have a time frame of 10 years, CVC is associated with corporations and has a different investment approach. CVC investments are the outcome of merging strategic and financial goals. Both corporations and start-ups can benefit from this form of investment. Entrepreneurial firms derive advantages from expert counsel, funding, and opportunities to connect with networks and corporate assets (Shuwaikh & Dubocage, 2022). Corporations exploit external sources of innovation (Rossi et al., 2017) by leveraging new ideas and potential strategic opportunities (Alvarez-Garrido & Dushnitsky, 2016; Rossi et al., 2017; Paolo & Shuwaikh, 2022). In addition, CVC programs are recognized as effective means to accomplish corporate social responsibility (CSR) goals due to their substantial advancements in resources, processes, and expertise propelled by innovation (Battisti et al., 2022). Given these characteristics, we deem the empirical context of CVC investments appropriate for conducting this research. Exploitative CVC investments, in this context, refer to investments made in companies that have a business model that is either similar or identical to that of the parent company (Wadhwa & Basu, 2013).

Conversely, exploratory CVC investments refer to investments made in companies that have a business model that is entirely distinct from that of the parent company (Hill & Birkinshaw, 2014).

The investigation of the relationship between ambidexterity, green innovation, and environmental performance in the context of CVC investments is a unique contribution to the ongoing advancement of these theories. The thesis highlights two significant deficiencies in the current body of literature, which serve as the impetus for our research efforts. Prior research has examined the positive effects of ambidextrous CVC investments on the financial performance of firms (Shuwaikh et al., 2022). However, the impact of these investments on green innovation has not been investigated. Given the understanding that green innovation can significantly improve a company's environmental performance, it is crucial to examine the impact of ambidexterity in this area.

Furthermore, previous studies, such as the one conducted by Benkraiem et al. (2023), have shown a clear correlation between advancements in green innovation and improved environmental performance. Nevertheless, this study is constrained by its dependence on a solitary metric of environmental performance. In order to overcome this constraint, our research endeavours to enhance the analysis by integrating diverse environmental performance metrics. In addition, we aim to strengthen the study's reliability by incorporating lagged dependent variables and analysing data from various time periods, including before, during, and after the global financial crisis. This comprehensive approach aims to provide a detailed and diverse understanding of the complex interactions between ambidexterity, green innovation, and environmental performance in the field of CVC investments.

Our research is groundbreaking as it is the first paper to thoroughly examine the relationship between ambidexterity, green innovation, and environmental performance in the specific context of CVC investments. Our study analyses data from 126 CVC investors between 2002 and 2021. It contributes significantly to the ongoing discussion on the most effective way to achieve ambidexterity. The findings support the dynamic approach suggested by Shuwaikh (2018) and Shuwaikh et al. (2022). Our research supports the use of a sophisticated approach where companies strategically combine exploratory and exploitative CVC investments, demonstrating dynamic ambidexterity to improve their environmentally friendly innovation. We argue that relying exclusively on static ambidexterity can hinder companies' green innovation

endeavours, unless it is accompanied by a simultaneous implementation of dynamic ambidexterity. This work highlights that the simultaneous application of both static and dynamic ambidexterity has a synergistic effect on firms' green innovation.

The findings of our study have broader implications that go beyond a simplistic binary perspective. This research challenges the notion of completely disregarding the concept of static ambidexterity, as suggested by Gibson & Birkinshaw (2004) and O'Reilly & Tushman (2008). The findings support the idea of combining static ambidexterity with dynamic practices in order to maximize the benefits of ambidextrous CVC investments. Our analysis confirms that the negative impact of static ambidexterity becomes stronger over time, while the dynamic and combined effects show improvement. In addition, our examination conducted over various time periods, including before, during, and after the global financial crises (GFC), produces noteworthy findings particularly for the post-GFC subset, thereby confirming the reliability and significance of our conclusions.

Our study on the influence of green innovation on environmental performance makes a substantial contribution to the ongoing discussion on effective corporate strategies in addressing increasing demands from customers and regulators to reduce environmental impacts. The results of our study support and expand upon the conclusions of Benkraiem et al. (2023), highlighting the fact that companies can significantly improve their environmental performance by promoting green innovation. Importantly, our results are strong and consistent, showing that they remain stable over time. This reinforces the long-term sustainability and effectiveness of prioritizing green innovation as a major factor in improving the environment. Our study reveals a complex pattern during the GFC, where green innovation initially harmed firms' environmental performance, but later resulted in a positive impact after the GFC. The inclusion of this temporal aspect enhances our comprehension of the complex correlation between green innovation and environmental results within the framework of economic downturns. In addition, our investigation goes beyond conventional measures, uncovering a favourable influence of green innovation not only on environmental performance but also on more comprehensive indicators such as ESG and Environmental Pillar scores. The holistic nature of green innovation's positive influence on corporate sustainability and responsibility is highlighted by this broader perspective.

The primary significance of our study stems from the amalgamation of two pivotal components: ambidexterity strategies and CVC investments. The results of our study highlight

the ability of corporate investors to strategically utilize ambidexterity in their CVC activities. By doing so, they can effectively use this approach to obtain the green innovation needed to make significant improvements in environmental performance. This discovery highlights ambidextrous CVC investments as a strategic opportunity for corporate investors to improve their environmental reputation by incorporating green innovation. Through the implementation of ambidextrous CVC investments, companies strategically avoid potential penalties from investors (Lee et al., 2015) while simultaneously enhancing their financial performance (Benkraiem et al., 2023). This strategic alignment not only enhances immediate benefits but also establishes a solid basis for long-term viability, fulfilling and even exceeding customers' changing demands. The comprehensive methodology of ambidextrous CVC investments, as revealed in our research, therefore emerges as a versatile strategy that harmonizes financial, sustainability, and customer satisfaction goals for corporate investors.

This paper is divided into 6 sections. Following the introduction, Section 2 presents the literature review. The data selection and the methodology are presented in Section 3. Following section 3, we describe and discuss the empirical results in section 4. Lastly, we present the conclusions, highlighting the opportunities for future research and our limitations in Section 5.

## **LITERATURE REVIEW**

### **Conceptualizing Ambidexterity**

The allocation of resources by firms is influenced by exploration and exploitation activities. Although fundamentally different, these activities are considered learning actions (March, 1991). As a result, the distinction between exploration and exploitation is our starting point to conceptualize our research. Exploitation comprises activities that are related to “refinement, production, efficiency, selection, implementation, and execution” while activities that include “search, variation, risk taking, experimentation, play, flexibility, discover, [and] innovation” are associated to exploration (March, 1991).

Organizational learning is also studied by Gupta et al. (2006) who added three important contributions to the literature. Firstly, they explain how exploration and exploitation deal with scarcity of resources. A trade-off in resource allocation between exploration and exploitation is inevitable, as both strategies require resources from the same pool (March, 1991). In addition,

similarly to other studies, we assume exploration and exploitation as two ends of the same continuum (Gupta et al., 2006; Phelps, 2010). Distant search is seen as exploration and local search as exploitation. Hence, at any given point in time, both activities are going to be influenced by the allocation of resources (Dushnitsky & Lenox, 2006). Therefore, the greater the amount of resources allocated to exploration, the smaller the amount of resources remaining for exploitation, and vice-versa (Shuwaikh et al., 2022). Secondly, there is a self-reinforcing effect of exploration and exploitation because the focus on exploration fosters further exploration while the concentration on exploitation leads to additional exploitation. This self-reinforcing effect can significantly reduce the benefits of both activities. The focus on exploration makes firms more likely to underperform as they reduce the focus on their operations and focus solely on experimentation and discovery. On the other hand, by concentrating on exploitation, companies become obsolete because they do not follow the technological innovation and lose competitiveness in the market. Thirdly, the structure, organisational routines and mindsets required for the two activities are completely different (O'Reilly & Tushman, 2013). These differences create pressures from both sides that make it difficult to maintain a balance between the two activities.

As a result, ambidexterity has been conceptualized as the ability to manage the tension between exploration and exploitation activities (Raisch & Birkinshaw, 2008), and the ability to match or simultaneously pursue them (He & Wong, 2004; Lavie et al., 2010; Raisch & Birkinshaw, 2008).

The optimal level of ambidexterity and the comparison between companies depends on the definition of ambidexterity. If we define ambidexterity as the balance between exploitation and exploration, the more equal the levels of exploitation and exploration, the more ambidextrous the companies. This form of ambidexterity can be computed as the absolute difference between exploitation and exploration (He & Wong, 2004). On the other hand, if we define ambidexterity as the combined degree of exploration and exploitation, the higher the degrees of these activities, the more ambidextrous is a firm. This type of ambidexterity results from the sum or the product between the degrees of exploration and exploitation (Gibson & Birkinshaw, 2004; He & Wong, 2004; Lubatkin et al., 2006).

There is not a consensus regarding the optimal approach of ambidexterity that firms should pursue. Firms are divided between balancing or maximising the exploration and

exploitation, limiting the benefits that ambidexterity can bring them, which motivates our research in this area.

## **Natural Resource Based View Theory and Green Innovation**

The Resource Based View (RBV) suggests that the development of competitive advantages requires the possession of non-substitutable, imitable, rare and valuable resources (Barney, 1991; Wernerfelt, 1984), but does not address the restrictions of the natural environment. As a result, the Natural Resource Based View (NRBV) theory was developed to complement it arguing that there is a relationship between skills, resources, and firm's natural environment.

According to the NRBV theory, firms with unique heterogeneous resources own competitive advantages (Barney, 1991; S. L. Hart, 1995). This framework focuses on three dimensions with different environmental benefits which are pollution prevention, product management, and sustainable development (S. Hart & Dowell, 2011; S. L. Hart, 1995). It suggests that, while striving for long-term success, companies should also be concerned about preserving the natural environment, using resources and skills with a longer-term view rather than focusing on short-term results. Hence, sustainable products and technologies are fundamental to the development of firms' competitive advantage.

The market, customers, governments and regulators are putting firms under pressure to develop technologies that create innovative products and processes to improve energy efficiency and reduce their environmental footprint (Dangelico & Pujari, 2010). According to "the Porter Hypothesis", regulators play a very important role as environmental laws can contribute to the development of innovative environmental activities while promoting economic outcomes (Shuwaikh et al. 2023). With flexible laws, firms can reduce or even offset the additional costs of complying with environmental policies through the innovations they develop (Porter & van der Linde, 1995).

According to the NRBV theory, firms can develop competitive advantages and improve their financial performance as long as they are able to manage environmental issues effectively (Hart & Dowell, 2011). This theory provides a framework to analyse the different technological innovations that firms can use to mitigate the impact of environmental pressures, based on firms' relationship with the natural environment. Battisti et al. (2022) highlighted that this framework is suitable for assessing the relationship between firms' environmental activities and their climate

change policies. We believe that this theoretical background is suitable for our research as it opens a window to explore the relationship between green innovation and firms' environmental performance.

### **Static Ambidexterity Concept**

Balancing exploration and exploitation have been the main topic of discussion regarding ambidexterity. However, its benefits depend on their impact on firm performance (Hill & Birkinshaw, 2014). Previous research has highlighted the positive effect of balancing the two activities on firm's financial performance (Levinthal & March, 1993). The positive contribution will continue due to the self-reinforcing effect of ambidexterity because when companies achieve the balance between exploration and exploitation, they will easily achieve it in subsequent periods.

The way to achieving the balance between exploration and exploitation has been discussed in the literature and the idea of striking the right balance has been widely used (Gupta et al., 2006; Raisch & Birkinshaw, 2008). Using this mechanism to set ambidexterity, previous research has found that ambidextrous firms are able to enhance their performance (Boumgarden et al., 2012; Hill & Birkinshaw, 2014; Rossi et al., 2021). Therefore, with similar degrees of exploration and exploitation, firms can effectively improve their organisational performance (Cao et al., 2009). They should seek new knowledge and new capabilities to develop innovative solutions and, thereby, maximise their future cash flows. On the other hand, they should use their current resources and capabilities to improve their current performance and increase their chances of continuity (Levinthal & March, 1993).

There is empirical evidence that a balanced ambidexterity has greater impact on sales, revenues and operating competence (Cao et al., 2009; He & Wong, 2004), while an imbalance approach lead to additional risk to firms' performance (Levinthal & March, 1993). Despite the positive impact on short-term performance, firms should be aware that the exploitation of current resources and capabilities will not provide them with long-term sustainable competitive advantages because they will not capture innovative technologies (Tushman & Anderson, 1986) and their current resources and capabilities may become obsolete in the short-term (Christensen & Overdorf, 2000). With this argument, the authors do not exclude exploitative activities, because if firms focus only on exploration the failure rate is even higher due to the high costs of experimentation, research or discovery, which in turn increases the risk of becoming unprofitable.

In our research the balance between exploitation and exploration activities is conceptualised as static ambidexterity. We hypothesise that if firms decide to adopt a static approach of ambidexterity by striking a balance between explorative and exploitative CVC investments, they will capture green innovation. Therefore, our first hypothesis is as follows:

*Hypothesis (1): Static Ambidexterity positively impacts corporate investors' green innovation performance.*

## **Dynamic Ambidexterity Concept**

Previous research has conceptualized simultaneous ambidexterity as the simultaneous pursuit of both exploration and exploitation in the same period (Gupta et al., 2006). This form of ambidexterity provides firms with the opportunity to strengthen current cash flows through productivity improvements achieved with current skills and knowledge, while enhancing future cash flows through experimentation, innovation (March, 1991). Firms should combine both activities, otherwise they will face serious problems in taking a long-term view because resources may become obsolete if they focus only on specialization. On the other hand, they may risk becoming unprofitable and, thus, failing if they focus exclusively on external activities and ignore their own operations (Levitt & March, 1988). Focusing on exploitation or exploration will certainly lead to poor performance (Belderbos et al., 2010; Uotila et al., 2009) and the survival of companies may be threatened due to the self-reinforcing effect of exploration and exploitation (March, 1991).

CVC investments are considered a mechanism to acquire innovation. There is empirical evidence that CVC investment can and does improve a company's innovation performance (Dushnitsky & Lenox, 2005, 2006). In addition, previous research has also highlighted the possibility of using explorative and exploitative strategies when firms make their CVC investments (Hill & Birkinshaw, 2014; Wadhwa & Basu, 2013). While exploitative CVC investments are those made in companies with a high degree of similarity to the parent firm's business model (Wadhwa & Basu, 2013), explorative CVC investments are those made in companies with completely different business models (Hill & Birkinshaw, 2014).

The positive effect of jointly pursuing explorative and exploitative CVC investments on firms innovation results from the complementary use of both activities (Hill & Birkinshaw, 2014). By investing in companies with a similar business model, corporate investors capture incremental innovation using or combining the technologies owned by these companies. On the

other hand, if they invest in completely different companies, they will explore opportunities for new technologies, capturing radical innovation.

In our research we conceptualize dynamic ambidexterity as the ability of simultaneously pursue explorative and exploitative CVC investments. Based on this theoretical framework, we formulate our second hypothesis:

*Hypothesis (2): Dynamic Ambidexterity positively impacts corporate investors' green innovation performance.*

### **Combining Static and Dynamic Ambidexterity**

Some authors have highlighted the benefits of the interaction between two forms of ambidexterity, arguing that this interaction can yield in a synergistic effect on organisational performance.

Cao et al. (2009) introduced the view of measuring ambidexterity as an interaction model between different types of ambidexterity. Based on a survey of 122 technology organisations, they argue that the simultaneous pursue of combined (i.e., dynamic ambidexterity in our study) and balanced ambidexterity has a synergistic effect on organizational performance. They emphasise that the benefits of high levels of combined ambidexterity (i.e. dynamic ambidexterity) can be enhanced by employing high levels of balanced ambidexterity. Using our definitions of ambidexterity, they argue that high levels of both static and dynamic ambidexterity, lead to a more effective allocation of the current resources and knowledge to acquire new capabilities. In addition, high levels of the two types of ambidexterity, allow firms to better integrate the new knowledge and resources into the existing set of competences. They also highlight that, although used together, the lowest performance is achieved when high levels of combined ambidexterity (i.e., dynamic ambidexterity) and low levels of balanced ambidexterity are employed. Therefore, when firms combine static and dynamic ambidexterity, they should employ high levels of both forms of ambidexterity otherwise they risk getting the worse performance.

Following the idea of measuring ambidexterity with an interaction model, Shuwaikh et al. (2022) found a synergistic improvement in firms' financial performance motivated by the interaction between simultaneous and balanced ambidexterity. They found strong empirical evidence of the positive impact of simultaneously pursue balanced and simultaneous ambidextrous CVC investments on corporate investors financial performance.

Capturing ambidexterity in an interaction model motivates insight into the impacts of interactions of different ambidexterity forms on organizational performance. Therefore, we hypothesise that, when investing in entrepreneurial companies, corporate investors should simultaneously pursue static and dynamic ambidexterity in order to synergistically capture green innovation. As a result, our third hypothesis is as follows:

*Hypothesis (3): The combined pursuit of Static and Dynamic Ambidexterity synergistically effects corporate investors green innovation performance.*

## **Green Innovation and Environmental Performance**

The concept of green innovation is related to new technologies that conserve energy, reduce the consumption of fossil fuels and water, reduce air pollution or resources wasted (Kraus et al., 2020). Companies' products, marketing and organisational innovations have been conceptualised as firms' green innovation as long as it significantly reduce their environmental footprint (Chen, 2008; Woo et al., 2014) either by consuming less energy or fewer materials (Dangelico, 2016).

In addition, using 297 large manufacturing firms, Kraus et al. (2020) suggested that green innovation can enhance firms' environmental performance by 27%. By integrating environmental practices in corporate strategies through green innovation, firms can consolidate a competitive advantage (De Marchi et al., 2022). Previous research focused on CVC investments has found that improvements in green innovation lead to improvements in financial performance (Benkraiem et al., 2023), which may compensate the high costs of becoming green. Furthermore, according to past literature, there is a positive impact of CVC programs on firm's environmental and social performance (Battisti et al., 2022) and green innovation can be used to increase corporate investors environmental performance (Benkraiem et al., 2023).

Other relevant studies have examined other tools that can effectively reduce firms' environmental impact. Chang & Gotcher (2020) defined environmental innovation ambidexterity as the "capability to simultaneously achieve efficient exploitation and effective exploration to contribute to a reduction of environmental impacts" and argued that environmental innovation ambidexterity can bring firms eco-innovation, strengthening the perspective of the dynamic capabilities (O'Reilly & Tushman, 2008). There is also empirical evidence that green supplier integration not only improves financial performance, but also environmental performance (Zhao et al., 2021).

Based on this background we aim to test if green innovation can drive corporate investors towards a better environmental performance. If we succeed finding this positive relationship, we will argue that ambidextrous CVC investments, provide corporate investors a gateway to enhance their environmental performance through the “acquisition” of green innovation. As a result, the fourth hypothesis of this study is presented bellow:

*Hypothesis (4): In the context of CVC investment, parent firms’ green innovation performance contributes to enhance their environmental performance.*

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## **DATA & METHODOLOGY**

### **Empirical Setting**

The hypotheses discussed are tested under the empirical setting of CVC investments. Hence, to conduct this study, we use U.S. firms that have made venture capital investments between 2000 and 2019 and have invested in green innovation from 2000-2021. U.S. firms are the most active in terms of VC investments (Benkraiem et al., 2023) and we focus on 2002-2021 as Refinitiv Eikon only provides environmental data from 2002 onwards.

Firstly, from Refinitiv Eikon, more specifically from the Private Equity screener, we downloaded firms that made at least one CVC investment. Secondly, from PATSTAT, we extracted firms with green innovation. When applicable we consider the parent firm name. Then, we merged the two data sets, matching firms that have CVC investments and green innovation. In the matching process, we assumed that each CVC investment made is going to benefit from corporates’ green innovation in the subsequent periods. Then, from Refinitiv Eikon, we extracted financial, accounting, and environmental data which was added to the merged dataset. The final sample comprises 126 CVC firms, 638 CVC investments and 7780 observations.

## Measures

### *Dependent Variables*

We considered GHG emissions to measure firms' environmental performance as it has been the main driver for global warming (IPCC, 2023). The total CO<sub>2</sub> Equivalents Emissions (in tons) are considered to measure the GHG emissions because it accounts in "79% of all U.S. greenhouse gas emissions from human activities" (US EPA, 2015). To measure environmental performance we compute the natural logarithm of GHG emissions ( $GHG_{it}$ ) to avoid a significant tail risk (Benkraiem et al., 2023) and the GHG per unit of revenue ( $GHG/rev_{it}$ ) to reflect the GHG emissions intensity (Bose et al., 2021; Busch & Hoffmann, 2011). In addition, to facilitate the interpretation of the results, the input variable is multiplied by (-1) (Busch & Hoffmann, 2011). This methodology is used to align the positive directions of the independent variables as lower GHG emissions are associated with better environmental performance.

$$GHG_{it} = (-1) * \ln(CO2_{it}) \qquad GHG/rev_{it} = (-1) * \frac{GHG_{it}}{Revenues_{it}}$$

### *Independent Variables*

The first set of variables measures firms' ambidexterity. Following previous studies (Lavie et al., 2010; March, 1991; Phelps, 2010; Shuwaikh et al., 2022), we start by computing the degrees of exploration and exploitation based on the SIC codes for the pairs of firms and companies. With this approach, we use the SIC code to assess the level of business relatedness between parent firm and funded company.

The degrees of exploration and exploitation range from zero to one, and their sum must be equal to one. We consider pure exploitation when the four digits of the SIC code of the firm and the company are the same, which means that the exploitation degree is 1 and the exploration degree is 0. If the first three digits are the same, we have 0.75 of exploitation degree and 0.25 of exploration degree. The degrees of exploitation and exploration are equal to 0.5 when the first 2 digits are the same. We consider pure exploration when all four digits are completely different, which means that the exploration degree is 1 and the exploitation degree is 0.

After computing the degrees of exploration and exploitation for each CVC investment the share of explorative and exploitative CVC investments out of the total CVC investment must be computed.

As a first step, we compute the explorative CVC investment performed by each firm at each point in time (*Explorative CVC<sub>it</sub>*). It is computed as the sum of the products between the degrees of exploration and the CVC investment amounts at each point in time for each company. In other words, the explorative CVC investment represents the sum of the different explorative CVC investments made by a firm in a certain year, which are computed as the product between the exploration share in that investment and its CVC investment amount.

$$\mathbf{Explorative\ CVC}_{it} = \mathbf{Exploration\ degree}_{it} * \mathbf{CVC\ investment\ amount}_{it}$$

For the second step, we compute the exploration share (*CVC Exploration Share<sub>it</sub>*), as the proportion of explorative CVC investments out of total CVC investments for each firm at each point in time.

$$\mathbf{CVC\ Exploration\ share}_{it} = \frac{\mathbf{Explorative\ CVC}_{it}}{\mathbf{Total\ CVC\ investment}_{it}}$$

At this point, we have the exploration share of the CVC investments performed by each firm at each point in time, therefore computing the exploitation share of CVC investments is the final step. The exploitation share (*CVC Exploitation Share<sub>it</sub>*) is easily computed because the sum of exploitation and exploration shares must be equal to 1.

$$\mathbf{CVC\ Exploitation\ share}_{it} = 1 - \mathbf{CVC\ Exploration\ share}_{it}$$

With the CVC exploration and exploitation shares for each firm in each year, we are finally able to compute ambidexterity variables.

Following previous research static ambidexterity (*Static<sub>it</sub>*) may be computed as the absolute value of the difference between exploration and exploitation shares (He & Wong, 2004; Shuwaikh et al., 2022). This variable measures how a firm balances exploitative and explorative investments.

$$\mathbf{Static}_{it} = |\mathbf{CVC\ Exploration\ Share}_{it} - \mathbf{CVC\ Exploitation\ Share}_{it}|$$

A value of static ambidexterity equal to 0 occurs when the CVC investment amount is equally allocated to both explorative and exploitative investments. This requires that CVC exploration and exploitation shares are 0.5. The opposite, a value for static ambidexterity equal to 1, occurs when the CVC investment amount is entirely allocated for explorative or exploitative investments.

Dynamic ambidexterity (*Dynamic<sub>it</sub>*) is the interaction of the explorative and exploitative shares (Gibson & Birkinshaw, 2004; He & Wong, 2004; Shuwaikh et al., 2022). This variable measures how firms pursue simultaneously explorative and exploitative investments.

$$\mathbf{Dynamic}_{it} = \text{CVC Exploration Share}_{it} * \text{CVC Exploitation Share}_{it}$$

The dynamic ambidexterity ranges from 0 to 0.25. It is 0 when the total of the CVC investment amount is allocated for explorative or exploitative investments, and it is 0.25 when the CVC investment amount is equally distributed over the two types of CVC investment.

The combination of the two types of ambidexterity ( $Combined_{it}$ ), measures the interaction between static and dynamic ambidexterity (Cao et al., 2009; Shuwaikh et al., 2022). This variable aims to study how firms try to balance their exploitative and explorative CVC investments while, at the same time, they are simultaneously investing in explorative and exploitative investments.

$$\mathbf{Combined}_{it} = \text{Static}_{it} * \text{Dynamic}_{it}$$

The second set of independent variables measures green innovation. Although some scholars use R&D expenditures to measure companies' innovation, the recent literature has used patent-based variables (Kogan et al., 2017; Seru, 2014) arguing that it is a better proxy because “they capture the actual innovation output and capture how effectively a firm has used its innovation inputs “ (Chemmanur et al., 2014; Shuwaikh & Dubocage, 2022). To measure green innovation we considered the number of green patent applications ( $Count_{it}$ ) in each year as well as the subsequent number of citations ( $Citations_{it}$ ) following (Kogan et al., 2017; Yang et al., 2022), allowing either a quantitative or qualitative analysis. Then, before taking the natural logarithm of these patent-based variables, we add one to avoid losing firm-year observations with zero patents or zero citations per patent (Chemmanur et al., 2014; Ma, 2020).

$$\mathbf{Count}_{it} = \ln(1 + \text{count}_{it}) \qquad \mathbf{Citations}_{it} = \ln(1 + \text{citations}_{it})$$

### **Control Variables**

As control variables, we include a set of nine control variables that may affect green innovation and environmental performance. Additionally, we control with firm-fixed effects to control for non-observed changes in the macroeconomic environment which are not related to green innovation or environmental performance. Moreover, to allow the comparison of firms in the same years, we also add year-fixed effects to the models ensuring that in a certain year, all firms are affected by the same macroeconomic effects.

Previous research suggest firm's size ( $SIZE_{it}$ ), computed as the logarithm of total assets, and number of employees ( $EMP_{it}$ ) (Dang et al., 2018; Ioannou & Serafeim, 2012; Miska et al., 2018) because larger firms tend to have a better environmental performance than smaller ones. Moreover, we control for R&D intensity ( $INV_{it}$ ) using the ratio of R&D expenses to total sales,

because some scholars have used R&D expenditures as a measure of firms' innovativeness (Becker-Blease, 2011). We also control for capital intensity ( $CAP_{it}$ ) using the ratio CAPEX to total assets. In addition, we also control for net profit ( $NPT_{it}$ ) and leverage ( $LEV_{it}$ ), using debt to asset ratio (Campbell, 2007; Ioannou & Serafeim, 2012). We also control for absorbed slack resources ( $ABS_{it}$ ), computed as the ratio between SGA expenses and total sales, which are administrative resources that remain from short-term transactions (Singh, 1986). Unabsorbed slack resources ( $UABS_{it}$ ), measured as the current ratio of the firm, are also included as control variable representing the financial resources that the firm needs to run its daily operations (Singh, 1986). To finish, we control for potential slack resources ( $POT_{it}$ ), computed as the ratio between total liabilities and the book value, since it demonstrates the firm ability to raise new financial resources (Bourgeois, 1981).

### ***Estimation Approach***

The estimation approach is based on panel linear regression models with firm and year-fixed effects. Firstly, we test our hypothesis and then, we perform some additional analysis to assess the robustness of our results. We use alternative dependent variables, we lag the dependent variables three periods, and we also study how the results change over different subsamples: before, during and after the global financial crisis.

To assess the impact of ambidexterity on green innovation we use the empirical model presented below where  $GI_{it}$  represents green innovation, measured by  $Count_{it}$  and  $Citations_{it}$ , and  $AMB_{it}$  represents ambidexterity, which is measured by  $Static_{it}$ ,  $Dynamic_{it}$  and  $Combined_{it}$ .

$$Equation(1): GI_{it} = AMB_{it} + SIZE_{it} + LEV_{it} + ABS_{it} + UABS_{it} + POT_{it} + EMP_{it} + NPT_{it} + CAP_{it} + INV_{it} + \sum FIRM_i + \sum YEAR_t$$

In addition, to address the impact of green innovation on environmental performance, we use the following empirical model where the dependent variable  $ENV_{it}$  represents environmental performance measured by  $GHG/rev_{it}$ ,  $GHG_{it}$  and the independent variable  $GI_{it}$  represents green innovation which is measured by  $Count_{it}$  and  $Citations_{it}$ .

$$Equation (2): ENV_{it} = GI_{it} + SIZE_{it} + LEV_{it} + ABS_{it} + UNA_{it} + POT_{it} + EMP_{it} + NPR_{it} + CAP_{it} + INN_{it} + FIRM_{it} + YEAR_{it}$$

## **RESULTS**

## Descriptive Statistics and Correlations

Based on the descriptive statistics presented in Table 1, we highlight that most of the firms selected do not invest the same proportions in explorative and exploitative CVC investments since the median for static and dynamic ambidexterity is 0.89 and 0.05, respectively. We also observe that the majority of firms' green patents were granted after 2011, as shown by the first quartile. This is consistent with what we were expecting because the concerns about climate change have started to gain more importance over the last decade.

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Insert Table 1 about here

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In addition, the correlation matrix presented in Table 2 does not report significant positive correlations higher than 0.7 which reduces the probability of facing multicollinearity problems (Tabachnick & Fidell, 2019).

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Insert Table 2 about here

## The Impact of Ambidexterity on Corporate Investors' Green Innovation

### *Static Ambidexterity and Green Innovation*

The results that illustrate the relationship between static ambidextrous CVC investments and green innovation (Hypothesis 1) are presented in Table 3. Coefficients disclosed are negative and significant when we measure green innovation using  $Count_{it}$  ( $b = -0.0784$ ;  $p < 0.05$ ) or  $Citations_{it}$  ( $b = -0.0724$ ;  $p < 0.1$ ). The negative coefficients indicate that static ambidextrous CVC investments reduce either the number of green patent applications or the number of green patent citations. Therefore, we do not find empirical evidence to support the positive contribution of static ambidextrous CVC investments to corporate investor's green innovation. Thus, we reject Hypothesis 1. These results underline that a negative impact on green innovation is achieved when corporate investors strike a balance between explorative and exploitative CVC investments. By investing equally in entrepreneurial companies with similar and completely different business models, corporate investors fail to capture green innovation.

Previous ambidexterity theories have highlighted that firms should attempt to achieve a static equilibrium between exploitation and exploration activities (Boumgarden et al., 2012) in order to maximize their performances (Uotila et al., 2009). Our results underline the other way around. The mid-point between exploitation and exploration (He & Wong, 2004) should not be

considered when investing in CVC to increase corporate investors' green innovation. These results are in line with recent studies that reject a static view of ambidexterity (Farjoun, 2010; Shuwaikh et al., 2022; Simsek et al., 2009) as a mechanism to deal with dynamic environments as it may lead to misalignments with firms environments (Miller, 1992; Venkatraman & Prescott, 1990).

### ***Dynamic Ambidexterity and Green Innovation***

In contrast to static ambidexterity, dynamic ambidexterity proved to have a different role in green innovation. Table 3 presents the results that explain the relationship between dynamic CVC investments and corporate investors' green innovation (Hypothesis 2). Coefficients reported are positive and significant when the variables  $Count_{it}$  ( $b = 0.3119$ ;  $p < 0.05$ ) and  $Citations_{it}$  ( $b = 0.2695$ ;  $p < 0.05$ ) are used to measure corporate investors' green innovation. The positive coefficients highlight that dynamic ambidextrous CVC investments increase both the number of green patent applications and the number of green patent citations. As a result, there is evidence of the positive contribution of dynamic CVC investments to corporate investors' green innovation, supporting Hypothesis 2. The simultaneous pursuit of both explorative and exploitative CVC investments enhances corporate investors' green innovation. Therefore, by simultaneously investing in entrepreneurial companies with a high degree of business similarity and completely different core businesses, corporate investors are able to "acquire" green innovation. They should combine explorative and exploitative CVC investments to face dynamic environments with innovative green solutions.

We used dynamic ambidexterity following Shuwaikh et al. (2022), who introduced this perspective in CVC investments. Our finding is consistent with Siggelkow & Levinthal (2003), who suggest that firms can take advantage of environmental dynamism through exploratory activities, and switch to exploitative activities when the environment becomes more stable. Firms need to be able to adapt what they are doing internally to the demands of the external environment, otherwise, they risk being misaligned which can damage their performance (Miller, 1992; Venkatraman & Prescott, 1990). This dynamic view of investing in CVC allows firms to adapt their balance to the different environmental conditions instead of striking to a right balance, enhancing their resource allocation when external opportunities appear (Jansen et al., 2006). Moreover, it avoids tensions between exploration and exploitation as it allows firm to allocate their resources according to the current needs that they face rather than being stuck at the defined

midpoint (Jansen et al., 2006). With these results, our study reinforces the argument introduced by Shuwaikh et al. (2022) who state that firms should fluctuate between explorative and exploitative CVC investments adopting a dynamic ambidexterity.

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Insert Table 3 about here  
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### ***The Impact of Combining Static and Dynamic Ambidexterity on Green Innovation***

Significant improvements are achieved when corporate investors combine static and dynamic ambidexterity. The impact of combining static and dynamic ambidextrous CVC investments on corporate investors' green innovation (Hypothesis 3) is reported in Table 3. The coefficients are significant, positive, and stronger than those displayed for dynamic ambidexterity when green innovation is measured through  $Count_{it}$  ( $b = 0.7905; p < 0.01$ ) or  $Citations_{it}$  ( $b = 0.5424; p < 0.1$ ), which supports Hypothesis 3. These coefficients suggest that when corporate investors combine dynamic and static ambidextrous CVC investments, they can not only boost their green innovation, but also achieve synergistic outcomes. As a result, we conclude that the interaction between balancing and combining explorative and exploitative CVC investments is the best practice in order to maximise corporate investors' green innovation.

Even though the negative contribution of static ambidexterity, we cannot disregard this approach because if it is performed together with dynamic ambidexterity, the best contribution to firms' green innovation is achieved. Achieving high levels of balanced and simultaneous ambidexterity has a synergistic effect on firms' green innovation. This finding is similar to previous research that pointed out the importance of the interactions between a balanced and combined use of exploration and exploitation activities (Cao et al., 2009; Shuwaikh et al., 2022). No previous research has studied the direct impact of ambidexterity on firms' green innovation under the empirical setting of CVC investments. Therefore, our results extend CVC literature (Rossi et al., 2021; Shuwaikh et al., 2022; Shuwaikh & Dubocage, 2022) revealing a positive contribution of ambidextrous CVC investments on green innovation.

### **The Impact of Green Innovation on Corporate Investors' Environmental Performance**

The results that present the effect of green innovation on environmental performance (Hypothesis 4) are presented in Table 4. The results are similar when we use both measures of green innovation. For the independent variable  $Count_{it}$ , we find positive coefficients when

regressing on  $GHG/rev_{it}$  ( $b = 0.0027$ ;  $p < 0.01$ ) or  $GHG_{it}$  ( $b = 0.0310$ ;  $p < 0.01$ ). For the independent variable  $Citations_{it}$ , the results also present positive coefficients when regressing on  $GHG/rev_{it}$  ( $b = 0.0032$ ;  $p < 0.01$ ) or  $GHG_{it}$  ( $b = 0.0636$ ;  $p < 0.01$ ). The coefficients suggest that either GHG emissions or GHG intensity are reduced by the number of green patent applications and green patent citations. Therefore, there is a positive relationship between green innovation and environmental performance, even when we switch the dependent and independent variables. Hence, enhancements in corporate investors' green innovation allow to improve their environmental performance.

Combining this result with the findings presented in the previous sections, we conclude that by investing in entrepreneurial companies, corporate investors can use ambidexterity as a gateway to improve their environmental performance through the acquired green innovation. By making ambidextrous CVC investments, they acquire green innovation which in turn is used to reduce their GHG emissions, thereby improving their environmental performance.

According to previous studies, green innovation requires a significant investment in clean technologies to reduce firms' GHG emissions (Benkraiem et al., 2023). In addition, more than innovation, knowledge and technology acquired, CVC investments provide firms with privileged access to social and ecological aspects, allowing them to reduce their environmental footprint while improving their environmental performance (Battisti et al., 2022). Based on a sample that comprises 297 large manufacturing firms in Malaysia, Kraus et al. (2020) identified green innovation as a driver of environmental performance, more specifically, they found that firms' environmental performance improves by 27%. Du et al. (2019) analysed 71 economies and found that the negative relationship between firms' green technology innovation and CO2 emissions depends on the income levels of each economy. Moreover, Xu et al. (2021) divided green innovation into subcategories and found that either green innovation as a whole or their subcategories can effectively reduce carbon emissions. Carbon emissions have a negative effect on firms' value and the market tends to react negatively in a more consistent way compared to positive performances (Lee et al., 2015).

Little is known about the effect of green innovation on firms' environmental performance under the CVC empirical setting. There is only one paper that addresses green innovation and environmental performance under this empirical setting (Benkraiem et al., 2023). The results presented in this paper are consistent with the ones that we disclose. The authors found a positive

relationship between green innovation and environmental performance based on GHG emissions intensity. However, they did not find any result when the logarithm of firms' GHG emissions was used. Therefore, we confirm their findings on GHG emissions intensity and extend their analysis with the positive and significant impact on the logarithm of firms' GHG emissions. Using either the number of green patent applications or citations, we argue that green innovation can effectively improve firms' environmental performance.

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Insert Table 4 about here  
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## **Robustness Checks**

### ***Robustness with Lagged Variables***

The impact of ambidexterity may require some time to produce effects on firm's green innovation depending on the time needed to integrate the company into the firm's portfolio (Shuwaikh & Dubocage, 2022). In addition, the impact of green innovation may also take some time to be reflected in environmental performance metrics. Consequently, it is of interest to analyse how the results change when we lag the dependent variables.

The results presented in Table 5, 6 and 7 illustrate the relationship between the different forms of ambidexterity and the lagged green innovation variables. We find similar relationships because no change in the signs of the coefficients was reported. Even when we lag the dependent variables  $Count_{it}$  and  $Citations_{it}$  one-, two- and three-years, static ambidexterity has negative coefficients, dynamic ambidexterity has positive coefficients and the combined use of static and dynamic has positive and the greatest coefficients. Moreover, we find a downward trend for static ambidexterity coefficients, highlighting a worsening effect over time. In contrast, we found a strengthening effect over time of dynamic and combined ambidexterity due to an upward trend of their coefficients. This result is in line with Miller (1992) and Venkatraman & Prescott (1990) who state that a static approach is not suitable to dynamic environments requirements because companies repeat misalignments with their environment, leading to even worse environmental performance over time.

The results for the lagged environmental variables are presented in Tables 8 and 9. We find a positive relationship between green innovation and lagged environmental performance. The coefficients for the variable  $Count_{it}$  are significant and positive when we lag the environmental variables  $GHG_{it}$  and  $GHG/rev_{it}$  one-, two- and three-years. Similarly, the

coefficients for the variable  $Citations_{it}$  are also positive for the lagged environmental variables. As a result, we conclude that green innovation captured with ambidextrous CVC investments can effectively increase corporate environmental performance, and this effect persists over time.

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Insert Table 5, 6 and 7

about here

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***Sensitivity Analysis with Alternative Dependent Variables***

We performed additional sensitivity tests to ensure that our findings are robust using alternative dependent variables. Measuring green innovation requires patent-based variables, therefore we have not used alternative dependent variables to test the robustness of the results regarding the relationship between ambidexterity and green innovation.

To evaluate the robustness of the relationship between green innovation and corporate investor's environmental performance, we use the ESG and Environmental Pillar scores as alternative dependent variables to measure environmental performance. The ESG score was developed to measure firms' Environmental, Social and Governance performance in response to the increasing investor demand for a measure that provides this kind of information. Nowadays, investors consider ESG score as an indispensable metric for conducting their investment analyses and for taking their investment decisions, especially the environmental pillar which measures the company's performance in terms of environmental and climate risks (Apergis et al., 2022). Therefore, we use the environmental pillar score ( $E Pillar_{it}$ ) as a measure of environmental performance as well as the ESG score ( $ESG_{it}$ ) which was computed by averaging the pillars' scores.

The results presented in Table 10, reveal a positive contribution of green innovation to ESG and environmental pillar scores. When analysing the effect on ESG score, the reported results show a positive and significant relationship when  $Count_{it}$  ( $b = 0.3429; p < 0.01$ ) is used to measure green innovation. Therefore, firms' ESG score is improved with additional green patent applications. Moreover, the similar result is achieved when the same analysis is conducted for the environmental pillar. The coefficients for both  $Count_{it}$  ( $b = 0.8189; p < 0.01$ ) and  $Citations_{it}$  ( $b = 0.4276; p < 0.05$ ) are positive and significant which illustrate the positive contribution of additional green patents and green patent citations to the environmental pillar score. As a result, there is robust evidence that improvements in green innovation lead to improvements in environmental performance.

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Insert Table 10 about here  
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### ***Robustness Over Time***

There is no doubt about the tremendous effect of the Global Financial Crisis (GFC) on the world economy, affecting especially the financing conditions in the U.S.. Due to its importance, we split or sample in three periods: before, during and after GFC to assess the differences and the impacts in our findings. Moreover, it is fair to expect differences between these three subsamples, as GHG emissions have increased dramatically in importance in recent years.

The coefficients for the analysis of the relationship between ambidexterity and green innovation are presented in Tables 11, 12 and 13. We do not find significant results for the periods before and during-GFC even when different measures of green innovation are used as dependent variables. However, for the post-GFC period we find significant results. These results show the robustness of our findings as the effects of the different types of ambidexterity on green innovation are consistent with those reported for the main sample.

The pursuit of static ambidexterity in CVC investments has a negative impact on green innovation, whereas dynamic ambidexterity and the combination of both have a positive impact on green innovation. The absence of results for the prior and during-GFC periods may be related to the smaller number of observations. Despite the long history of traditional VC investment, CVC investment has only begun to grow in importance over the last decade.

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Insert Table 11, 12 and 13

about here  
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Table 14 and 15 display the results for the analysis of green innovation and environmental performance within the three periods. Although we do not find results for the pre-GFC period, we do find significant results for the periods during and after the GFC. Overall, green innovation harmed environmental performance during the GFC. This result is highlighted by the negative coefficients of both green innovation variables even when the dependent variables are changed. In addition, we also find that after GFC green innovation started to have a positive role in improving firms' environmental performance under the CVC investments empirical setting.  $Count_{it}$  and  $Citations_{it}$  present positive and significant coefficients with 1% of significance level which ensures the robustness of our results.

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Insert Table 14 and 15

about here  
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## **CONCLUSION**

This thesis examines three crucial concepts - ambidexterity, green innovation, and environmental performance - with the objective of providing valuable insights to address current difficulties. The study is motivated by the urgent necessity to tackle present problems and the lack of empirical research on the integrated examination of these ideas in the context of CVC investments. Our research reveals the significant role that ambidextrous CVC investments play in helping corporate investors acquire green innovation. Dynamic ambidextrous CVC investments are particularly successful in boosting organizations' ability to capture green innovation. The study recommends maximising the investment in both exploratory and exploitative CVC activities simultaneously. This investment strategy has been shown to have a consistently favourable effect on green innovation over the following three years.

In contrast, a fixed ambidextrous strategy is observed to have an adverse influence on green innovation, reinforced by a declining trend that indicates a worsening effect over the subsequent three years. The study advises against corporations adopting a rigid perspective of ambidexterity alone, highlighting the negative impact of maintaining a balance between exploratory and exploitative CVC investments. A significant contribution arises when companies integrate both static and dynamic approaches to ambidexterity, resulting in synergistic effects that exceed the favourable impact of dynamic ambidexterity alone. This highlights the suggestion that companies should utilize both types of ambidexterity in their CVC investments, with a focus on the importance of a comprehensive strategy.

The study expands its analysis to several economic periods, investigating the consequences prior to, during, and subsequent to the GFC. The exact results are only available for the post-GFC period, although they are consistent with the general findings of the overall sample. This investigation into the passage of time offers vital insights into the lasting significance and practicality of the identified connections.

Environmental performance is now considered a vital measure that demonstrates companies' commitment to reducing their ecological footprint. Our study further supports the findings of Shuwaikh et al. (2023) and Benkraiem et al. (2023) by confirming the strong

association between green innovation and environmental performance. We have utilized many indicators to validate this correlation. We show that corporate investors can improve their environmental performance by efficiently utilizing the green innovation resulting from their ambidextrous CVC investments. Moreover, our analysis demonstrates that the influence of present green innovation on environmental performance persists over a period of time.

By broadening our analysis to encompass several economic periods, including those before, during, and after the GFC, we discover fascinating revelations. During the GFC, we find a detrimental impact of green innovation on enterprises' environmental performance, in contrast to the favourable benefits reported post-GFC. Furthermore, our research encompasses particular aspects, such as the Environmental Pillar and ESG ratings, demonstrating a favourable impact.

The findings of our research have significant consequences in the fields of management, government, and regulation. We promote the importance of including ambidexterity in CVC investments, highlighting its ability to capture innovation, especially in the green sector, and ultimately guiding companies towards enhanced environmental performance. The basis of our advice is built around three fundamental principles. Firstly, enterprises can respond to customer and regulatory demands and avoid market penalization by reducing their ecological footprint (Lee et al., 2015). Furthermore, the incorporation of green innovation and environmental performance into corporate plans improves the profitability of companies (Benkraiem et al., 2023). Finally, these measures enable companies to achieve a competitive advantage in the market, hence enhancing their long-term viability (Nidumolu et al., 2009).

The implications for regulators and governments are diverse and critical to build a business environment that can be maintained over time. Prioritizing the acceleration and optimization of acquisition procedures is essential to stimulate the growth of the CVC investments. Identifying CVC as a means of promoting green innovation among companies establishes it as a crucial entry point. Regulators can actively encourage enterprises to adopt environmental sustainability by facilitating these processes. Furthermore, it is advisable for governments to contemplate implementing rewards for companies who actively participate in CVC and ambidextrous practices in order to obtain environmentally friendly innovations. These incentives play a crucial role in pushing companies to decrease their GHG emissions, effectively tackling environmental concerns. This assistance is especially vital in mitigating the

supplementary expenses linked to companies' efforts to embrace eco-friendly practices, as emphasized in the study conducted by Benkraiem et al. (2023).

In the future, there are other paths that can be pursued for additional investigation. Subsequent study efforts could concentrate on unravelling the factors that determine the inclination towards a particular type of ambidexterity over another. Although we have analysed the GFC, further occurrences or circumstances may provide a more detailed comprehension of the complex correlation between ambidexterity and green innovation.

An intriguing avenue for future research entails conducting a thorough cost-benefit analysis of investing in CVC to harness green innovation and subsequently diminish a company's environmental impact. Gaining a comprehensive understanding of the economic consequences of these investments, will offer useful knowledge for companies considering strategic initiatives that are in line with environmental goals.

Moreover, doing a comparison examination of the performance of CVC and Institutional Venture Capital will provide a useful contribution to the continuing discussion on the optimal form of venture capital. This comparison analysis has the potential to reveal unique benefits and drawbacks, providing stakeholders with a more lucid understanding of the strategic options at hand. Ultimately, extending the range of this study outside the boundaries of the United States to include other geographic regions shows potential. Examining the topic from a wider viewpoint would offer valuable understanding of the specific characteristics and differences in the interactions between CVC, organizational ambidexterity, and environmentally-friendly innovation across different regions. Ultimately, it is crucial for enterprises, regulators, and governments to work together in order to effectively navigate the complex connections between CVC, ambidexterity, and green innovation. By following the recommended strategies and exploring these proposed research paths, stakeholders can together contribute to a sustainable and inventive future.

## APPENDICES

### TABLE 1

#### Descriptive Statistics

<b>Variables</b>	<b>Count</b>	<b>Mean</b>	<b>Std</b>	<b>Min</b>	<b>25%</b>	<b>50%</b>	<b>75%</b>	<b>Max</b>
Static	7870	0.77	0.27	0.00	0.61	0.89	1.00	1.00
Dynamic	7870	0.08	0.08	0.00	0.00	0.05	0.16	0.25
Patent year	7962	2014	5	2000	2011	2015	2019	2021
Count	7965	6	2	1	5	6	8	10
Citations	6967	7	3	1	5	7	9	12
GHG	7175	-14	2	-18	-15	-14	-12	-7
GHG/rev	7174	-0.06	0.15	-4.17	-0.04	-0.03	-0.02	0.00
LEV	7403	37	37	-181	20	31	50	1228
NPT	7431	6.7	7.2	-22.6	1.0	4.6	11.0	61.3
ABS	7392	0.3	0.1	0.0	0.2	0.3	0.4	1.0
UABS	7321	2.0	1.0	0.3	1.3	1.7	2.4	12.6
POT	7394	-0.7	54.2	-3025.1	0.6	0.9	1.9	51.3
CAP	7389	0.1	0.0	0.0	0.0	0.0	0.1	0.8
SIZE	7403	18	1	12	17	18	19	22
EMP	7332	91170	136927	370	24000	68000	107300	1608000
INV	7104	0.1	0.1	0.0	0.1	0.2	0.2	0.5

This table presents the descriptive statistics for the dependent, independent, and control variables used in the model.

**TABLE 2****Correlation Matrix**

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Static	1.00															
2. Dynamic	-0.98***	1.00														
3. Patent year	-0.01***	0.01***	1.00													
4. Count	-0.08***	0.12	-0.09***	1.00												
5. Citations	-0.04***	0.08*	-0.37***	0.81	1.00											
6. GHG	-0.23***	0.21	0.03**	-0.23***	-0.17***	1.00										
7. GHG/rev	-0.12***	0.12	0.06*	0.10	0.10*	0.40	1.00									
8. LEV	-0.02***	0.02**	0.20	-0.19***	-0.27***	0.10*	0.02**	1.00								
9. NPT	0.13	-0.11***	0.28	0.31	0.19	-0.54***	0.02**	-0.16***	1.00							
10. ABS	-0.21***	0.18	0.05*	0.05**	0.01**	0.50	0.24	-0.07***	-0.20***	1.00						
11. UABS	-0.09***	0.11	-0.23***	0.15	0.23	0.26	0.11	-0.23***	-0.06***	0.01**	1.00					
12. POT	0.02**	-0.02***	-0.03***	0.07*	0.02**	-0.03***	0.01***	-0.06***	0.04**	0.05**	0.02**	1.00				
13. CAP	0.15	-0.12***	-0.05***	0.35	0.36	-0.52***	-0.14***	-0.23***	0.54	-0.21***	-0.04***	0.03**	1.00			
14. SIZE	0.14	-0.13***	0.24	0.21	0.10	-0.76***	-0.06***	-0.02***	0.63	-0.31***	-0.28***	0.04**	0.32	1.00		
15. EMP	0.11	-0.11***	0.07*	0.07*	0.07*	-0.41***	0.05**	0.05*	0.35	-0.15***	-0.24***	0.02**	0.22	0.44	1.00	
16. INV	-0.08***	0.10	0.12	0.33	0.25	0.38	0.41	-0.16***	0.12	0.53	0.35	0.06*	0.11	-0.17***	-0.20***	1.00

This table presents the Pearson-correlation coefficients. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 3****Ambidexterity and corporate investors' green innovation**

Variable	Count			Citations		
Static	-0.0784**			-0.0724*		
Dynamic		0.3119**			0.2695**	
Combined			0.7905***			0.5424*
LEV	0.0006*	0.0006*	0.0006*	-0.0004	-0.0004	-0.0004
ABS	-1.8260***	-1.8257***	-1.8338***	-1.5075***	-1.5074***	-1.5165***
UABS	-0.0917***	-0.0917***	-0.0911***	-0.0690***	-0.0689***	-0.0685***
POT	-0.0001	-0.0000	-0.0000	0.0003	0.0003	0.0003
SIZE	0.1976***	0.1974***	0.1985***	0.0529*	0.0528*	0.0538*
CAP	-0.6646	-0.6669	-0.6531	0.9584	0.9577	0.9685
NPT	0.0063**	0.0063**	0.0063**	0.0060**	0.0060**	0.0060**
EMP	-0.0000**	-0.0000**	-0.0000**	-0.0000	-0.0000	-0.0000
INV	8.4277***	8.4210***	8.4320***	7.3222***	7.3183***	7.3367***
Constant	2.7030***	2.6210***	2.5937***	5.9125***	5.8364***	5.8185***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0637	0.0640	0.0642	0.0477	0.0478	0.0477
Observations	6913	6913	6913	6149	6149	6149

This table examines the effect of the different types of ambidexterity on corporate investors' green innovation performance. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 4****Green innovation and corporate investors' environmental performance**

Variable	GHG/rev		GHG	
Count	0.0027***		0.0310***	
Citations		0.0032***		0.0636***
LEV	0.0001***	0.0001***	0.0003*	0.0004***
ABS	0.0256*	0.0184	1.8963***	1.7539***
UABS	-0.0012*	-0.0012*	0.0336***	0.0236***
POT	0.0000	0.0001***	-0.0001*	0.0004*
SIZE	0.0152***	0.0184***	-0.4954***	-0.4596***
CAP	0.1487***	0.2048***	-2.1484***	-1.8687***
NPT	0.0029***	0.0031***	0.0042***	0.0057***
EMP	-0.0000***	-0.0000***	-0.0000***	-0.0000***
INV	0.1906***	0.2055***	-1.6225***	-1.6847***
Constant	-0.3934***	-0.4588***	-5.3520***	-6.2017***
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

R-squared	0.2114	0.2507	0.3762	0.3808
Observations	6830	6066	6830	6066

This table examines the effect of green innovation on corporate investors' environmental performance. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 5**

**Static ambidexterity and corporate investors' green innovation: lagged variables**

Variable	Count			Citations		
	T+1	T+2	T+3	T+1	T+2	T+3
Static	-0.0738*	-0.0730*	-0.0883**	-0.0760*	-0.0876*	-0.1119*
LEV	-0.0001	-0.0001	-0.0008**	-0.0005	-0.0007	-0.0014***
ABS	-0.9421***	-0.7797**	-0.1187	-1.0257***	-0.5860	-0.8479*
UABS	-0.0507***	-0.0050	0.0320*	0.0058	0.0212	0.0430*
POT	0.0004*	-0.0000	0.0005*	0.0008***	0.0002	-0.0009
SIZE	0.1149***	0.0631**	0.0414	0.0103	-0.0289	-0.0693*
CAP	-0.0522	0.9694	1.1213	1.7314**	0.4332	0.7534
NPT	0.0049*	-0.0029	-0.0069**	0.0030	0.0016	-0.0064
EMP	-0.0000***	-0.0000**	-0.0000***	-0.0000***	-0.0000***	-0.0000***
INV	5.3680***	2.7037***	0.1569	6.4120***	3.8391***	2.6423***
Constant	4.2493***	5.3920***	5.9168***	6.5239***	7.5149***	8.5203***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0262	0.0061	0.0059	0.0310	0.0185	0.0206
Observations	6841	6769	6698	6075	5997	5920

This table examines the effect of static ambidexterity on corporate investors' green innovation performance lagged 1, 2 and 3 years. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 6**

**Dynamic ambidexterity and corporate investors' green innovation: lagged variables**

Variable	Count			Citations		
	T+1	T+2	T+3	T+1	T+2	T+3
Dynamic	0.2906**	0.2897**	0.3482**	0.2871**	0.3224*	0.4276**
LEV	-0.0001	-0.0001	-0.0008**	-0.0005	-0.0007	-0.0014***
ABS	-0.9417***	-0.7794**	-0.1184	-1.0249***	-0.5853	-0.8489*
UABS	-0.0507***	-0.0050	0.0321*	0.0059	0.0213	0.0430*
POT	0.0004*	-0.0000	0.0005**	0.0008***	0.0002	-0.0009
SIZE	0.1147***	0.0628**	0.0411	0.0102	-0.0290	-0.0695*
CAP	-0.0540	0.9668	1.1185	1.7303**	0.4318	0.7508

NPT	0.0049*	-0.0028	-0.0069**	0.0030	0.0016	-0.0063
EMP	-0.0000***	-0.0000**	-0.0000***	-0.0000***	-0.0000***	-0.0000***
INV	5.3620***	2.6980***	0.1501	6.4060***	3.8330***	2.6368***
Constant	4.1721***	5.3161***	5.8250***	6.4443***	7.4226***	8.4027***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0265	0.0064	0.0061	0.0311	0.0186	0.0208
Observations	6841	6769	6698	6075	5997	5920

This table examines the effect of dynamic ambidexterity on corporate investors' green innovation performance lagged 1, 2 and 3 years. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 7**

**Combined ambidexterity and corporate investors' green innovation: lagged variables**

Variable	Count			Citations		
	T+1	T+2	T+3	T+1	T+2	T+3
Combined	0.7081**	0.7146**	0.8074**	0.5687*	0.5486	0.8370*
LEV	-0.0001	-0.0001	-0.0008**	-0.0005	-0.0007*	-0.0014***
ABS	-0.9499***	-0.7887**	-0.1297	-1.0314***	-0.5950	-0.8660*
UABS	-0.0501***	-0.0044	0.0328*	0.0064	0.0219	0.0440**
POT	0.0004*	0.0000	0.0005**	0.0008***	0.0002	-0.0009
SIZE	0.1156***	0.0640**	0.0427	0.0113	-0.0276	-0.0675
CAP	-0.0409	0.9772	1.1314	1.7460**	0.4432	0.7658
NPT	0.0049*	-0.0028	-0.0069**	0.0030	0.0016	-0.0064
EMP	-0.0000***	-0.0000**	-0.0000***	-0.0000***	-0.0000***	-0.0000***
INV	5.3743***	2.7127***	0.1699	6.4234***	3.8548***	2.6732***
Constant	4.1466***	5.2899***	5.7927***	6.4230***	7.4007***	8.3671***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0265	0.0065	0.0061	0.0309	0.0183	0.0205
Observations	6841	6769	6698	6075	5997	5920

This table examines the effect of combining static and dynamic ambidexterity on corporate investors' green innovation performance lagged 1, 2 and 3 years. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 8**

**Green patent applications and corporate investors' environmental performance: lagged variables**

Variables	GHG/rev			GHG		
	T+1	T+2	T+3	T+1	T+2	T+3
Count	0.0017***	0.0018***	0.0009*	0.0228***	0.0334***	0.0203***
LEV	0.0001***	0.0000	-0.0000***	0.0004**	-0.0001	0.0001
ABS	0.0263*	0.0035	0.0040	1.0210***	-0.0201	-0.9920***

UABS	-0.0016**	-0.0030***	-0.0020***	0.0654***	0.0487***	0.0481***
POT	-0.0000	-0.0000	0.0000	0.0006***	0.0003***	0.0002*
SIZE	0.0119***	0.0094***	0.0040***	-0.4580***	-0.3784***	-0.3068***
CAP	-0.0394	0.0230	-0.1150***	-0.1111	2.2599***	0.7507**
NPT	0.0019***	0.0001	-0.0004***	0.0002	-0.0022	-0.0027*
EMP	-0.0000***	-0.0000***	-0.0000	-0.0000***	0.0000	0.0000***
INV	0.2233***	0.1896***	0.1647***	0.0154	-0.2121	0.8602**
Constant	-0.3192***	-0.2525***	-0.1377***	-6.1386***	-7.3620***	-8.3262***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.1157	0.0406	0.0271	0.2092	0.1140	0.0687
Observations	6726	6628	6525	6726	6628	6525

This table examines the effect of green innovation, measured by the number of green patents, on corporate investors' environmental performance lagged 1, 2 and 3 years. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 9**

**Green patent citations and corporate investors' environmental performance: lagged variables**

Variable	GHG/rev			GHG		
	T+1	T+2	T+3	T+1	T+2	T+3
Citations	0.0024***	0.0017***	0.0009	0.0415***	0.0225***	0.0158*
LEV	0.0001***	0.0000*	-0.0000	0.0003**	-0.0001	0.0001
ABS	0.0149	-0.0049	-0.0045	1.2129***	0.6060***	-0.6806***
UABS	-0.0011	-0.0025***	-0.0017**	0.0570***	0.0477***	0.0515***
POT	-0.0000	-0.0000	0.0000	0.0001	-0.0007***	-0.0007**
SIZE	0.0160***	0.0145***	0.0086***	-0.4565***	-0.4121***	-0.3471***
CAP	0.0503*	0.1530***	-0.0089	-0.6319*	2.4925***	0.9510**
NPT	0.0018***	-0.0000	-0.0006***	-0.0015	-0.0020	-0.0026*
EMP	-0.0000***	-0.0000***	-0.0000**	-0.0000***	-0.0000***	0.0000**
INV	0.2661***	0.2301***	0.2007***	0.0155	-0.7675**	0.6550*
Constant	-0.4053***	-0.3517***	-0.2277***	-6.2730***	-6.8432***	-7.7097***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.1456	0.0621	0.0335	0.3509	0.1793	0.0965
Observations	6054	5972	5870	6054	5972	5870

This table examines the effect of green innovation, measured by green patent citations, on corporate investors' environmental performance lagged 1, 2 and 3 years. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 10****Green innovation and corporate investors' environmental performance: alternative variables**

Variable	ESG		E Pillar	
Count	0.3429***		0.8189***	
Citations		-0.0726		0.4276**
LEV	0.0014	0.0025	-0.0084**	-0.0043
ABS	40.4157***	45.9508***	52.8124***	68.5254***
UABS	-0.0730	0.3621**	0.3394*	0.5527***
POT	-0.0033**	-0.0042	0.0019	0.0074
SIZE	5.1157***	5.3938***	6.4909***	6.3771***
CAP	20.0594***	36.8872***	42.7398***	46.9056***
NPT	-0.2567***	-0.1962***	-0.3011***	-0.1983***
EMP	0.0000***	0.0000***	0.0000***	0.0000***
INV	-104.5718***	-105.9969***	-105.7202***	-125.6235***
Constant	-19.1322***	-26.2588***	-54.5517***	-55.5194***
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
R-squared	0.1887	0.2217	0.2626	0.2783
Observations	6830	6066	6830	6066

This table examines the effect of green innovation on corporate investors' environmental performance using ESG and Environmental Pillar scores as alternative dependent variables. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 11****Static ambidexterity and corporate investors' green innovation: sample breakdown**

Variable	Count			Citations		
	Before GFC	During GFC	After GFC	Before GFC	During GFC	After GFC
Static	-0.0457	-0.0019	-0.1021***	-0.1296	-0.0308	-0.0484*
LEV	0.0204***	0.0052***	0.0000	0.0113*	-0.0023	-0.0006***
ABS	1.1384	0.1487	-1.4659***	2.2956**	1.2902	-1.1107***
UABS	-0.0771	0.0352	-0.1989***	-0.1487**	-0.0258	-0.1639***
POT	-0.0004	0.0030***	-0.0000	-0.0042	-0.0002	0.0003
SIZE	0.6635***	0.4599***	0.4042***	0.7982***	-0.0884	0.2817***
CAP	1.1017	-1.1404	-3.5911***	0.7823	-0.7378	-1.9055***
NPT	0.0718***	0.0108**	0.0132***	0.1253***	0.0022	0.0126***
EMP	-0.0000***	-0.0000	-0.0000***	-0.0000***	0.0000	-0.0000***
INV	-1.5946	3.0968*	6.5274***	-3.7352	-2.4354	4.8763***
Constant	-4.2802	-1.8566	-0.4870	-3.7175	9.9761***	2.0416***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0940	0.0868	0.0785	0.1033	0.0071	0.0955

Observations	595	724	5594	592	717	4840
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This table examines the effect of static ambidexterity on corporate investors' green innovation performance before, during and after GFC. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 12**

**Dynamic ambidexterity and corporate investors' green innovation: sample breakdown**

Variable	Count			Citations		
	Before GFC	During GFC	After GFC	Before GFC	During GFC	After GFC
Dynamic	0.1429	0.0711	0.3841***	0.3969	0.1361	0.1922**
LEV	0.0204***	0.0052***	0.0000	0.0112*	-0.0023	-0.0006***
ABS	1.1376	0.1262	-1.4677***	2.2933**	1.2776	-1.1123***
UABS	-0.0771	0.0353	-0.1991***	-0.1488**	-0.0256	-0.1640***
POT	-0.0004	0.0030***	-0.0000	-0.0042	-0.0002	0.0003
SIZE	0.6637***	0.4599***	0.4039***	0.7991***	-0.0880	0.2815***
CAP	1.1112	-1.1416	-3.5975***	0.8094	-0.7366	-1.9098***
NPT	0.0719***	0.0108**	0.0132***	0.1256***	0.0022	0.0127***
EMP	-0.0000***	-0.0000	-0.0000***	-0.0000***	0.0000	-0.0000***
INV	-1.5918	3.1311*	6.5202***	-3.7281	-2.4142	4.8728***
Constant	-4.3311	-1.8612	-0.5904	-3.8633	9.9342***	1.9931***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0940	0.0871	0.0789	0.1032	0.0076	0.0958
Observations	595	724	5594	592	717	4840

This table examines the effect of dynamic ambidexterity on corporate investors' green innovation performance before, during and after GFC. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 13**

**Combined ambidexterity and corporate investors' green innovation: sample breakdown**

Variable	Count			Citations		
	Before GFC	During GFC	After GFC	Before GFC	During GFC	After GFC
Combined	0.2253	0.4762	0.8197***	0.4819	0.3917	0.4601**
LEV	0.0204***	0.0052***	0.0000	0.0112	-0.0022	-0.0006***
ABS	1.1361	0.1100	-1.4636***	2.2903**	1.2912	-1.1148***
UABS	-0.0771	0.0362	-0.1991***	-0.1485**	-0.0251	-0.1642***
POT	-0.0004	0.0030***	-0.0000	-0.0042	-0.0002	0.0003
SIZE	0.6656***	0.4634***	0.4050***	0.8048***	-0.0850	0.2818***
CAP	1.1298	-1.1290	-3.5823***	0.8493	-0.7254	-1.9070***
NPT	0.0720***	0.0107**	0.0132***	0.1258***	0.0021	0.0127***
EMP	-0.0000***	-0.0000	-0.0000***	-0.0000***	0.0000	-0.0000***
INV	-1.5961	3.1697*	6.5219***	-3.7497	-2.4231	4.8790***
Constant	-4.3564	-1.9378	-0.6139	-3.9352	9.8722***	1.9846***

Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0939	0.0898	0.0786	0.1028	0.0085	0.0958
Observations	595	724	5594	592	717	4840

This table examines the effect of combining static and dynamic ambidexterity on corporate investors' green innovation performance before, during and after GFC. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 14**

**Green patents applications and environmental performance: sample breakdown**

Variable	GHG/rev			GHG		
	Before GFC	During GFC	After GFC	Before GFC	During GFC	After GFC
Count	-0.0003	-0.0100***	0.0017***	0.0404*	-0.0742***	0.0036
LEV	0.0001	-0.0001	0.0001***	-0.0018	0.0006	0.0001
ABS	-0.1137***	0.1879***	0.1435***	-0.0133	-0.4290	2.2786***
UABS	0.0054	-0.0064***	0.0013**	0.0731*	0.0085	0.0404**
POT	-0.0019***	0.0001***	0.0000	-0.0194***	0.0014***	-0.0001**
SIZE	0.0495***	-0.0046	0.0043***	0.3942***	-0.7473***	-0.4739***
CAP	-0.0167	-0.2029***	0.1042***	1.5225	-2.0470**	-3.1834***
NPT	0.0121***	0.0046***	0.0034***	0.0983***	0.0004	0.0025**
EMP	-0.0000**	-0.0000	-0.0000***	-0.0000	-0.0000*	-0.0000***
INV	-0.0621	-0.2181**	0.0901***	-6.9913***	-0.0334	-2.0109***
Constant	-0.8910***	0.0653	-0.2278***	-20.2373***	-0.1382	-5.5240***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.2847	0.3551	0.2341	0.3531	0.3099	0.3665
Observations	518	712	5600	518	712	5600

This table examines the effect of green innovation, using the number of green patents, on corporate investors' environmental performance before, during and after GFC. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**TABLE 15**

**Green patents citations and environmental performance: sample breakdown**

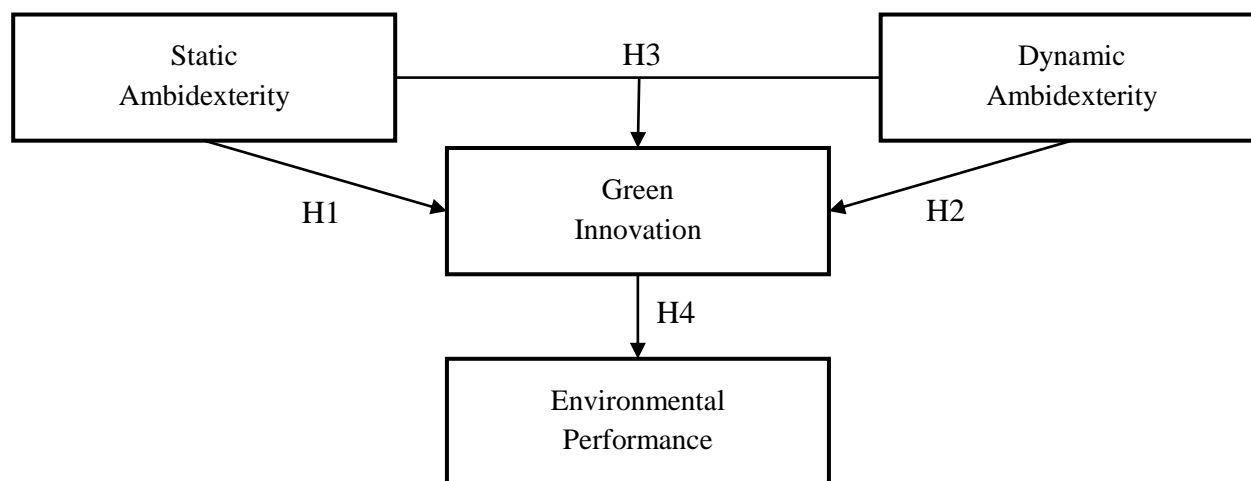
Variable	GHG/rev			GHG		
	Before	During	After	Before	During	After
Citations	-0.0029*	-0.0045**	0.0021***	0.0046	-0.0613***	0.0337***
LEV	0.0001	-0.0002**	0.0001***	-0.0010	-0.0000	0.0002
ABS	-0.1077***	0.1885***	0.1467***	0.0324	-0.4153	2.0986***
UABS	0.0053	-0.0071***	0.0015**	0.0731*	0.0034	0.0369***
POT	-0.0020***	0.0001**	0.0001***	-0.0195***	0.0012***	-0.0001
SIZE	0.0511***	-0.0077	0.0065***	0.4130***	-0.8072***	-0.4576***
CAP	-0.0226	-0.2192***	0.2096***	1.5150	-1.9619**	-2.5470***

NPT	0.0124***	0.0046***	0.0037***	0.1009***	-0.0011	0.0026**
EMP	-0.0000**	-0.0000*	-0.0000***	-0.0000	-0.0000	-0.0000***
INV	-0.0668	-0.2457***	0.1251***	-7.1012***	-0.4021	-1.9868***
Constant	-0.8934***	0.0991	-0.2863***	-20.3310***	0.9715	-6.0147***
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.2886	0.3457	0.2843	0.3488	0.3084	0.3915
Observations	515	705	4846	515	705	4846

This table examines the effect of green innovation, using citations of green patents, on corporate investors' environmental performance before, during and after GFC. T-statistics are shown in parentheses and \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

**FIGURE 1**

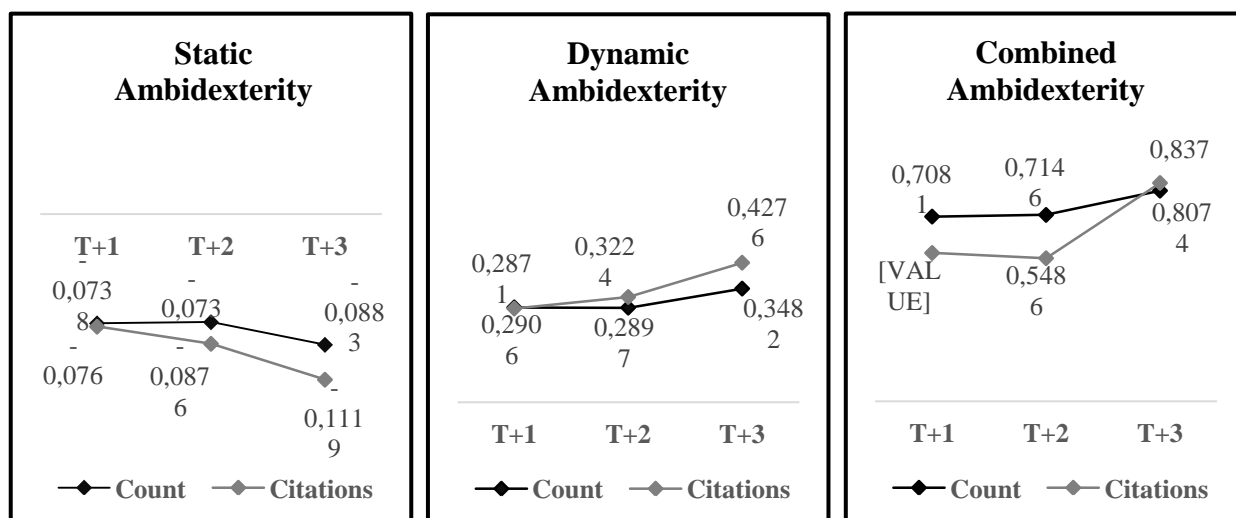
**Research Model**



This figure presents our research model, illustrating our hypothesis.

**FIGURE 2**

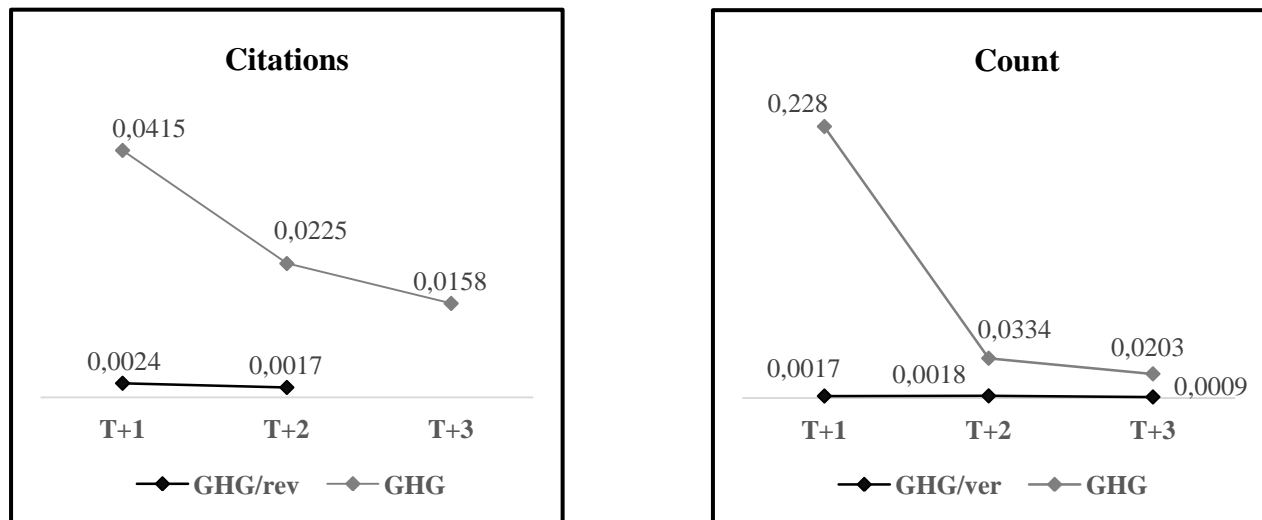
**Evolution of the effects of ambidexterity on green innovation**



These figures present the t-statistics of the different types of ambidexterity on corporate investors' green innovation performance lagged 1, 2 and 3 years.

**FIGURE 3**

**Evolution of the effects of green innovation on environmental performance**



These figures present the t-statistics of the different variables that measure green innovation on corporate investors' environmental performance lagged 1, 2 and 3 years.

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