The influence of venture capital financing types (IVC vs CVC) on financial, environmental and emissions performance

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Abstract

The current context highlights the crucial importance of "going green" in the pursuit of global sustainable development. This master thesis aims to analyze the influence of venture capital (VC) financing types on the financial, environmental and emissions performance of companies. In this paper, the comparison between independent venture capital (IVC) and corporate venture capital (CVC) was studied. The sample consists of 325 US companies, including 32 CVC-funded companies and 293 IVC-funded companies, between 2002 and 2022.

The results reveal that IVC-funded companies have higher environmental, social and governance (ESG) scores and lower Green House Gas emissions than CVC-funded companies, demonstrating the strong impact of IVC on environmentally sustainable practices.

Moreover, the results show the complexity of financial performance with different types of financing. Further research is needed to develop a comprehensive understanding of the underlying mechanisms involved.

This thesis contributes to the important role of venture capital investments, whether IVC or CVC, in achieving more sustainable practices.

Keywords: Corporate Venture Capital, Emissions Performance, Environmental Performance, Financial Performance, Independent Venture Capital, Venture capital, Sustainability.

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Abstrato

O contexto atual realça a importância crucial de "ser verde" na prossecução do desenvolvimento sustentável global. Esta tese de mestrado tem como objetivo analisar a influência dos tipos de financiamento do capital de risco (CR) no desempenho financeiro, ambiental e de emissões das empresas. Neste trabalho, foi estudada a comparação entre o capital de risco independente (IVC) e o capital de risco corporativo (CVC). A amostra é constituída por 325 empresas norte-americanas, incluindo 32 empresas financiadas por CVC e 293 empresas financiadas por IVC, entre 2002 e 2022.

Os resultados revelam que as empresas financiadas pelo IVC têm pontuações ambientais, sociais e de governação (ESG) mais elevadas e emissões de gases com efeito de estufa mais baixas do que as empresas financiadas pelo CVC, demonstrando o forte impacto do IVC nas práticas ambientalmente sustentáveis.

Além disso, os resultados mostram a complexidade do desempenho financeiro com diferentes tipos de financiamento. É necessária mais investigação para desenvolver uma compreensão abrangente dos mecanismos subjacentes envolvidos.

Esta tese contribui para o importante papel dos investimentos de capital de risco, quer se trate de IVC ou CVC, na consecução de práticas mais sustentáveis.

Palavras-chave: Capital de risco empresarial, desempenho em termos de emissões, desempenho ambiental, desempenho financeiro, capital de risco independente, capital de risco, sustentabilidade.

Título: A influência dos tipos de financiamento do capital de risco (IVC vs CVC) no desempenho financeiro, ambiental e de emissões.

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Glossary

CPP - Climate Performance Potential

CVC - Corporate Venture Capital

CSR - Corporate Social Responsibility

ESG - Environmental, Social & Governance

GHG - Green House Gas

IVC - Independent Venture Capital

ROA- Return on Assets

ROE - Return on Equity

VC - Venture Capital

WRDS - Wharton Research Data Services

1. Introduction

Venture capital financing has played a pivotal role in the growth of startups and businesses in recent years (Shuwaikh and Dubocage 2022). However, limited research has explored into the impact of the two distinct venture capital approaches: Independent Venture Capital (IVC) and Corporate Venture Capital (CVC) on the environmental and financial performance of companies (Benkraiem, Gonçalves, and Shuwaikh 2023; Shuwaikh, Dubocage, and Murer 2023). This topic requires in-depth exploration based on literature and empirical evidence to better understand how these approaches influence company success and promote sustainable practices. Historically, companies have primarily focused on profitability. However, this trend is undergoing a shift, with an increasing emphasis on environmental considerations (Benkraiem, Gonçalves, and Shuwaikh 2023; Shuwaikh and Dubocage 2022; Kraus, Rehman, and García 2020). It's important to exploit this type of subject, particularly in the current context, where global attention is increasingly focused on environmental issues and initiatives to mitigate climate change. Achieving the objectives set out in the Paris Agreement, such as the transition to renewable energy sources, the development of resource-efficient processes, a circular economy, the preservation of biodiversity and the promotion of sustainable mobility, is now a major area of research for companies operating in these sectors. COP 21 in Paris in 2015, marked by the signing of a binding global climate agreement by 95 countries, catalyzed growing interest in financing strategies that foster innovation for sustainability. Even more recently, the historic agreement reached at COP 28 in Dubai commits nearly 200 countries to moving away from fossil fuels, underlining the need for an equitable transition by 2050. The agreement calls for a tripling of renewable energies by 2030, a doubling of energy efficiency efforts, and encourages low-emission technologies. Nuclear power is explicitly recognized, in line with an earlier agreement.

In the current environmental context, this topic deserves in-depth exploration based on literature and empirical evidence to better understand how these approaches influence business success. The existing literature on venture capital financing and its impact on corporate sustainability and financial performance has provided valuable information on various aspects. However, there remains a notable research gap in carrying out comparative analysis between IVC and CVC financing types and their respective impacts on companies financial, environmental and emissions performance. This research gap remains significant.

There are papers comparing financial and environmental performance, using ESG criteria, such as (Mansouri and Momtaz 2022; Lange and Banadaki 2023; Velte 2017; Chouaibi, Chouaibi, and Rossi 2022; Kim and Li 2021; Naeem and Çankaya 2022.). Comparison with gas emissions is also present through these papers, (Benkraiem and al. 2023; Lewandowski 2017). Financial performance and corporate social responsibility are also analyzed in these papers, (Alakent, Goktan, and Khoury 2020; Diekel and al. 2023; Battisti and al. 2022).

However, there remains a notable research gap in carrying out a comparative analysis between IVC and CVC financing types and their respective impacts on corporate sustainability and financial performance. The paper investigates the following research question:

"What is the impact of venture capital financing types, Independent Venture Capital (IVC) and Corporate Venture Capital (CVC) on the financial, environmental, and emissions performance of companies?"

To address this question, the first contribution is a comparative study between the two venture capital financing types, IVC and CVC, was conducted, examining the characteristics and objectives of each through their financial, environmental, and emissions performance. IVC, known as "traditional venture capital," is a form of venture capital investment with the primary objective of achieving high financial returns. In contrast, CVC represents a form of investment where a large corporation directly invests in startups, leveraging external innovation and the growth of young companies to strengthen its core operations. The two types differ fundamentally in structure, interests, and motivation. (Shuwaikh, Dubocage, and Murer 2023). By addressing this gap, a better comprehension of the advantages and disadvantages of each financing type can be achieved, because we know that CVC or IVC is impacted by company-specific characteristics (Mazza and Shuwaikh 2022). This research aims to elucidate the differences between IVC and CVC financing.

The second major contribution concerns the financial performance between IVC and CVC. The financial performance is an important indicator for investors in measuring the success of a company (Rina Yuniarti, Noorlailie Soewarno, and Isnalita 2022). This study provides various stakeholders with essential information to make decisions regarding their venture capital financing strategies. The study highlights the potential advantages and disadvantages of IVC or

CVC financing. Moreover, they can choose a funding source that truly aligns with their objectives and values, thereby constructing an optimal strategy.

The third crucial contribution of this study is environmental and emissions performance, allowing the identification of key factors shaping the impact of IVC and CVC funding on the sustainability of businesses. This analysis provides an in-depth understanding of the financial impact on sustainability-oriented businesses, because investor's assessment of financial performance will affect the company's sustainability in the future (Rina Yuniarti, Noorlailie Soewarno, and Isnalita 2022). Using decisive criteria such as the Environmental, Social, and Governance (ESG) score for environmental performance (Bassen and Kovács 2008) and the Greenhouse Gas (GHG) emissions, this study targets crucial indicators. This identification provides valuable insight into how IVC and CVC funding can contribute to businesses' sustainability efforts. By focusing on sustainability, this analysis goes beyond traditional financial indicators, offering a better understanding of the connections between funding choices and environmental performance. It provides essential information for investors adopting sustainable development strategies.

This thesis is structured as follows to address the research question on the impact of venture capital financing types (IVC vs CVC) on financial, environmental, and emissions performance. In Section 2, a systematic literature review will be presented, highlighting existing research. Section 3 will outline the data selection and methodology employed in this study. Section 4 will present empirical results and the analysis of each model. Finally, Section 5 will discuss limitations and provide recommendations for future research.

2. Theoretical framework

2.1 Introduction to Venture Capital Funding Types: Analysis of IVC & CVC

Venture capital funds (VCs) play a crucial role in the development of start-ups and entrepreneurial companies (Shuwaikh and Dias 2023). Venture capital financing is characterized by the coexistence of independent venture capital (IVC), the "traditional" venture capital and corporate venture capital (CVC). This section highlights the difference between these two types of financing, indicating their roles and characteristics.

2.1.1 Independent Venture Capital

IVC, a strategic approach to financing innovative companies, is based on fundamental principles defined by renowned researchers and practitioners. As (Fulghieri and Sevilir 2009) explain, IVCs emerge from independent venture capital firms that administer funds dedicated to investing in companies with high innovation potential. The ultimate aim of this approach is to generate a return on financial investment by promoting the growth and value enhancement of selected companies.

IVC is distinguished by its expert management of multiple funds from diverse sources, such as banks, pension funds, hedge funds, insurance companies, university endowments, high-net-worth individuals, and family offices, as highlighted by (Colombo and Murtinu 2017). Each fund is meticulously structured as an independent limited partnership, with a management company as general partner and capital contributors as limited partners (Chemmanur, Loutskina, and Tian 2014).

This structure offers transparent governance and aligns the interests of investors, reinforcing the credibility of IVCs. The diversity of funding sources gives IVCs the agility to take calculated risks and explore a wide range of opportunities, positioning these players as key catalysts for innovation and economic growth. Additionally, IVCs are independent of start-ups, typically having no pre-existing relationships with them, ensuring an unbiased and objective approach to selecting investment opportunities (Colombo and Murtinu 2017).

IVCs' focus on achieving high financial returns is a distinctive feature of this financing, as highlighted by (Chemmanur, Loutskina, and Tian 2014). This exclusive focus on financial results distinguishes IVCs from other forms of investment, underlining their commitment to maximizing gains for investors. The primary objective remains to achieve a substantial financial return on investment, aligning investors' interests with the growth of innovation-driven companies (Fulghieri and Sevilir 2009).

A key aspect of IVCs' contribution is that they not only provide funds, but also specialist expertise and advice. As (Fulghieri and Sevilir 2009) assert, IVC investors play an active role in supporting the strategic development of the companies in which they invest. This involvement goes beyond a simple financial injection, enhancing portfolio companies' chances of success.

In conclusion, IVC are important players in the financial landscape, focused on promoting innovation and economic growth. Their structured model, independence from start-ups, focus on high financial returns and active contribution through specialized expertise make them strategic partners for innovative companies seeking financing and growth.

2.2.2 Corporate Venture Capital

CVC represents a strategic approach in which established companies invest in innovative start-ups, as outlined by (Fulghieri and Sevilir 2009, Shuwaikh, 2018). This type of investment goes beyond a simple injection of capital at the initial stage, involving direct proximity between the parent company and the start-up. This close relationship, mentioned by (Fulghieri and Sevilir 2009), is often established to exploit strategic synergies, transcending traditional financial advantages.

One of the distinguishing features of CVC is its diversified objectives. In addition to financial returns, CVC companies pursue strategic objectives such as accessing new technologies (Mazza and Shuwaikh 2022), exploring unexplored markets and creating strategic partnerships, according to (Fulghieri and Sevilir 2009). This clean approach, highlighted by (Chemmanur, Loutskina, and Tian 2014), aims to enhance the competitive advantage of parent companies.

CVC-backed companies have distinctive characteristics. CVC-backed companies exhibit higher innovation output despite their youth, higher risk and lower profitability compared to IVC-backed companies, as (Chemmanur, Loutskina, and Tian 2014) point out. These insights are reflected in higher R&D investments, illustrating CVCs' willingness to participate in innovative projects with high potential.

An essential dimension of CVC is its capacity to add value through the strategic access to specialized resources available within the parent company of the CVC investor. Firms receiving support under the CVC model stand to gain significant advantages from specific resources and expertise, encompassing vital elements like distribution channels, a robust sales force, established brand recognition, enhanced production capabilities, and complementary technological proficiencies, as elucidated by the insights of (Colombo and Murtinu 2017).

In summary, CVC is emerging as an investment strategy that goes beyond financing, creating strategic links between established companies and innovative start-ups. This approach, while pursuing financial objectives, also aims to strengthen the parent company's competitive position, while offering start-ups access to strategic resources and skills crucial to their development.

2.2.3 Financial performance

The selection of key indicators such as Return on Assets (ROA), Return on Equity (ROE), and Tobin's Q in my study of VCs is based on a careful selection of the most relevant variables to highlight financial performance. Moreover, these indicators are represented in several of the papers I study (Naeem and Çankaya 2022; Benkraiem and al. 2023) (Velte 2017).

The Return on Equity (ROE) stands out as an indispensable analytical instrument, delving into the correlation between profits and equity. A strong ROE implies adept financial management, compelling investors to maintain their commitment to the investment cycle.

The Return on Assets (ROA), with its focus on asset profitability, provides me with a nuanced perspective to assess how venture capitals leverage their investments. By measuring the ability to generate profits in relation to revenues, the ROA offers an insight into how these financial

entities adeptly manage allocated resources to yield positive returns. It is therefore a fundamental indicator in assessing their financial acuity.

The integration of Tobin's Q is of particular importance in the field of venture capital. By assessing market value relative to asset replacement cost, this metric provides insights into how the market perceives the overall value of ventures capital-backed.

In conclusion, the application of these three specific variables in the analysis of venture capital is relevant to the evaluation of the financial performance of companies financed by venture capital, more precisely by IVC or CVC. Thus, in this thesis, we will compare the financial performance of IVC and CVC.

Hypothesis 1: Companies receiving IVC financing have a better financial performance compared to companies relying on CVC.

2.2 Venture capital and ESG performance

Environmental, social and governance, broadly familiar as ESG factors are one of the fastest-growing trends and most discussed among investors over the last few years (Naeem and Çankaya 2022).

ESG ratings have seen considerable development in recent years. (Bassen and Kovács 2008) argue that ESG scores are crucial in providing information used by investors and other stakeholders in evaluating a company's risks and opportunities. ESG is a term commonly used by investors to assess a company activity related to environmental, social and governance, also considered non-financial performance indicators used to identify issues related to business ethics, corporate social responsibility and corporate governance (Kim and Li 2021).

In this master's thesis, the focus is exclusively on ESG because investors are more focused on the company's ESG value and performance than on CSR performance, because ESG reflects environmental, social and corporate governance activities together to achieve more accurate evaluation (Naeem and Çankaya 2022).

Furthermore, companies are giving increased priority to ESG strategies and investments due to the rising demand of transparency and sustainability in the business world (Naeem and Çankaya 2022). The disclosure of such information reduces information asymmetry between stakeholders, thereby boosting investor confidence (Yang and al. 2023). Additionally, higher levels of transparency reduce the fraudulent nature of information between the company and investors, thus lowering realized risks (Cheng, Ioannou, and Serafeim 2014).

VC are encouraged to integrate ESG into start-ups. While many private equity firms are already integrating ESG into their decisions due to increasing demand from investors and other stakeholders (Zaccone and Pedrini 2020), this is driving growing interest in adopting a sustainable investment approach (Bocken, Rana, and Short 2015)

(Botsari and Lang 2020) revealed that 70% of VC incorporate ESG criteria into their investment decisions. We found that there is a specific phase for investors when it comes to incorporating ESG criteria. Indeed, the integration of ESG criteria takes place only in the selection or due diligence phase, and not throughout the investment process (Lange and Banadaki 2023). We also note that, although 7 out of 10 VCs already integrate ESG, this integration does not take place throughout the investment process, mainly during the due diligence phase (Botsari and Lang 2020). In conclusion, venture capitalists apply ESG screening mainly on an exclusionary basis during due diligence (Botsari and Lang 2020).

In conclusion, venture capitalists have recognized that ESG plays a central role in their future investment decisions, and that it is imperative to integrate ESG into their strategies if they are to secure new funds (Lange and Banadaki 2023).

Hypothesis 2: IVC-backed companies have better ESG performance than CVC-backed companies.

2.3 Venture capital and Greenhouse Gas emissions

The current context highlights the crucial importance of the "going green " in the pursuit of global sustainable development. Climate change, mainly the result of human activities releasing large emissions of greenhouse gases (Adedoyin, Alola, and Bekun 2020), is having a significant impact on the planetary ecosystem. Companies are recognizing the importance of green

investments to combat pollution. However, meeting the global challenge of climate change caused by GHGs remains a complex undertaking (Sun and al. 2022; Al-Ismail and al. 2023; Goglio and al. 2020) . This paper of (Shuwaikh, Benkraiem, and Dubocage 2023) highlights the need to set high ambitions to create a low-carbon, sustainable future.

Investment in green innovation has become essential in many contemporary industries. Entrepreneurs leading green businesses, positioned in green sectors, are more likely to receive funding from venture capital (Mrkajic, Murtinu, and Scalera 2019). VC plays a crucial role in providing high-risk financial resources through their selection process and post-investment monitoring (Samila and Sorenson 2011).

However, it is noted that there is a significant gap in venture capital investments in "green" startups, mainly due to unpredictable regulatory risks (Bianchini and Croce 2022). Sustainable venture capitalists aim to align their investments with companies that have a positive environmental impact, but visibility remains a challenge (Hegeman and Sørheim 2021).

An innovative approach involves introducing the concept of "Climate Performance Potential" (CPP) to enhance the assessment of the environmental sustainability of venture capital firms (Diekel and al. 2023). The CPP evaluates a startup's potential to reduce at least 100 million tons of CO2 emisions, providing a more informed perspective for investors (Leendertse, Van Rijnsoever, and Eveleens 2021).

The CPP, defined as the climate performance potential of a startup, emphasizes the assessment of GHG emissions. This evaluation reduces information asymmetries, enabling startups to demonstrate their attractiveness and assisting venture capitalists in making more informed decisions (Trautwein 2021).

In conclusion, companies are now obligated to reduce their greenhouse gas (GHG) emissions to mitigate climate change and must comprehend the impact of these emissions on their operations. Identifying businesses and entrepreneurs aligned with the sustainability goals of venture capital remains a significant challenge (Lin 2022), this thesis will examine:

Hypothesis 3: IVC-backed companies have better carbon emissions than CVC-backed companies.

3. Data and methodology

3.1 Sample selection

The sample selected for this thesis includes only companies located in the USA, this choice reflecting the country position as the most dynamic venture capital market and its impact as a benchmark of success. In recent years, venture capital investment in the USA has grown significantly, reaching unprecedented levels. Venture capital-backed companies account for 41% of total US market capitalization and 62% of US public companies R&D spending (Gornall and Strebulaev 2021). Furthermore, the environmental dimension is becoming increasingly important within companies, through various initiatives such as the reduction of greenhouse gas emissions, the adoption of respectful technologies, and the implementation of strategies aimed at minimizing their ecological footprint. This cultural shift will continue to encourage change in corporations as society realizes the urgent need for ecological and social change.

Regarding the study sample, we select a target period of 2002-2022. The data was extracted from various platforms, which I describe below. Firstly, information on US companies financed by independent venture capitalists (IVCs) or corporate venture capitalists (CVCs) was obtained from the Thomson VentureXpert database. Financial and accounting data were obtained from Standard and Poor's Compustat database. ESG score and GHG emission data were retrieved from Datastream Refinitiv Eikon database.

A careful procedure was undertaken to consolidate multiple databases, specifically merging the Thomson VentureXpert database with the Compustat and Refinitiv Eikon databases. Initially, the Thomson VentureXpert database was integrated with the Compustat database, employing the "VLOOKUP" function through company names and tickers. Subsequently, a parallel process was executed for data obtained from Datastream Refinitiv Eikon. A meticulous manual verification process was then conducted to ensure the accuracy and alignment of the merged data.

The final sample used for analysis consisted of 32 companies funded by CVC, 293 companies funded by IVC, and a total of 1,311 observations.

3.1.1 Dependent variables

In this study, ROE, ROA, Tobin's Q, ESG score and GHGrev are used as dependent variables to determine the relationship between financial performance but also environmental and emissions.

The financial performance of a company is gauged through three distinct variables: Return on Equity (ROE), Return on Assets (ROA), and Tobin's Q. ROE assesses the return generated on shareholders' equity, providing insights into the company's overall financial profitability. A higher ROE signifies a more lucrative return on invested funds. Return on Assets (ROA) serves as an indicator of profitability by evaluating the return generated on all company assets, reflecting the company's efficiency in turning assets into profits. Tobin's Q, on the other hand, measures the company's value by comparing the market value of its assets with their replacement cost. Calculated as the ratio of replacement cost to market value, Tobin's Q values above 1 suggest positive market valuation, while values below 1 may indicate undervaluation. These three metrics collectively offer a comprehensive assessment of the financial health and market standing of the company under study, we take the same financial performance indicators represented by (Benkraiem and al. 2023). Financial performance is used for testing hypothesis1.

The environmental performance is represented by ESG score, this variable is for testing hypothesis 2. The ESG score is a global score based on companies' self-reported information. These scores are recorded on an annual basis and are constructed from three different sub-indices (environmental, social, governance).

To test the validity of hypothesis 3. The emission performance is illustrating by GHG emissions, that is the total CO2 and CO2 equivalents emission in tons. GHG emission intensity is determined by calculating the ratio of Scope 1 (direct) and Scope 2 (indirect) emissions to revenue. This metric serves as an indicator of a firm's tangible carbon performance, where a lower intensity score signifies a superior carbon performance for the company. Normally, as the use of absolute GHG emissions would entail significant risk, two different measures are used to assess environmental performance, the natural logarithm of GHG emissions (lnGHG) and GHG emissions per unit of revenue" (Benkraiem and al. 2023). In this thesis, we have chosen to conserve the greenhouse gas emissions intensity variable (GHGrev) for our analysis.

This decision is based on the observation that this variable offers better performance and more precise adaptation of the results. Additionally, the ratio of GHG emissions to revenue is commonly used to assess environmental performance (Busch and Hoffmann 2011). It is considered the optimal solution for in-depth analysis of our data. In addition, for a better interpretation of emissions performance, with lower GHG emissions corresponding to higher values for environmental performance, the input variables are multiplied by (- 1), in line with (Busch and Hoffmann 2011).

3.1.2 Independent variables

In this thesis, an additional step needs to be created to answer my hypotheses. It consists in identifying the subset of companies, i.e. distinguishing between companies that received IVC financing or CVC financing, respectively. This classification is achieved by introducing a binary variable, called "investor_type", which distinguishes between the two types of financing, this will represent the one and only independent variable.

This independent variable assigns a value of 1 to companies receiving IVC financing and 0 to those receiving CVC financing. This binary model enhances our ability to effectively address the hypotheses outlined in this thesis.

The utilization of a binary variable is pivotal in modeling and comprehending the associations among various financing types. This approach offers a significant advantage by simplifying intricate scenarios, facilitating clearer and more precise analysis, leading to meaningful conclusions.

In addition, this approach facilitates the analysis of results within a regression table. Coefficients are crucial in estimating the effects of IVC and CVC financing, acting as essential indicators for evaluating the scale of their influence on financial, environmental and emissions performance.

3.1.3 Control variables

In this master thesis, eight control variables will be used. The control variables were calculated from company financial statements retrieved from the Compustat platform.

Financial leverage, represented by the "lev" variable, measures the degree to which a company uses debt to finance its operations and assets. It is calculated as total debt by total equity, and reflects the proportion of a company's financial structure financed by debt. Leverage is included as a control variable to reflect the potential impact of a company's debt levels on financial, environmental and emissions performance.

The "size" variable, representing the total scale of a company, is evaluated by indicators such as total assets, sales and others. This variable is measured using the natural logarithm of total assets. As a control variable, it reduces the influence of company size on the dependent variables. By controlling for size, researchers seek to discern whether the observed effects are attributable to factors beyond the scale of the company.

Capital intensity, indicated by the "cap_intensity" variable, evaluates the level of capital investment required to generate income. It assesses the efficiency with which capital is used in the production process. It is calculated as the ratio of capital expenditure to total assets. This variable considers fluctuations in capital investment, which may influence financial, environmental, and emissions performance.

The innovation capacity, represented by the "innov_cap" variable, quantifies a company's commitment to innovation and its ability to participate in R&D activities. This variable is calculated as the ratio of Research and Development Expense to total assets. The aim of this measure is to control the capacity to innovate on different performances.

The "ageoffinancing" variable represents the age at which the company was first financed. The inclusion of this variable is intended to explore the implications of the temporality associated with obtaining financing; this measure is reported in months.

The "invest_date" control variable focuses on the date of the first investment in the company, providing a precise timeline of when investors first injected funds.

The "fund_stage" control variable represents the stage in the financing cycle that a company has reached when raising funds. This variable is decomposed into four distinct categories: Seed Stage, Early Stage, Later Stage and Balanced Stage.

- Seed Stage indicates that the company is in its early stages, seeking funding to bring its project to fruition.
- Early Stage, companies are engaged in their development, seeking funds to expand their operations.
- Later Stage: at this stage, companies have generally established their market presence and are seeking additional funding for significant expansion.
- Balanced Stage: At this stage, the company maintains a balance between innovation and consolidation.

The inclusion of the "fund_stage" variable in our analysis enables us to explore the implications of the financing phase on aspects of financial, environmental and emissions performance.

The "public_status" control variable provides information on the public or private status of companies, with several distinct categories:

- Acquisition: The company has been acquired by another entity.
- Active: The company is currently active.
- In Registration: The company is in the process of registering to become a public entity.
- LBO: The company has been acquired through a leveraged buyout.
- Pending Acquisition: The company is awaiting acquisition by another entity.
- Private: The company is not listed on the stock exchange and is generally owned by private shareholders.
- Public: The company is listed on the stock exchange, allowing its shares to be traded on the public market.
- Went Public: The company was private and is now listed on the stock exchange.

These control variables are non-negligible, as they allow for a more nuanced analysis, consideration of various confounding factors, and enhancement of the accuracy in interpreting the relationships between the independent and dependent variables.

3.2 Empirical modeling

After sufficient data had been collected and all the necessary variables determined, models were developed to test the hypotheses. All regressions were fitted using Stata statistical software. To evaluate the various hypotheses of this master thesis, ordinary least squares (OLS) regressions were used.

Concerning the detail of the terms of the equation models, $_{it}$ represents the individual company $_{i}$ at time $_{t}$. The coefficients β_0, β_1, β_2, β_3, β_4, β_5 β_6 β_7, β_8 and β_9 symbolize the fixed effects that measure the impact of the corresponding independent variables on the dependent variable in the model. They represent the constant contribution of each independent variable to the dependent variable. On the other hand, the term α_i represents unsystematic or unobserved variations, which are specific to each individual or unit in the sample, while the term u_{it} captures residual errors or disturbances that are not explained by the independent variables or random effects. It captures idiosyncratic variations specific to each observation or unmodeled changes over time.

Firstly, to test the impact of investor type on the financial performance, three distinct equations are applied:

$$ROEi_t = \alpha i + \beta 0 + \beta 1(investors\_type) + \beta 2(lev) + \beta 3(size) + \beta 4(cap\_intensity) + \beta 5(innov\_cap) + \beta 6(ageatfinancing) + \beta 7(invest\_date) + \beta 8(fund\_stage) + \beta 9(public\_status) + ui_t$$

$$ROAi_t = \alpha i + \beta 0 + \beta 1(investors\_type) + \beta 2(lev) + \beta 3(size) + \beta 4(cap\_intensity) + \beta 5(innov\_cap) + \beta 6(ageatfinancing) + \beta 7(invest\_date) + \beta 8(fund\_stage) + \beta 9(public\_status) + ui_t$$

$$Tobin's\ Qi_t = \alpha i + \beta 0 + \beta 1(investors\_type) + \beta 2(lev) + \beta 3(size) + \beta 4(cap\_intensity) + \beta 5(innov\_cap) + \beta 6(ageatfinancing) + \beta 7(invest\_date) + \beta 8(fund\_stage) + \beta 9(public\_status) + ui_t$$

By using these three equations to test the financial performance, under various aspects, such as profitability, return on equity and market value. This methodology offers a comprehensive evaluation of the hypothesis, providing an in-depth perspective on how investor type influences the various dimensions of financial performance.

To validate the first hypothesis using regressions, it is important that the "investor_type" variable has a positive and statistically significant β1 coefficient in all regressions. On the other hand, it should be noted that in the regression concerning financial performance, a negative and statistically significant β1 coefficient for the "investor_type" variable would indicate that IVC-funded companies have lower leverage and potentially exhibit higher financial performance. For example, this may indicate that IVC-financed companies tend to have lower levels of debt.

Secondly, to evaluate the impact of investor type on environmental performance represented by the ESG score, the resulting regression equation is specified as follows:

$$\begin{aligned} ESGi_{\mathrm{t}} = \ & \alpha i + \beta 0 + \beta 1(investors\_type) + \beta 2(lev) + \beta 3(size) \\ & + \beta 4(cap\_intensity) + \beta 5(innov\_cap) + \beta 6(ageatfinancing) \\ & + \beta 7(invest\_date) + \beta 8(fund\_stage) + \beta 9(public\_status) + ui_{\mathrm{t}} \end{aligned}$$

To validate the second hypothesis using regressions, it should be noted that in the regression concerning environmental performance, a positive and statistically significant β1 coefficient for the "investor_type" variable would indicate that IVC-funded companies have higher ESG scores.

Thirdly, to examine the impact of investor type on emission performance, one distinct equation is employed:

$$\begin{aligned} GHGrevi_{\mathrm{t}} = \ & \alpha i + \beta 0 + \beta 1(investors\_type) + \beta 2(lev) + \beta 3(size) \\ & + \beta 4(cap\_intensity) + \beta 5(innov\_cap) + \beta 6(ageatfinancing) \\ & + \beta 7(invest\_date) + \beta 8(fund\_stage) + \beta 9(public\_status) + ui_{\mathrm{t}} \end{aligned}$$

By applying this equation, we can analyze emissions performance, specifically GHG emissions intensity, a standardized measure that indicates the amount of GHG produced for each monetary unit of revenue generated. This measure makes it possible to take environmental efficiency into account by evaluating emissions in relation to economic activity.

To enrich our analysis, we have created a visual diagram. This diagram provides an overview of the relationships between our key variables, making it easier to understand the underlying dynamics and reinforcing the clarity of our hypotheses and the coherence of our argument.

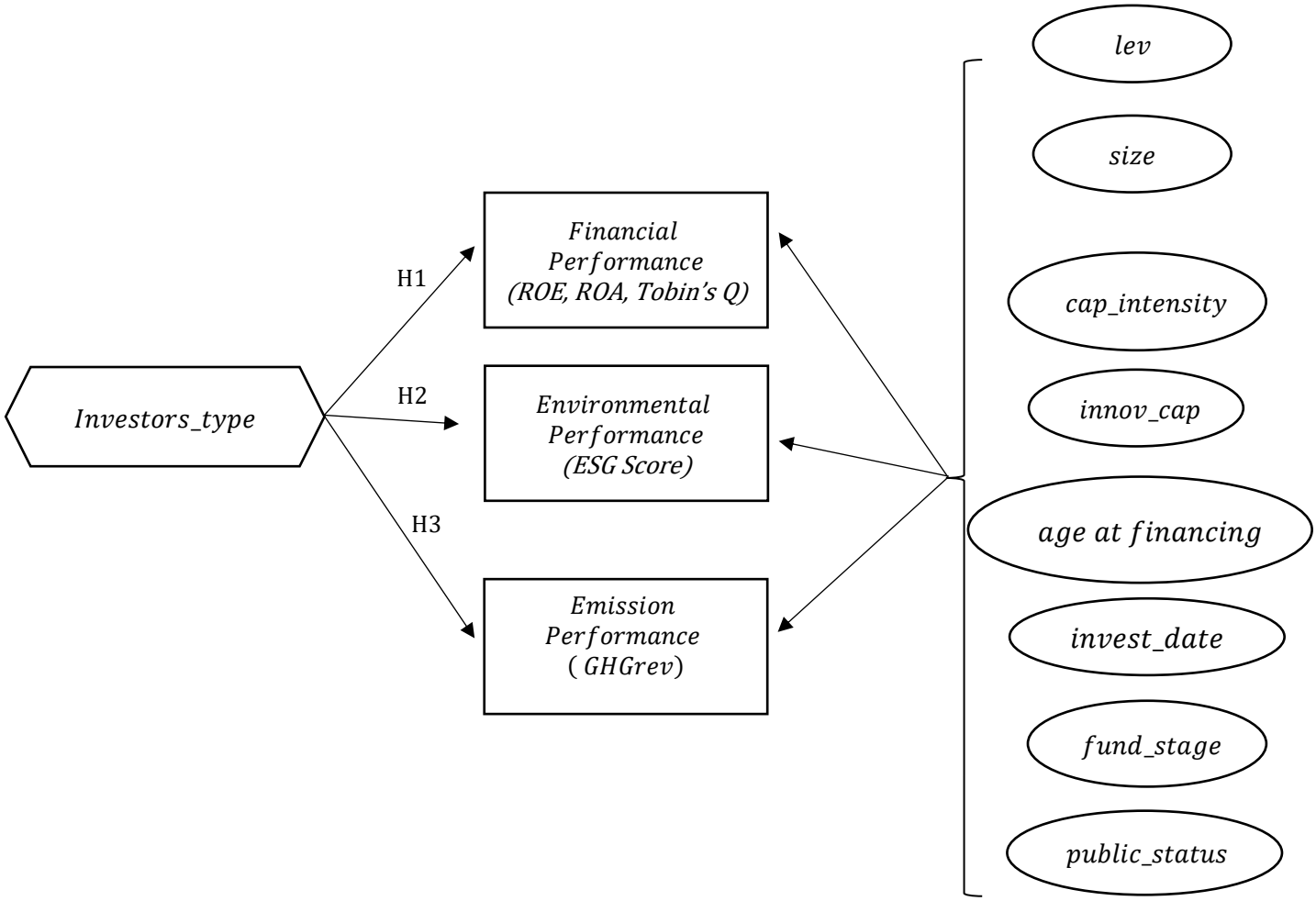

Figure 1: Representation of the research question. This one includes all dependent, independent and control variables. Hypothesis H1: Companies receiving IVC financing have a better financial performance compared to companies relying on CVC. H2: IVC-backed companies have better ESG performance than CVC-backed companies. H3: IVC-backed companies have better GHG emissions than IVC-backed companies.

4. Empirical results and discussion

4.1 Descriptive statistics and correlation matrix

Table 1: ***Summary statistics***

	Mean	SD	Min	Max	Median	Skewness	Kurtosis
ROE	-.236	.716	-11.713	2.563	-.076	-9.594	130.796
ROA	-.331	.965	-31.350	1.006	-.23	-25.953	819.806
Tobin's Q	4.172	3.593	0.303	33.853	3.066	2.599	13.167
ESG	30.673	12.402	1.560	85.74	28.62	1.147	5.123
GHGrev	226.101	3357.764	-1415.147	106289.99	14.163	29.168	911.334
investors type	.918	.274	0.000	1	1	-3.056	10.341
lev	.681	15.356	-206.323	459.884	.12	17.807	645.255
size	5.992	1.333	1.262	11.774	5.829	.913	5.287
cap intensity	.023	.032	0.000	.543	.012	5.231	64.231
innov cap	.249	.383	0.000	10.827	.185	17.605	457.464
ageatfinancing	22.795	29.695	-146.000	221	15	.672	11.008
invest date	18356.861	1587.372	15392.000	21843	18224.5	.173	2.207
fund stage	1.654	.762	1.000	4	2	1.368	5.105
public status	8.188	1.18	1.000	9	8	-2.93	14.892

The table shows the summary statistics for all dependent, independent, and control variables used in the different models. The statistical data for the variable assessing emissions performance, namely GHGrev, is presented before inversion. As a result, the values indicate higher greenhouse gas (GHG) emissions and lower environmental performance.

Table 1 summarizes the statistics of the underlying research sample. The analysis shows a varied set of financial and non-financial indicators, representing the underlying dynamics of the entities studied, the sample includes 325 companies.

The sample show a mean (median) Return on Assets (ROA) of -0.331 (-0.23), indicating that firms are underperforming in terms of generating profits in proportion to their total assets. By measuring other indicators, specifically Return on Equity (ROE) and Tobin's Q, are recorded at -0.236 (-0.076) and 4.172 (3.066) respectively, indicating different financial and market valuation levels. The high kurtosis value of 819.806 for ROA implies more pronounced extreme values compared to a normal distribution, a high kurtosis can be interpreted as a greater concentration of observations around the mean, but has very thick tails, indicating a significant presence of extreme values.

Concerning the measure of the environmental performance, the mean (median) is 30.673 (28.62) respectively, offering insights into the green activities of the sampled companies. The dispersion of ESG scores is reflected by a standard deviation of 12.402, illustrating a certain variability in ESG performance within the sample. As for the distribution of scores, the positivity of skewness (1.147) indicates a slight asymmetry towards above-average ESG performance. However, kurtosis (5.123) suggests that the distribution is relatively moderate in terms of extremes, meaning that, while some scores may be high, there is no excessive concentration around extreme values.

Prior to inversing the emissions performance measures, including GHG emissions intensity, the average (median) is 226.101 (14.163). The last value is distinguished by a significant probability of extreme results, illustrated by a high kurtosis of 911.334 and a positively high skewness of 29.168, underlining the exceptional and potentially risky nature of the data distribution. This skewness implies a considerable heavier tail risk in the distribution of GHG emissions intensity. This suggests the presence of outliers, perhaps represented by companies with exceptionally high CO2 emissions.

Additionally, the financial leverage provides an average (median) value of 0.681 (0.12), indicating a moderate level of financial leverage, the kurtosis is 645.255 suggesting an asymmetric distribution with the potential for extreme positive outcomes. Other variables like size, capital intensity and innovation capacity correspond to 5.992 (5.829), 0.023 (0.12) and 0.249 (0.185) respectively. Notably, for the innovation capacity, a remarkably high kurtosis of 457.464 and a positive skewness of 17.605 can be observed. We also note that the average (median) values of the variables age at financing, invest date, fund stage and public status associated to 22.795 (15), 1,8356.861 (18224.5), 1.654 (2) and 8.188 (8) respectively. Most companies in the sample exhibit an investor type of 1 (IVC), as indicated by the median value.

This detailed statistical summary provides a robust foundation for understanding the financial, environmental, and emissions-related dynamics within the research sample.

Table 2: ***Correlation Matrix***

Variables	(ROE)	(ROA)	(Tobin's Q)	(ESG)	(GHGrev)	(investor_type)	(lev)	(size)	(cap_intensity)	(innov_cap)	(ageatfinancing)	(invest_date)	(fund_stage)	(public_status)
ROE	1.000													
ROA	0.318***	1.000												
	(0.000)													
Tobin's Q	0.188***	-0.156***	1.000											
	(0.000)	(0.000)												
ESG	0.089***	0.121***	0.023	1.000										
	(0.001)	(0.000)	(0.398)											
GHGrev	-0.001	0.044	0.006	0.036	1.000									
	(0.984)	(0.147)	(0.844)	(0.228)										
investor_type	-0.027	-0.029	-0.004	0.041	0.110***	1.000								
	(0.337)	(0.291)	(0.896)	(0.140)	(0.000)									
lev	-0.022	0.006	-0.055**	-0.020	0.028	-0.011	1.000							
	(0.426)	(0.842)	(0.047)	(0.467)	(0.356)	(0.682)								
size	0.249***	0.289***	0.109***	0.454***	0.061**	0.029	0.014	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.043)	(0.287)	(0.610)							
cap_intensity	-0.082***	0.015	0.022	0.089***	0.023	0.064**	0.005	0.197***	1.000					
	(0.003)	(0.600)	(0.416)	(0.001)	(0.439)	(0.021)	(0.860)	(0.000)						
innov_cap	-0.321***	-0.910***	0.108***	-0.144***	-0.035	0.032	-0.013	-0.364***	-0.061**	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.242)	(0.244)	(0.631)	(0.000)	(0.027)					
ageatfinancing	0.023	0.033	0.070**	0.047*	-0.014	-0.195***	0.001	0.032	0.133***	-0.052*	1.000			
	(0.403)	(0.243)	(0.012)	(0.091)	(0.655)	(0.000)	(0.985)	(0.246)	(0.000)	(0.061)				
invest_date	-0.108***	-0.035	-0.064**	-0.110***	0.023	-0.194***	0.033	-0.099***	-0.064**	0.051*	0.197***	1.000		
	(0.000)	(0.213)	(0.021)	(0.000)	(0.444)	(0.000)	(0.239)	(0.000)	(0.023)	(0.069)	(0.000)			
fund_stage	0.017	0.012	-0.018	0.024	-0.053*	-0.018	0.025	0.087***	0.029	-0.001	-0.070**	-0.043	1.000	
	(0.536)	(0.671)	(0.519)	(0.393)	(0.081)	(0.504)	(0.375)	(0.002)	(0.290)	(0.962)	(0.012)	(0.123)		
public_status	0.060**	0.002	0.047*	0.010	-0.014	0.010	-0.027	-0.074***	-0.027	0.020	-0.119***	-0.477***	-0.035	1.000
	(0.030)	(0.953)	(0.086)	(0.708)	(0.637)	(0.728)	(0.330)	(0.007)	(0.324)	(0.460)	(0.000)	(0.000)	(0.199)	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The correlations for the variable measuring emissions performance, "ghgrev", is shown after inversion.

Table 2, correlation matrix, demonstrates that “ROE” has a highly significant positive correlation with “ROA”, “Tobin’s Q” and “ESG” of 0.318, 0.188 and 0.089 respectively, along with “size”. Conversely, “ROE” has a negative significant correlation the variables “cap_intensity”, “innov_cap” and “invest_date”. We can observe that the variable “public_status” has a positive correlation with "ROE" at a significance level of 5%. The second financial performance, “ROA” has a highly significant positive correlation with “ESG” of 0.121 and “size”. However, “ROA” is negatively linked to “Tobin’s Q” at the 1% significance level with values of -0.156, as well as “innov_cap”. The third financial performance, “Tobin’s Q” has a highly significant positive correlation with “size” and “innov_cap”, 0.109 and 0.108 respectively. Moreover, the variable “Tobin’s Q” has a negative correlation with “lev” and “invest_date” of -0.055 and -0.064, respectively, at a significance level of 5% but also a positive relation with “ageatfinancing”. We note a positive relation with the variable “public_status” at 10%.

Concerning the environmental performance variable, “ESG” has a significant negative relationship to “innov_cap” and “invest_date” of -0.144 and -0.110, respectively. The variable “ESG” has a highly significant positive correlation with “size” and “cap_intensity”.

On the other hand, concerning the emissions performance variables, “GHGrev” has a highly significant positive correlation with “investor_type” of 0.110, that means investors have preference for companies with low emissions revenue performance. The variables have also a positive relation of 0.061 with “size” at the 5% significance level. And a negative relationship with “fund_stage” at 10%. The variable “investor_type” is positively linked to “cap_intensity” at the 5% significance level with value of -0.064. And the variable has a significant negative correlation with “ageatfinancing” and “invest_date”.

About control variables, "lev" exhibits no statistically significant correlations. “size” reveals a high significant positive correlation of 0.197 with “cap_intensity” and a high negative correlation with “innov_cap”, “invest_date” and “public_status”. The variable “cap_intensity” has a high positive relationship with “ageatfinancing” of 0.133, also has a negative correlation with “innov_cap” and “invest_date” of -0.061 and -0.064, repectively, at the 5% significance level. The control variable “innov_cap” has a negative correlation with “ageatfinancing” and a positive with “invest_date” at the 10% significance level. The variable “ageatfinancing” has significant correlation with “invest_date”, but a negative correlation with “fund_stage” and

“public_status”. Finally, the variable “invest_date” has a high negative significant correlation with “public_status”

To conclude, it is important to highlight that the financial performance "ROE" and "ROA" have a strong correlation with the variable "ESG", moreover the variable " Tobin’s Q" is positive. Regarding carbon emission performance, it indicates positive correlations with “ROA” and “Tobin’s Q”.

4.2 Relationship between type of investor and financial performance

Table 3: ***Financial Performance***

	(1)	(2)	(3)
VARIABLES	ROE	ROA	Tobin’s Q
investor_type	-0.0594	0.00374	-0.384
	(0.0750)	(0.0451)	(0.399)
lev	-0.00109	-0.000398	-0.0125**
	(0.00120)	(0.000720)	(0.00637)
size	0.103***	-0.0315***	0.577***
	(0.0162)	(0.00974)	(0.0862)
cap_intensity	-4.003***	-0.944**	0.773
	(0.689)	(0.414)	(3.669)
innov_cap	-0.469***	-2.353***	1.758***
	(0.0520)	(0.0313)	(0.277)
ageatfinancing	0.00105	-0.000363	0.00998***
	(0.000662)	(0.000398)	(0.00353)
invest_date	-3.92e-05***	1.60e-05*	-0.000187**
	(1.43e-05)	(8.61e-06)	(7.62e-05)
fund_stage	0.00268	0.0208	0.0159
	(0.0254)	(0.0153)	(0.135)
public_status	0.0190	0.0228*	-0.0955
	(0.0199)	(0.0120)	(0.106)
Constant	-0.0553	-0.0451	4.656**
	(0.408)	(0.245)	(2.172)
Observations	1,258	1,258	1,258
R-squared	0.156	0.836	0.062

This table explores the impact of venture capital funding types (IVC vs CVC) on financial performance. All models are computed using random effects, and standard errors are presented in parentheses. Significance levels are denoted by *, **, and ***, representing statistical significance at the 10%, 5%, and 1% thresholds, respectively.

The Table 3 indicates the result of equation (1), (2) and (3) and represented the hypothesis 1.

The coefficient for "investor_type" with the variable “ROE” (equation1) is -0.0594. This negative result means that IVC-financed companies have a lower return on equity (ROE) than CVC-financed companies. However, the result is not statistically significant. Note that, in this thesis, we examine venture capitalists. They invest primarily in the growth of companies, even if these are not profitable initially.

The coefficient for "investor_type" with the variable “ROA” (equation2) is 0.00374. The positive coefficient indicates that IVC-financed companies have a higher ROA than CVC-financed companies. However, the coefficient is statistically significant at the 5% level ($p < 0.05$). This positive association indicates that, on average, companies with IVC backing perform better in terms of return on assets.

The coefficient for "investor_type" with the variable “Tobin’s Q” (equation3) is -0.384. This negative coefficient indicates that IVC-financed companies have a lower Tobin’s Q than CVC-financed companies. However, the result is not statistically significant. In other words, a negative Tobin’s Q indicates that the market values companies at a level lower than the book value of their assets. Moreover, a lower market valuation may reflect a higher perception of risk on the part of IVC.

Further noteworthy relationships may be observed considering the control variables.

There is a negative correlation between the "Tobin’s Q" variable and leverage of -0.0125 at 5% significance level, showing that high leverage and therefore high financial risk imply lower financial performance on average for the IVC sample. The "size" variable has a strong correlation with financial performance, positive for "ROE" and "Tobin’s Q" and negative for "ROA", which translates into larger companies in terms of revenue appearing to have lower ROA, but higher ROE and Tobin's Q. Concerning "cap_intensity", we observe that less capital-intensive companies benefit from worse short-term financial performance, as measured by ROA and ROE. The "innov_cap" variable affirms the same thing as the previous one, and also shows

a positive "Tobin’s Q" as a measure of short- and long-term financial performance. The variable "ageatfinancing" has a strong positive correlation with "Tobin’s Q" but very close to zero, the positive correlation may suggest that companies financed at a later age tend to have a better "Tobin’s Q". Concerning "invest_date", we observe that companies that received their first investment earlier have a slightly lower "ROE" and "Tobin’s Q", in contrast to the "ROA" measure. The "fund_stage" variable has no impact on financial performance. And finally, the "public_status" variable has a positive result with "ROE" and positive and significant for "ROA".

Overall, the results of the three regression models are quite mixed. The first model shows that companies funded by IVC have a lower ROE, which makes sense because VCs invest in business growth. Model 2 establishes a significant relationship between the type of investor and ROA, which is a positive indicator of financial performance. However, Model 3 suggests that they have a lower Tobin's Q, indicating potentially lower market valuations.

4.3 Relationship between investor types and environmental & emissions performance

Table 4 : ***Environmental and Emissions Performance***

VARIABLES	(1) ESG	(2) GHGrev
investor_type	2.460**	1,897***
	(1.235)	(452.5)
lev	-0.0177	5.496
	(0.0197)	(6.145)
size	3.840***	156.2*
	(0.267)	(94.29)
cap_intensity	-9.245	1,941
	(11.35)	(3,926)
innov_cap	0.590	-216.1
	(0.856)	(534.8)
ageatfinancing	0.0262**	-1.019
	(0.0109)	(3.620)
invest_date_num	-0.000268	0.137
	(0.000236)	(0.0887)
fund_stage_num	-0.704*	-232.4*
	(0.418)	(139.3)
public_status_num	0.926***	43.57
	(0.328)	(108.1)
Constant	3.053	-5,392**
	(6.719)	(2,345)
Observations	1,258	1,049
R-squared	0.180	0.026

The Table 4 indicates the estimation result of the equation (4) and (5) through investors types and different control variables. Significance levels are denoted by *, **, and ***, representing statistical significance at the 10%, 5%, and 1% thresholds, respectively.

Model 1 is represented by ESG Score.

Firstly, the coefficient for investor type (2.460) suggests a positive association, indicating that companies benefiting from IVC financing may have higher ESG scores than those dependent on CVC financing. Moreover, we note that the coefficient is significant at 5% of significance level.

Secondly, the negative coefficient attributed to leverage, at -0.0177, indicates that higher levels of debt are correlated with lower financial performance, reinforcing the idea of increased financial risk.

Thirdly, the variable “size” has a highly significant positive coefficient of 3.840, this implies that larger companies may present stronger levels of environmental, social and governance performance, due to the capacity and resources required to implement ESG initiatives and practices on a larger scale.

Fourthly, “cap_intensity” shows a coefficient of -9.245, which implies a negative relationship, but due to a considerable standard deviation, statistical significance remains uncertain, justifying the need for further investigation.

Fifthly, « innov_cap” has a positive coefficient at 0.590. This result can be interpreted as, companies oriented towards sustainability and good ESG practices are likely to invest more in research and development, thus fostering a greater capacity for innovation, potentially suggesting a more thorough integration of sustainable practices by innovative companies.

Sixthly, “ageatfinancing” has a significant positive coefficient of 0.0262 at 5% of significance level. This indicates that there is a relationship between the age at which a company is first financed and its ESG score. Furthermore, the positive correlation may suggest that companies financed at a later age tend to have higher ESG scores.

Seventhly, the variable “invest_date” has a correlation non-significant and very close to zero (-0.000268), suggesting that there are practically no linear correlations between these two variables.

Eighthly, “fund_stage” show a negative coefficient of -0.704. The correlation is negative, indicating an inverse relationship between company financing stage and ESG score. This means that companies in the early stages of financing (Seed Stage and Early Stage) tend to have higher ESG scores than companies in more advanced stages (Later Stage and Balanced Stage).

Finally, “public_status” has a high positive correlation with a value of 0.926, suggesting a robust relationship between these two variables. This means that companies with public status tend to have higher ESG scores than private companies.

In general terms, companies receiving funding from IVC investors exhibit superior ESG scores in comparison to those supported by CVC investors.

Model 2 is represented by GHG Emissions per unit of revenue (GHGrev).

Firstly, the coefficient for investor type (1.897) suggests a high positive association, indicating that companies benefiting from IVC financing may have lower GHG emissions on revenue than those dependent on CVC financing. Moreover, we note that the coefficient is significant at 1% of significance level.

As for the other variables, the coefficient of leverage (5.496) is not statistically significant. Consequently, there is no strong evidence that leverage significantly affects greenhouse gas emissions intensity in this model.

The coefficient of the variable “size” is positive at 156.2 and is statistically significant at 10%. This means that, in this model, firm size has a little significant impact on greenhouse gas emissions intensity. This result remains fairly low

The positive coefficient “cap_intensity” of 1.941 is not statistically significant. Consequently, capital intensity does not appear to be a significant factor in explaining variations in greenhouse gas emissions intensity in this model.

The variable “innov_cap” has a negative coefficient of -216.1, although not statistically significant, suggesting a negative association between innovation capacity and greenhouse gas emissions intensity. However, the lack of significance indicates that caution should be exercised before drawing strong conclusions.

The variable “ageatfinancing” has a coefficient of -1.019, the non-significance of the correlation suggests that there is insufficient statistical evidence to assert that age at financing has a significant relationship with the "GHGrev" variable.

The variables "invest_date" and "public_status" have a positive correlation of 0.137 and 43.57 but not significant, so these variables do not seem to be a significant factor in explaining variations in greenhouse gas emissions.

The negative coefficient (fund_stage) of -242.4 is statistically significant at a level of 10. This suggests that, at more advanced stages of financing, companies may have lower greenhouse gas emissions relative to revenue.

In our analysis, we have adopted one distinct measure to assess emissions performance "GHGrev". It is essential to note that emissions intensity (GHGrev) offers a more robust and significant perspective. Furthermore, the use of the ratio of greenhouse gas emissions to revenue is common practice in the academic literature, as demonstrated by researchers such as (Busch and Hoffmann 2011).

4.4 Robustness tests

4.4.1 Sensitivity analysis

Robust regression is an advanced method that provides estimates of regression coefficients that are robust to atypical observations, minimizing the potential impact of outliers on our results and hypotheses, but also those that exhibit heteroscedasticity. We use the "rreg" command in Stata to implement this robust approach. One of the significant advantages of robust regression lies in its ability to better model the distribution of errors, offering a more realistic view of the relationships between independent and dependent variables. This robustness is particularly crucial in contexts where data may exhibit unusual fluctuations.

Table 5 : ***Robustness of Financial, Environmental and Emissions Performance (Function RREG)***

VARIABLES	(1) ROE	(2) ROA	(3) Tobin's Q	(4) ESG	(5) GHGrev
investor_type	-0.0112	-0.00997	-0.0311	3.041**	1.148
	(0.00966)	(0.0157)	(0.242)	(1.204)	(1.335)
lev	-0.000557***	0.000233	-0.00323	-0.0168	-0.00562
	(0.000154)	(0.000251)	(0.00386)	(0.0192)	(0.0180)
size	0.0132***	0.0356***	0.186***	3.070***	2.658***
	(0.00221)	(0.00356)	(0.0548)	(0.260)	(0.276)
cap_intensity	0.234**	-0.0147	-2.009	-2.863	-71.72***
	(0.0914)	(0.144)	(2.222)	(11.06)	(11.50)
innov_cap	-0.343***	-1.102***	-0.246	-0.0138	-5.478***
	(0.0125)	(0.0179)	(0.275)	(0.835)	(1.567)
ageatfinancing	6.66e-06	8.50e-05	0.00206	0.0135	0.0194*
	(8.53e-05)	(0.000139)	(0.00214)	(0.0106)	(0.0106)
invest_date	-5.98e-06***	-4.01e-06	-0.000131***	-0.000265	3.52e-05
	(1.85e-06)	(3.01e-06)	(4.64e-05)	(0.000230)	(0.000260)
fund_stage	-0.00389	-0.0119**	0.104	-0.168	-0.224
	(0.00328)	(0.00533)	(0.0820)	(0.408)	(0.409)
public_status	0.00292	0.00944**	0.119*	0.644**	-0.850***
	(0.00257)	(0.00418)	(0.0642)	(0.320)	(0.317)
Constant	0.000898	-0.217**	3.527***	8.066	-21.73***
	(0.0526)	(0.0855)	(1.315)	(6.549)	(6.879)
Observations	1,256	1,257	1,257	1,258	1,048
R-squared	0.528	0.825	0.038	0.134	0.162

This table explores the impact of venture capital funding types (IVC vs CVC) with the sensitivity analysis. Significance levels are denoted by *, **, and ***, representing statistical significance at the 10%, 5%, and 1% thresholds, respectively.

In the original regression, the "investor_type" variable showed a significant impact of "ESG" and "GHGrev", with coefficients of 2.460 ($p<0.05$) and 1.897 ($p<0.01$), respectively. The robustness check confirms the significant impact of "ESG" on "investor_type", with a slightly higher coefficient of 3.041 ($p<0.05$). This reinforces the initial conclusion of the importance of "ESG" in influencing "investor_type".

The robustness check confirms the significant negative impact of "lev" on "ROE", maintaining consistency with the original regression. The "Tobin's Q" variable remains negative, but there is a positive impact on the "ROA" variable. Leverage remains stage with the "ESG" variable, while the "GHGrev" variable is strongly influenced and shows a negative level much closer to zero.

We note that with all dependent variables, "size" is positively and significantly related to the dependent variables, meaning that when this factor increases, we can predict with some certainty that the dependent variable will also increase. This consistency between models lends robustness to the conclusion and suggests that this variable plays a significant role irrespective of model specification or other variables included.

In contrast, "cap_intensity" is distinguished by a positive relationship with the dependent variable in one model and a negative relationship in another. This could indicate a more complex or non-linear relationship. For example, there may be an optimal level of capital intensity that maximizes the dependent variable, and a level below or above this optimal level may lead to decreases. It is also possible that the relationship depends on other factors.

The "innov_cap" variable shows greater variability from one model to another. It fluctuates in importance and even direction; positive in some models, negative in others. This inconsistency indicates that the relationship between this variable and the dependent variable is more complex, and may be influenced by other variables or specific contexts.

There is total positivity for the "ageatfinancing" variable, significant for "GHGrev".

The data for "invest_date" remain similar except for "ROA", which changes sign but remains very close to zero.

Fund_stage" is distinguished by a positive relationship with the dependent variable in one model and a negative one in another. This could indicate a more complex or non-linear relationship, and that the relationship depends on other factors.

Concerning "public_status", the results are much more significant, positive for both financial and environmental performance.

We note that the number of observations remains constant in both tables, ranging from 1,048 à 1,258. This consistency in sample size improves the comparability of results.

In conclusion, the robustness check with this method serves as a critical validation of the results. Although there are slight variations, the overall pattern suggests that the relationships identified between the variables are robust and remain statistically significant.

4.4.2 Addition of a new variable

This analysis aims to enrich our thesis by introducing a new variable to the regression model. This represents a significant extension, aimed at capturing subtle nuances that could influence our results.

This new variable, "total_funding", has been carefully selected to extend the scope of our analysis. It represents the cumulative total amount of financing a company has raised up to the specified date, measured in millions of US dollars (USD Mil). This data is often used to assess a company's ability to attract new investment.

Table 6: ***Robustness of Financial, Environmental and Emissions Performance (Add variable "totalfinding")***

VARIABLES	(1) ROE	(2) ROA	(3) Tobin's Q	(4) ESG	(5) GHGrev
investor_type	-0.0635	0.0109	-0.205	2.348*	1,919***
	(0.0761)	(0.0453)	(0.399)	(1.243)	(460.9)
lev	-0.00108	-0.000403	-0.0124*	-0.0174	5.470
	(0.00121)	(0.000718)	(0.00632)	(0.0197)	(6.220)
size	0.113***	-0.0375***	0.633***	3.644***	173.7*
	(0.0178)	(0.0106)	(0.0931)	(0.290)	(103.2)
cap_intensity	-4.289***	-0.882**	0.922	-11.70	2,164
	(0.714)	(0.425)	(3.739)	(11.65)	(4,099)
innov_cap	-0.457***	-2.358***	1.794***	0.505	-197.3
	(0.0528)	(0.0314)	(0.276)	(0.862)	(546.4)
ageatfinancing	0.000774	-0.000255	0.0128***	0.0278**	-0.605
	(0.000714)	(0.000425)	(0.00374)	(0.0117)	(3.896)
invest_date	-3.76e-05**	1.83e-05**	-0.000106	-0.000344	0.137
	(1.49e-05)	(8.89e-06)	(7.83e-05)	(0.000244)	(0.0930)
fund_stage	0.00504	0.0196	0.00363	-0.723*	-237.0*
	(0.0257)	(0.0153)	(0.135)	(0.420)	(141.7)
public_status	0.0248	0.0238*	0.134	0.908**	35.05
	(0.0235)	(0.0140)	(0.123)	(0.384)	(130.7)
totalfunding	-5.56e-05*	-8.32e-06	-0.000292*	0.00136***	-0.0706
	(2.98e-05)	(1.77e-05)	(0.000156)	(0.000486)	(0.155)
Constant	-0.177	-0.0634	0.805	5.653	-5,449**
	(0.443)	(0.264)	(2.320)	(7.232)	(2,567)
Observations	1,230	1,230	1,230	1,230	1,025
R-squared	0.158	0.840	0.070	0.188	0.026

This table explores the impact of venture capital funding types (IVC vs CVC) with the new variable. Significance levels are denoted by *, **, and ***, representing statistical significance at the 10%, 5%, and 1% thresholds, respectively.

The addition of a variable in the regression table has a strong impact.

The "investor_type" variable confirms the significant impact of "ESG" and "GHGrev" on "investor_type", with a slightly higher coefficient for "GHGrev" and significance at ($p<0.05$) for "ESG". This reinforces the initial conclusion of the importance of these two variables in influencing "investor_type".

The variables "lev", "cap_intensity", "innov_cap", "ageatfinancing" and "fund_stage" have better coefficients and all maintain the same level of significance obtained in the original regression. This shows that the addition of "totalfunding" has no impact on these variables, that it determines a certain stability and that the first regression shows robust and consistent results.

We note that for the "size" variable, the results are positively and significantly related to the dependent variables. The results are strongly correlated at 1%, except for "GHGrev", which is at 10%, although these are still good indicators.

The data for "invest_date" remain similar in terms of coefficient, but the significance level fluctuates, with "ROE" going from ($p<0.01$) to ($p<0.05$), while for "ROA" it's the other way around, improving our level to ($p<0.05$). The rest of the results remain insignificant.

The "public_status" variable obtains only positive results, and is correlated with the "ESG" variable.

For our new variable, the results are close to zero. For every one-unit increase in "total_funding", the "ROE", "ROA" and "Tobin's Q" variables decrease by a minimal amount. Moreover, for "ROE" and "Tobin's Q" the relationship is only significant at the 0.1 level, suggesting a trend, but not a strong statistical certainty. The coefficient associated with "total_funding" for the ESG variable is 0.00136. This suggests that an increase of one unit in "total_funding" is associated with an increase of around 0.00136 units in the ESG variable. The relationship is significant at the 0.01 level, indicating a trend with high statistical certainty. The coefficient associated with "total_funding" for the GHG Revenue variable is -0.0706.

These results reinforce the validity of our findings and the reliability of our hypotheses. Despite subtle variations, the overall trend suggests that the links established between the variables are resilient and maintain their statistical significance.

5. Limitations and avenues for future research

My study was developed with a variety of dependent variables, control variables, and a binary independent variable to define the types of funding (IVC or CVC). It is imperative to acknowledge that our representation remains incomplete due to certain data limitations and the absence of relevant indicators, such as Growth Revenue or Return on Invested Capital (ROIC).

The presence of unobserved variables can potentially blur the relationship between independent and dependent variables. The chosen period for analysis, ranging from 2002 to 2022, allows for the examination of long-term trends and dynamics. However, it is essential to recognize that, especially in the robustness check, a significant portion of the data originates from the years 2015 to 2022, introducing a temporal bias into the conclusions.

The limitations inherent in the sample selection process deserve careful attention. The use of a sample consisting of 32 companies funded by CVC, 293 companies funded by IVC, may potentially bias the results, possibly not accurately reflecting the true distribution of companies financed by VC across the entire database. This may result in an under-representation of the diversity and complexity of the venture capital landscape. In addition, the constitution of the sample from the WRDS platform and the Compustat database, and its merging with Thomson VentureXpert database, presents limitations. Incomplete financial and venture capital data led to the exclusion of certain companies, generating selection biases and reducing the representativeness of the final sample.

The ESG environmental performance scores and GHG emission levels of our venture capital companies are taken from data provider Thomson Reuters. However, the reliability of the results could be improved by diversifying data sources. The integration of other platforms such as Bloomberg or MSCI could provide additional insights into the environmental performance of the companies studied.

In addition, the data fusion process needs to be carefully examined because of the possibility of human error or input errors when manipulating data or using Excel functions. Rigorous validation of this process is crucial to ensure accurate results.

Finally, it is essential to note that our focus on the US market, while dynamic, limits the generalizability of our findings to other geographical contexts. For future research, it would be

interesting to extend the geographical scope to include studies of venture capital firms in Europe or Asia. This extension would enable a more detailed comparison and understanding of venture capital dynamics worldwide.

For future research, it could be interesting to explore the notion of "absorptive capacity" to extend this thesis. This essentially refers to a company's ability to learn and apply new ideas. By examining how this absorptive capacity influences the relationships between different variables, we could gain a better understanding of the actual impact of IVC and CVC funding.

These limitations underline the importance of interpreting the results carefully, and offer stimulating directions for future research aimed at resolving these specific challenges and enriching our understanding of CVC and IVC financing in a global context.

6. Conclusion

This thesis explores the influence of venture capital financing types (IVC vs. CVC) on companies' financial, environmental and emissions performance. To evaluate these influences, I used a database including financial data, ESG scores and GHG emissions of different companies. The analysis uses a complete dataset comprising 293 IVC-funded companies, 32 CVC-funded companies and a total of 1,311 observations covering the period from 2002 to 2022.

This study provides precious results to answer our research question: *What is the impact of venture capital financing types, Independent Venture Capital (IVC) and Corporate Venture Capital (CVC) on the financial, environmental, and emissions performance of companies?*

In terms of financial performance (Hypothesis 1), the results suggest a complexity between companies funded by institutional venture capitalists (IVCs) and those funded by corporate venture capitalists (CVCs). The return on equity (ROE) tends to be lower for IVC companies. This is logical because my thesis focuses on venture capitalists, who predominantly invest in the growth of companies, even when they are not initially profitable. However, return on assets (ROA) shows a significant relationship with the type of investor IVC, which is a positive indicator of financial performance, while Tobin's Q is lower for IVC companies. These results highlight the complicated relationship between financing type and financial performance.

In terms of environmental performance (Hypothesis 2), companies financed by institutional venture capitalists (IVCs) show significantly higher ESG scores than those financed by corporate venture capitalists (CVCs). Company size seems to be a determining factor, with larger companies showing stronger ESG performance. In addition, more advanced stages of financing and public status are also associated with higher ESG performance.

In terms of greenhouse gas emissions (Hypothesis 3), companies financed by institutional venture capitalists (IVCs) have lower GHG emissions than those financed by corporate venture capitalists (CVCs). Company size, capital intensity and innovation appear to play important roles in the variation of GHG emissions. In addition, more advanced stages of financing are associated with lower GHG emissions.

Sensitivity analysis brought nuances to our results, underlining the need to consider the robustness of the conclusions. Variations in the coefficients and their statistical significance highlight the complexity of the underlying relationships, reinforcing our understanding.

At the same time, the introduction of a new variable, total funding, expands the scope of our analysis. The results of this inclusion are essential to assess its impact on existing relationships. Despite these adjustments, the stability of the weights in the robust regression reinforces the reliability of our conclusions, underlining a resilience in the face of change.

Concerning the limitations, the scope of the study is restricted to US companies, requiring future research to broaden the results. Unobserved variables and external factors may influence the relationships identified, underscoring the need for further research. The diversity of results highlights the complexity of financial, environmental and social relationships, suggesting the need to consider multiple factors in future studies.

Overall, your study provides interesting insights into the relationship between the type of venture capital financing and company performance. Although the results vary by area (financial, environmental, emissions), a clear trend emerges showing that companies financed by institutional venture capitalists (IVCs) have superior environmental performance and GHG emissions, but financial performance that requires further analysis.

The implications of these results are significant for investors, entrepreneurs and policy-makers, underlining the importance of considering the type of venture capital financing in the overall assessment of company performance. The results can also guide investment decisions by highlighting trends related to ESG practices and GHG emissions in the context of venture capital financing.

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