

Determinants on the undervaluation of Belgian holdings

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Preface

This master's dissertation is the final step in my academic career at Ghent University before achieving a master's degree in finance and risk. It is an extension of everything I learned over the past years but also where my passion in Finance lies. Finding a balance between writing this dissertation and finishing my internship was challenging from time to time. However, I had a lot of help and support during this whole process.

I would like to thank my promotor Prof. Dr. Koen Inghelbrecht, who gave me the guidance, insights, and feedback I needed during the whole process. Without his help this dissertation wouldn't look like the dissertation as of today. I would like to express my gratitude as well for the unconditional support of my family and friends not only during this master's dissertation but throughout my entire studies at Ghent University.

I hope my dissertation on the determinants of the undervaluation of Belgian holding companies can illustrate the reason for the existence of this discount and even more importantly what the main drivers are of this phenomenon.

Thanks.

Stijn De Cock

Abstract

This paper provides an analysis on the determinants of the undervaluation of Belgian Holdings. The main focus lies on explaining what holdings are and how they operate within the financial system in Belgium. Even more importantly, determinants are looked upon from several frameworks in order to explain why the share price deviates from its fair value. The empirical evidence shows that discount is strongly and negatively related to investor sentiment as measured by the Euro Area Economic Sentiment Indicator. The discount is also found to be adversely related with the dividend yield, size of a holding, and the use of leverage. This suggests that investors are willing to pay a higher price (lower discount) for a holding that pays more dividends, has more assets under management and uses more debt. Lastly, a positive relation can be found between the discount and both the expenses and number of listed subsidiaries of a holding. This can be translated that investors want to pay a lower price (higher discount) for a holding that has higher expenses and has a lot of listed subsidiaries in its portfolio. The variables interest rate, maturity, ownership concentration and liquidity were not found to be significant in explaining the undervaluation of Belgian Holdings.

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List of used abbreviations

Abbreviation	Meaning
A&H	Ackermans & Van Haaren
AVG	Average
BDS	Bois Du Sauvage
BEL-20	Belgian stock index
BENELUX	Belgium, Netherlands, and Luxemburg
BRE	Brederode
CAPM	Capital Asset Pricing Model
CEF	Closed-end fund
COVID	Coronavirus disease
DIET	D'leteren
ESI	Economic sentiment indicator
FLO	Floridienne
GBL	Group Bruxelles Lambert
GDF Suez	Gaz de France and Suez
GIMV	Gewestelijke Investeringsmaatschappij voor Vlaanderen
Holdco	Holding Company
IPO	Initial Public Offering
LSDV	Least square dummy variable
MAX	Maximum
MIN	Minimum
NAV	Net asset value
OLS	Ordinary least squares
OTC	Over the counter
Privak	Private Equity bevak
QFG	Quest for growth
SE	Standard errors
SENTIX	Sentiment Index
SG&A	Selling, general, and administrative expenses
SOF	Sofina
Stoxx-600	European stock index
T-bills	Treasury Bills
TINC	The infrastructure company

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1 Introduction

Holding companies (holdcos) acquired a lot of power and capital throughout history, which made them have a large influence on both the industrial and non-industrial sectors of the Belgian economy. This can be explained by the attractive tax landscape of Belgium, companies are not obliged to pay taxes on the added value they create. Only when dividends are provided to the shareholders, a tax will be implied by the Belgian state (Verhasselt, 2004). Also, where banks fail to provide capital to starting entrepreneurs, holdings provide a solution. They close the funding gap for start-ups by providing risk capital, this is relevant since start-ups are one of the major drivers for economic growth in a country. Lastly, holding structures provide transparency in corporate governance and management efficiency (Park & Shin, 2022).

Holdings are not only of use on the macroeconomic level but also play a role at the microeconomic level. Retail investors benefit by investing in holding companies as well. By buying only one share of the holding company, investors are diversified over several countries and sectors. Holding companies can invest in both listed and non-listed companies, which might increase the attractiveness of holdings since they allow retail investors to invest in private equity. This market would not be accessible for retail investors when holdings wouldn't provide the opportunity to invest in them. Furthermore, the returns of holding companies usually outperform those of the Stoxx-600 index in the long run. Lastly, investors can also benefit from the know-how of the managers of these holdings for free which is in contrast with mutual funds where fees will be implied for the same service (Mampaey, 2023).

However, holdings have never quoted at a discount as high as in the past 10 years (Mampaey, 2023). A rational investor would consider this as an investment opportunity if the discounts weren't justified. This is something that will be researched in this master's dissertation.

“What are the determinants of the undervaluation of Belgian Holdings? “

This has already been investigated for Italian holdings by Alesii (2000) and Korean holdings by Park and Shin (2022). Rommens et al. (2004) also created a framework for the holding discount in Belgium. Despite these papers, there is a lack of empirical foundation on the determinants of the Holdco discount. This is why this dissertation will also base itself on the literature conducted on the closed-end fund discount. Both holdings and closed-end funds are instruments to invest in financial assets. The biggest difference between both of them is that a holding has the objective to actively manage the companies in which it has a stake which is

in contrast with a closed-end fund whose main objective is to make profits through buying/selling stocks only (Rommens et al., 2004). Despite this difference, both are confronted with a fluctuating discount that couldn't exist when markets were efficient (Fama, 1970). Given the efficient market hypothesis, assets should be priced in the market at their fair value. If this is not the case scholars speak of an anomaly, something that is present in the data but cannot be explained by the literature. Therefore, this dissertation builds on the academic research conducted on both topics and applies this to Holdcos whenever possible. This dissertation will cover three frameworks: the efficient market hypothesis, the closed-end fund puzzle, and the BlackRock framework. The efficient market hypothesis will be discussed since taking the assumption that markets are efficient the Holdco and Closed-end fund discount could not exist. The closed-end fund puzzle is discussed since this is a phenomenon widely discussed in the literature and can be used as a basis for the Holdco discount. The closed-end fund puzzle discusses 2 drivers of this phenomenon: company-specific characteristics and noise traders. Lastly, the BlackRock framework explains the closed-end fund puzzle from 4 perspectives: market sentiment, investor sentiment, fund specific, and manager & firm.

This dissertation contributes to the existing literature on the Holdco discount but mostly the Belgian Holdco landscape for several reasons. Firstly, it approaches the Holdco discount from an empirical point of view rather than a purely theoretical framework. Secondly, this dissertation tries to research the Holdco discount from several perspectives. Most papers only look upon certain firm-specific characteristics rather than taking market sentiment, investor sentiment, and the ownership and firm history as well into account. Thirdly, the Holdco discount is researched within the macroeconomic environment of Belgium which hasn't been done a lot before. Lastly, the period of investigation 1995-2022 is wider than that of the existing literature. Most papers only look at a smaller period rather than including all years for which data is available. Besides this, the use of daily data instead of monthly or yearly data might provide additional insights. The results of this study can benefit the literature but also investors and managers interested in holdings. Investors can use this information to make a well-founded decision on whether to invest in holding companies or not. Managers on the other hand can adapt their policy towards the determinants of the Holdco discount when they're aiming to be priced at their fair value.

This master's dissertation will analyze a wide range of categorized determinants on the Holdco discount. While doing so a selection based on Mampaey (2021) of ten listed Belgian Holdcos will be investigated for the period between 1995 to 2022 which leads to a total of 37.438 used observations. Moreover, a subsample analysis will be performed to test the relation of the Holdco discount and its determinants over the past 10 years. Lastly, a cross-sectional analysis will be performed by grouping the sample companies based on the industries they're invested in. This way additional insights will be provided on whether there is a relation between industry composition and the determinants of the Holdco discount.

The data is retrieved from Holdcos' annual reports and Refinitiv datastream. Since the data is stored in the form of a panel dataset the respective hypotheses will be tested using a fixed effect model. The fixed effect model is significant and provides a robust explanation for the Holdco discount. The highest portion of explanatory power for the Holdco discount is derived from the relation between the discount and investor sentiment, dividend, expenses, listed participations, leverage, and size.

This dissertation is built up as follows: Section 2 of this dissertation gives an overview of what holdings are and how they're situated within the economic system. Furthermore, it describes how the net asset value of holdings can be derived and when they are quoted at a discount. Also, the consensus in the existing literature on this topic will be covered in this section. Section 3 describes the sample, variables, and the methodology used in this dissertation. Section 4 presents the main results, subperiod analysis, and cross-sectional analysis with their respective robustness checks. Finally, section 5 provides a discussion and conclusion.

2 Literature Review

2.1 What is a holding company?

2.1.1 What is a holding company? And what are the reasons for its existence?

“A holding company is a parent company created to buy and control the ownership interests of other companies” (Feldman, 2024, p.1). Holding companies (also known as Holdcos) tend to be actively involved in the management of their subsidiaries. This is because they manage risk capital and as a result, they expect a return on their investment in the long run. So, to succeed they will guide and help their subsidiaries actively.

Holding companies are a hybrid form of an investment company and a venture capital. Likewise, investment companies, holdings bring together a pool of money that is managed by agents. This way individual investors get the opportunity to diversify their risk without giving up on their expected return. In exchange for this investment, retail investors are entitled to both dividend and voting rights (Verhasselt, 2004). The difference between a holding and an investment company is the word risk capital. Investment companies invest the savings of individual investors mostly into stocks, bonds, real estate,... these asset classes are considered less volatile and as a result less risky than risk capital. Holdings invest just like venture capitals in start-ups and scale-ups who need money to grow but are also faced with a higher probability to go bankrupt. The difference between both is that holdings want their subsidiaries to grow but will not necessarily sell the subsidiary when it reaches the state of maturity (Verhasselt, 2004). On the contrary, venture capitals will sell their shares at a premium and look for a new investment opportunity whenever its subsidiary becomes mature (Aernoudt, 2019).

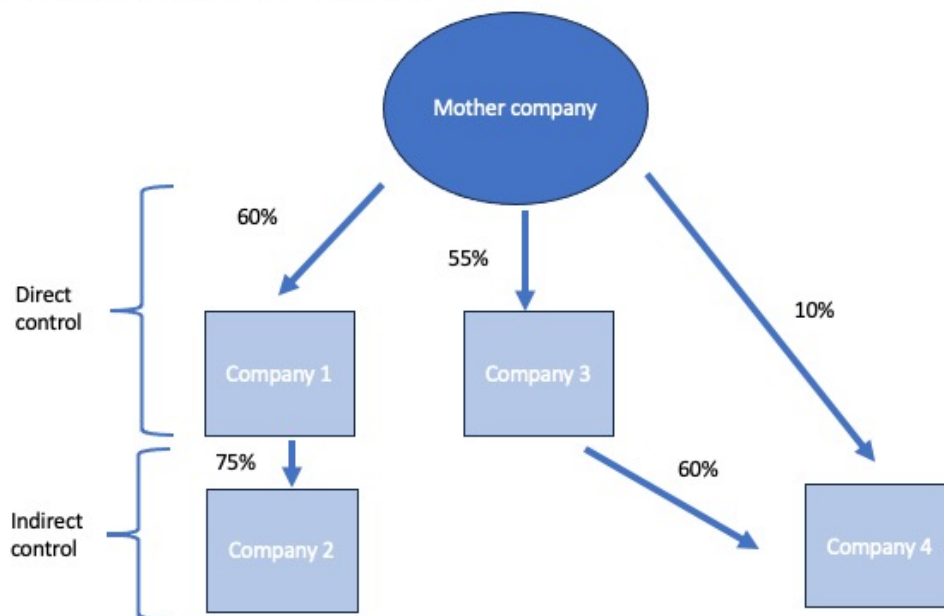
One of the main reasons holding companies exist is because of the malfunctioning of the capital market. In a well-functioning capital market, every project that needs funding should get that funding. However, information asymmetry and potential agency problems disrupt this theory. Financiers don't dispose of the same information as the entrepreneurs who need funding, this phenomenon is called information asymmetry. Besides this, there are agency problems since financiers have no control over how entrepreneurs will allocate these funds. As a result, economically feasible projects don't get the funding they deserve (Verhasselt, 2004; Aernoudt, 2019). In the banking industry, a common solution is the demand for additional guarantees to decrease the exposure at default. This might work for mature companies with positive cash flows and a lot of tangible fixed assets, but most start-ups don't possess a lot of tangible fixed assets. This is why most start-up companies are mostly affected

by the funding gap. Risk capital offers a solution to overcome this valley of death (Aernoudt, 2019).

2.1.2 Structure and Characteristics

Holding companies are the parent companies of their subsidiaries. Both are legally different companies that function separately from each other. However, holdings control the activities happening in their subsidiaries. They work with a decentralized pyramidal structure designed to create an extensive network with a minimum of capital. A majority of the shares are held when an investor owns 50% of the shares plus one, this is called direct control. However, control can be also gained indirectly by a smaller proportion of the shares (Verhasselt, 2004). As shown in Figure 1 the parent company owns 0% of the shares of company 2, but by holding a majority of the shares in company 1 she can pursue indirect control in company 2. The same situation occurs for company 4 by a majority of the shares in company 3.

Figure 1: Illustration of a pyramidal structure holding



Source: own elaboration

2.1.3 Categories of Holdings

Daems (1978) differentiated five categories concerning holdings based on their economic function. However, only four categories are still relevant (VDV accountant, 2023):

1. Financial holding: They don't pursue any kind of commercial activity and are not involved in managing their subsidiaries. Their main task is providing help to their subsidiaries, this could be both financial help and knowledge. In exchange the subsidiaries need to achieve the financial targets as agreed upon.
2. Industrial holding: Pursues commercial activities and actively manages an extensive portfolio of companies.
3. Portfolio holdings: the category that is most related to a mutual fund. Portfolio holdings are result-driven, and their focus lies on selling their underlying portfolio with an added value.
4. Patrimony holdings: these are holdings managed by wealthy families who try to hedge the risk of their patrimony. This could be an extra incentive since they risk their capital, and they're less likely to take unnecessary risks (Mampaey, 2022).

2.1.4 Differentiation between holdings and closed-end funds

A closed-end fund is an investment company traded on an exchange or the OTC-market. As mentioned before they bring together a pool of money and invests those funds in financial assets. Their business model is the following: an investor buys/sells shares from the closed-end fund and has a claim on their underlying portfolio. The difference between an open-end fund and a closed-end fund is that the number of shares is fixed for a closed-end fund. This means that the price moves around the net asset value, which creates premiums and discounts (Bodie et al., 2021). When a holding is quoted on an exchange the difference between holdings and closed-end funds becomes less clear. However, the biggest differentiation is that a holding has the objective to actively manage the companies in which it has a stake. Closed-end funds their main objective is to make profits through buying/selling financial assets only (Rommens et al., 2004).

2.1.5 Net asset value and holding company discount

The net asset value is a formula used to determine the price you have to pay for one share of an investment company. It reflects the value and the performance of the underlying portfolio (Rommens et al., 2004; Bodie et al., 2021).

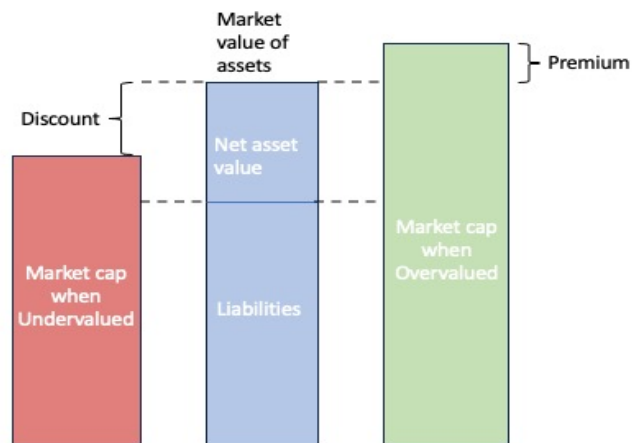
$$\text{Net asset value} = \frac{\text{Total assets} - \text{Total liabilities}}{\text{\#Common shares outstanding}}$$

It's also possible that the price paid on the market doesn't reflect the intrinsic value. The price can be either above or below the net asset value, respectively called a premium and a discount as shown in Figure 2. In this case, there is an arbitrage opportunity, it's possible to make a profit without taking any risk. So, investors can take advantage of this arbitrage opportunity by making the market price return to the fair value of this financial asset. This is only true for efficient markets. If markets are inefficient it can be the case that this discount or premium will remain there even in the long run. The focus of the research lies on the discount or undervaluation of a holding, which can be calculated as follows (Blackrock, 2023).

$$Discount (\%) = \frac{Net\ asset\ value - market\ capitalization}{Net\ asset\ value} * 100$$

The same valuation techniques can be applied to both closed-end funds and holdings.

Figure 2: Illustration calculation of the net asset value



Source: Own elaboration

2.2 Theoretical frameworks on the Holdco discount

Efficient market hypothesis

According to the efficient market hypothesis stated by Fama (1970), prices should reflect the fair value of financial assets. So, if an asset has a higher return than other companies in its sector this can only be explained by taking a higher risk. Fama (1970) distinguished three forms for the efficiency of the markets. The weak form states that prices in the market reflect all historical data so there can be no profit made by technical trading. The semi-strong form states that the market reflects all public information, so there can be no profit made by fundamental analysis. The strong form goes even further by stating that both public and private information is reflected by stock prices. So, there can be no profit made even by insider trading. However, there can also be anomalies present in the financial markets. Patterns found within the data cannot be explained according to the theory and contradict the efficient market hypothesis as a result. One way to interpret these anomalies is as a sign that markets are only efficient until a certain level. Another way to look at anomalies is by considering them as an additional risk factor, which explains higher returns that can be achieved by buying these stocks (Fama & French, 2015).

Closed-end fund puzzle

Given the efficient market hypothesis, the closed-end fund puzzle and the Holdco discount can be considered an anomaly. The first scholar who documented the presence of closed-end fund discounts was Pratt (1966), he argued that they were the result of a public misunderstanding and a lack of sales effort. Malkiel (1977) was the first to perform an analysis of the determinants of the closed-end fund discount. He argued that managerial skills, managerial fees, bookkeeping procedures, and unrealized capital appreciation could lie at the basis of the discount phenomenon. Every single one of these variables lacked the explanatory power to solve the closed-end fund puzzle, which caused the discount to be acknowledged as an anomaly in the world of finance. Lee et al. (1991) described in their paper that closed-end funds are characterized by a recurring pattern within the data. First, closed-end funds are quoted at a premium of 10%. Within 120 days after their foundation, they move to a discount of 10%. However, these discounts on closed-end funds are subject to fluctuations over time. Lastly, when closed-end funds are terminated by either liquidation or converting to an open-ended structure then the share prices converge to their fair value and the discount shrinks as a result.

There are several explanations for this cycle. There can be made a distinction between standard explanations and arguments related to investor sentiment. Arguments 1 to 3 provide standard explanations for the closed-end fund puzzle. Argument 4 provides an explanation regarding investor sentiment.

1. Agency costs

Boudreaux (1973) argued that closed-end funds should trade at a discount when managers don't add enough value. This was later supported by an empirical analysis performed by Malkiel (1977). However, Lee et al. (1991) argued in their influential paper that the fluctuations in discounts are too large to only account for agency costs. Agency costs can also not explain why rational investors buy the same asset at a premium when it will become a discount later. The consensus on agency costs is divided since Kumar & Noronha (1992), Cherkes (2001), Gemmill & Thomas (2002), and Cherkes et al. (2008) provided evidence that despite everything managerial fees are still an important source of discounts.

2. Capital gains/Tax liabilities

The tax timing used by managers of closed-end funds affects the CEF discount as well. Whenever a closed-end fund sells one of its subsidiaries then profits, also known as capital gains, are generated. But if these capital gains are realized at the wrong time, then investors end up with less profit. So, if a closed-end fund has a history of selling investments during less favorable market conditions, it can make that fund less attractive to investors. They might prefer funds that manage their taxes and investments more wisely to maximize their returns (Brickley et al., 1991; Malkiel, 1977; Elton et al., 2005; Day et al., 2011). However, Lee et al. (1991) still argue that tax liabilities can only account for a discount of no more than 6% so tax liabilities need to be complemented by other determinants to explain the holdco discount.

3. Illiquidity of assets

Cherkes et al. (2008) argue that closed-end funds transform illiquid assets into liquid securities as a service to their investors. However, discounts are observed when closed-end funds are less liquid than the assets in their portfolio (Datar, 2001; Deli & Varma, 2002). The effect of illiquidity can be explained from 2 perspectives according to Lee et al. (1991). On the one hand, closed-end funds tend to be overvalued when their assets are confronted with trading restrictions. This is called the restricted stock hypothesis. However, this hypothesis can be ruled out since in practice a lot of funds only hold public securities without any trading restrictions. On the other hand, the

illiquidity of assets can be explained by the block discount hypothesis. This theory argues that whenever closed-end funds hold substantial blocks of shares of their subsidiaries then the sales value of these assets might be much lower than the reported NAV when being sold in a block trade.

4. Noise trader sentiment:

Lee et al. (1991) argue that there are 2 types of investors. On the one side, there are rational investors. They have a short-term investment horizon, so liquidity is an important factor when allocating resources. These investors are also known as institutional investors. On the other side, there are noise traders. If those noise traders are optimistic about returns on these securities, they drive up their prices which causes premiums. If noise traders are pessimistic about returns on the securities, they drive down prices which leads to a discount. This is not necessarily a problem if different noise traders traded the securities randomly since the risk would be diversifiable in this case. However, the unpredictability of these traders impounds an additional risk on the assets they trade which is why a higher expected return is justified. Pontiff (1995) and Pontiff (1997) confirmed these arguments by illustrating that the returns of the closed-end fund were up to 64% more volatile than the returns of its assets. Also, they showed that the higher the exposure to investor sentiment the higher the additional risk premia demanded by the institutional investors.

Taking all the arguments into account the cycle can be explained as follows. The premium is high in the beginning since individual investors are particularly optimistic about closed-end funds. While rational investors would not invest right after the IPO of a closed-end fund. Fluctuations are there due to changes in investors' sentiment about future returns. When closed-end funds are terminated through liquidation or conversion to an open-end then noise trader risk is eliminated and so is the discount. As a result, holding a fund is riskier than holding its portfolio directly. This is why the required rate return must be higher and so the discount is justified.

Blackrock framework

Lee et al. (1991) provide a general explanation for the closed-end fund discounts but don't provide an in-depth explanation of why there might be a difference between closed-end funds. Blackrock (2023) distinguishes several dimensions of premiums and discounts for which a closed-end fund can distinguish themselves from one another. This framework can be combined with existing literature on Holding companies and closed-end fund discounts.

Market sentiment

This dimension consists of factors like interest rate, inflation, business cycle, and asset class performance, ... Sharpe (1964) illustrates how these factors might have an impact through the capital asset pricing model (CAPM). Holdings have to offer at least the same return as a risk-free investment like treasury bills emitted by a government. Besides this, they need to offer an additional risk premium for what happens in the market, better known as systemic risk. In contrast with firm-specific risk, systematic risk is non-diversifiable and cannot be avoided by holding a portfolio of subsidiaries. However, some holdings are more sensitive to what happens in the market than others which is captured by beta. This leads to the following formula:

$$E(R_i) = R_f + \beta_i [E(R_M) - R_f]$$

With:

$E(R_i)$ = Expected return of a holding

R_f = Risk – free rate

β_i = beta

$E(R_M - R_f)$ = Risk premium

The CAPM can be used as an indication that there might be a relation between the market conditions and the Holdco discount. The literature confirms the reasoning of the CAPM regarding the importance of the interest rate in explaining the Holdco discount. Pontiff (1966) argued that the mispricing of closed-end funds is the most severe in times of high interest rates. Flynn (2005) confirmed this later by explaining that interest rates and so bond yields are alternative returns against which closed-end funds must compete. Lastly, both Cherkes et al. (2008) and Ramadorai (2012) found that an increase in the short-term interest rate has an adverse relation with closed-end fund premiums. In short, both papers indicated the level of interest rates are positively related to the Holdco discount.

Investor sentiment

This dimension looks upon the closed-end fund puzzle from a behavioral finance point of view. De Long et al. (1990) were the first to present a model between behavioral finance and the closed-end fund discount. They argued that irrational noise traders affect both prices and expected returns. The unpredictability of these noise traders deters rational arbitrageurs from betting against them when they make the price of an asset deviate from its fair value. This is why those same noise traders can earn a higher return than a rational investor would do since

they bear a disproportionate amount of risk created by themselves. Lee et al. (1991) explained the closed-end fund puzzle by assuming that noise traders held a high percentage of the shares of closed-end funds. This was later confirmed by Fujiwara (2006) for the Japanese closed-end fund market and by Lin et al. (2008) for real-estate closed-end funds.

Fund specific

This dimension looks at the CEF discount from upon arguments related to the corporate actions of this fund. Firstly, decisions related to diversification can show a positive relation with the size of the closed-end fund discount (Denis et al., 2002). Holdings operate as an internal capital market, by transferring resources from one subsidiary to another. When done efficiently this creates benefits for both the investor and for the holding but this doesn't have to be the case. Denis et al. (2002) show that diversification also adds complexity and can cause inefficient cross-subsidization by just transferring resources from the profitable subsidiaries to the less profitable ones. Taking diversification into account there might be a relation between the industry composition and the discount of a fund as well. Intuitively, it can be argued that investing in cyclical industries like innovative or niche industries will lead to larger fluctuations in the Holdco discount. However, there is no empirical evidence to be found on this topic (Detournay, 2003). Another parameter is the difficulty of replicating the portfolio of a company Pontiff (1996). Portfolio managers decide on the number of participations they like to have in listed and non-listed companies and as a result the replicability of the portfolio. The more listed participations a holding company has, the more tempted an individual investor is to replicate the portfolio rather than invest directly in it to avoid this Holdco discount (Park & Shin, 2022).

Furthermore, the dividend policy of a holding has a significant impact on the Holdco discount. Malkiel (1995) and Pontiff (1996) argue that dividends encourage rational arbitrageurs to reduce closed-end fund discounts since dividends are deposits on the fund's capital gains and as a result lower the holding costs. In short, holdings with a higher dividend payout ratio will be less subjected to discounts since arbitrageurs are more incentivized to participate in these holdings (Yoon & Starks, 1995). Next up, the expense ratio shows a positive relation with the Holdco discount (Charrón, 2009). Kumar and Noronha (1992), Berk and Stanton (2007), and Gemmill & Thomas (2002) find that differences in managerial fees do explain a small proportion of variation in discounts between closed-end funds. Cherkes et al. (2008) explain this variation as follows: lowering the expense ratio of a company increases the share of the fund's cash flows that goes to the investor rather than the manager. As a result, the expenses of a holding are positively related to the discount. Lastly, the literature is divided on the relation between the Holdco discount and leverage. The use of debt and so leverage can increase the value of a firm since debt can be used as an interest tax shield and create leveraged returns

at the same time. Also, the use of debt can solve agency problems by disciplining the agents or managers (Eun et al., 2024). The downside of using additional debt is the increased exposure to volatility and risk.

Manager & Firm

This dimension looks at arguments related to the track record of the fund manager and the firm. Whereas rational investors don't see past performance as a guarantee for future performance, Brounen and Ter Laak (2005) disclose evidence of a negative relation between past performance and the Holdco discount. This might be an indication that markets are not as efficient as originally thought. Discounts are also found to be weakly related to future performance (Roelfeldt and Tuttle, 1973; Lee et al., 1990). Another essential parameter that needs to be considered is size. Large firms enjoy the benefit of economies of scale and greater access to capital (Brounen & Laak, 2005; Park & Shin, 2022; Kumala et al., 2024). Consequently, there is a negative relationship between fund size and discount. Charrón (2009) and Rahman (2022) suggest that firms with a longer listing history become more well-known to the investors in the market and have a smaller discount as a result. Moreover, liquidity and ownership concentration play an important role in explaining the CEF discount as well. As mentioned before, closed-end funds provide small investors the opportunity to invest in illiquid assets by buying shares of the liquid CEF. They can sell the CEF shares to another investor at any time without the underlying assets needing to be sold, thus avoiding illiquidity costs (Cherkes et al., 2009). Whereas Pontiff (1996) argues that large funds might have a liquidity premium because they can be traded in bigger volumes and with a low bid/ask cost. Lastly, ownership concentration is a parameter that investors are cautious about. Controlling shareholders can cause a principal-agent problem by generating private benefits of control at the expense of minority shareholders (Barclay et al., 1993; Rommens et al., 2004).

2.3 Hypotheses

The previous section of this dissertation discussed the most common theories and empirical findings related to the discount phenomenon. These will act as a foundation for ex-ante expectations of relationships between the Holdco discount and some of its determinants.

Interest rate

Not only are closed-end funds mostly mispriced in times during which interest rates are high (Pontiff, 1966), but they also determine the yield given on financial products like bonds and treasury bills. Flynn (2005) confirmed this later by showing that interest rates and so bond yields are alternative returns against which closed-end funds must compete. Lastly, both Cherkes et al. (2008) and Ramadorai (2012) found that an increase in the interest rate has an adverse relation with closed-end fund premiums. In short, both papers indicated that the level of interest rates is positively related to the Holdco discount.

H1: “There is a positive relationship between the interest rate and the holding company discount.”

Investor sentiment

Noise traders primarily hold and trade closed-end funds. Since institutional investors are more likely to replicate the underlying portfolio of the closed-end fund. If those noise traders are optimistic about returns on these securities, they drive up their prices which causes premiums. If noise traders are pessimistic about returns on the securities, they drive down prices which leads to a discount. The unpredictability of these noise traders deters rational arbitrageurs from making the stock price of the CEF return to its fair value (De Long et al., 1990; Fujiwara, 2006; Lin et al., 2008).

H2: There is a negative relationship between investor sentiment and holding company discount.

Dividends

Miller & Modigliani (1961) argue that in efficient capital markets dividend policy is irrelevant. A rational investor isn't bothered whether the profits of a company are given as a dividend or kept within the company through retained earnings. However, they can serve as a signal to their investors about the firm's growth prospects which can affect the stock price. This led to the signaling theory supported by Bhattacharya (1979). A positive signal could be sent to the investors by increasing dividends steadily year after year. This would be perceived as an

indication that the firm expects stable or higher cash flows in the future. At the same time paying too many dividends might hinder the future growth of a company (Bodie et al., 2021). Within the literature of closed-end funds and holdings, dividends encourage rational arbitrageurs to reduce closed-end fund discounts since dividends are deposits on the fund's capital gains and as a result lower the holding costs for these arbitrageurs. This makes them more incentivized to arbitrage those holdings with a higher dividend payout ratio (Yoon & Starks, 1995; Malkiel, 1995; Pontiff, 1996; Chan et al., 2008).

H3: There is a negative relationship between dividend and the Holdco discount.

Expenses

Despite holdings not having any production activities there are still a high amount of expenses related to monitoring and managing their subsidiaries actively (Rommens et al., 2004). Lowering these operating expenses increases the share of the fund's cash flows that goes to the investor rather than the manager. As a result, the expenses of a holding are positively related to the discount (Kumar and Noronha, 1992; Gemmill & Thomas, 2002; Berk and Stanton, 2007; Charrón, 2009)

H4: There is a positive relationship between the expenses of the holding and the discount.

Listed companies

The more listed participations a holding company has, the more tempted the investor is to replicate the company's portfolio rather than invest directly in it to avoid the Holdco discount (Pontiff, 1996; Park & Shin, 2022). So as a result, the discount of a holding will increase as the number of listed subsidiaries increases.

H5: There is a positive relationship between the number of listed companies and the Holdco discount.

Leverage

The consensus within the literature is ambiguous. On the one hand, the use of debt and so leverage can increase the value of a firm since debt can be used as an interest tax shield and create leveraged returns at the same time. Also, the use of debt can solve agency problems by disciplining the agents or managers (Eun et al., 2024). In this point of view, the use of leverage can be explained as an additional liquidity benefit since the additional funds can be used for new investment opportunity sets, and investors anticipate this by paying more for the fund's shares (Ramadorai, 2012; Elton et al., 2013; Dam et al., 2023). On the other hand, the use of leverage is not a guarantee for better fund performance, and it increases exposure to systematic risk (Cherkes et al., 2008). Scholars say the risk and exposure to the macroeconomic environment overrule these benefits (Brounen and Ter Laak, 2005; Park and Shin, 2022). This is why a positive relation between the use of leverage and the closed-end fund discount will be predicted in this paper.

H6: There is a positive relationship between the use of leverage and the discount of a holding.

Asset size

Large firms enjoy the benefit of economies of scale and greater access to capital (Brounen & Laak, 2005; Park & Shin, 2022; Kumala et al., 2024). These benefits result in lower discounts compared to their net asset value. However, one might argue that larger holding companies are associated with higher discount rates since they face more difficulties in managing the funds efficiently. This would cause managers to be less engaged in stock selection (Chan et al., 2008; Rahman, 2022)

H7: There is a negative relationship between the size of a holding and its discount.

Maturity

There was a recurrent cycle present in the closed-end fund discount described by Lee et al. (1991). The premium is high in the beginning since individual investors are particularly optimistic about closed-end funds. Fluctuations are there due to changes in investors' sentiment about future returns. When closed-end funds are terminated through liquidation or conversion to an open-end then noise trader risk is eliminated and so is the discount. This theory indicates movements throughout the life of a closed-end fund but doesn't tell us what thrives the fluctuations of the discount. That's why this dissertation bases itself on Chan et al. (2008), Charrón (2009), and Rahman (2022) who suggest that firms with a longer listing history become more well-known to the investors in the market and have a smaller discount.

H8: There is a negative relationship between the maturity of a holding and the discount.

Ownership concentration

Controlling shareholders can cause a principal-principal problem by generating private benefits of control at the expense of minority shareholders. At the same time, a certain degree of ownership concentration is necessary to incentivize these shareholders to keep monitoring the management. Otherwise, a principal-agent problem arises with the principal being the shareholders and the agent being the management of the company (Eun et al., 2024). Taking both views into consideration minority shareholders can still have an advantage by investing in holdings with controlling shareholders. Monteiro (2019) even reported a negative relationship between ownership concentration and market performance. He argued that the ownership concentration in Belgium firms is significantly high, which is a typical characteristic for countries using the French-civil-law. However, both Barclay et al. (1993) and Pontiff (1993) and Chan et al. (2008) argue that the conflicting interests of the minority and the controlling shareholders overrule in these types of situations.

H9: There is a positive relationship between the ownership concentration of the holding and the discount.

Liquidity

One explanation of the relation between liquidity and the Holdco discount is if assets are traded infrequently, it causes the market to stay in a non-equilibrium which most of the time triggers a discount (Gemmill & Thomas, 2002). At the same time, holdings provide a liquidity transformation. Shares of a holding can be sold to another investor at any time without the underlying assets needing to be sold, thus avoiding trading costs (Datar, 2001; Chan et al., 2008; Cherkes et al., 2008). Lastly, liquid funds can be traded in bigger volumes and with a low bid/ask cost (Pontiff, 1996).

H10: There is a negative relationship between the liquidity of a holding and the discount.

Table 1: Summary of the hypotheses

	Variable	Ex-ante relationship
H1	Interest rate	Positive
H2	Investor sentiment	Negative
H3	Dividend	Negative
H4	Expenses	Positive
H5	Listed companies	Positive
H6	Leverage	Positive
H7	Size	Negative
H8	Maturity	Negative
H9	Ownership concentration	Positive
H10	Liquidity	Negative

3 Data and Methodology

3.1 Data collection

The data collection happened through Refinitiv Datastream, which is an industry-leading data source. Most of the financial data is directly requested from Refinitiv Datastream itself. However, data for the variables listed participations and ownership concentration is not provided by Datastream so it needed to be added through annual reports of the sampled holdings. The period used for this dissertation is 1995-2022 on a daily frequency. This range is chosen because this is the maximum range available on Refinitiv Datastream.

Since there is a collection of time series data on the one hand and cross-sectional data on the other hand this dataset is well suited to be integrated into a panel dataset. Panel datasets are more informative since they consider both dimensions and have more data points compared to performing only a time-series or only a cross-sectional study and a result will lead to more useful insights. This dissertation covers thus an unbalanced panel dataset using 37.438 observations.

3.2 Sample selection

Starting from the database of Bel-first 51 companies are considered having a holding activity. However, under this type of categorization, Elia is for example considered as a holding as well. This can be explained by the fact that Elia Group manages several subsidiaries: Elia Transmission, Eurogrid International, and Elia Grid International. So, this suits the definition of Feldman (2024) that a holding company is a parent company that is created to buy and control the ownership interests of other companies. However, this doesn't suit the idea that individual investors get the opportunity to diversify their risk without giving up on their expected return stated by Verhasselt (2004). This is because Elia is completely focused on one sector and one geography. So, companies might perfectly suit the legal definition of a holding but are not applicable as a holding company for this research.

This research looks at holdings as a hybrid form between venture capitals and investment companies that actively manage their subsidiaries to create added value but also care about diversifying their activities through their subsidiaries. This is why this dissertation bases itself on the classification of Belgian holdings by Mampaey (2021). Besides this, there is a lack of data for non-listed holdings which is an extra motivation to select Holdings as described above. Listed companies are obliged to publish annual key information to their investors. This transparency requirement makes them suited candidates to study the Holdco discount phenomenon. The following companies are categorized as Belgian holding by Mampaey (2021).

Ackermans & Van Haaren

Ackermans & Van Haaren is a well-diversified investment company founded in 1876 and listed on Euronext Brussels since 1984. They're part of the BEL 20, which are the 20 biggest companies listed on Euronext Brussels. They consider themselves as a long-term partner of family businesses with sustainable growth potential to become market leaders in their sector. The categorization of their activities into sectors as of 31 December 2022 can be found in Table 2.

Compagnie du Bois Sauvage

Compagnie du Bois Sauvage is a company founded by the Paquot family with the remaining free-floating shares being listed on Euronext Brussels. Compagnie du Bois Sauvage tries to participate actively in the strategic orientations of their subsidiaries. This allows them to be a long-term investor alongside the entrepreneurs. They invest in a limited number of industrial holdings, both listed and unlisted. The categorization of their activities into sectors as of 31 December 2022 can be found in Table 2.

Floridienne

Floridienne is a holding company of the family Waucquez mainly present in niche markets with a focus on differentiation through creativity and innovation. Their mission is to be a reliable business partner of multinationals for which Floridienne's activities are too narrow or "out of the box". Also, they own almost all the shares of their participations which is in contrast with other holdings that only take a minority shareholder participation. The categorization of their activities into sectors as of 31 December 2022 can be found in Table 2.

Groep Brussel Lambert

GBL is the second largest holding in Europe and is also part of the BEL 20. It was founded by Albert Frère, one of the most known businessmen on Belgian soil. With his investment company GBL, he had a major impact on the Belgian economy as of today. GBL initially invested mainly in French companies like GDF Suez, Total, Lafarge, and Pernod Ricard. Despite the strategy remaining the same, investing in a small number of quality firms, they switch partially to private equity and growth capital as well.

GIMV

An investment company listed on Euronext Brussels with a focus on private equity and risk capital. The fund was initiated by the government of Flanders to help Flemish companies in their expansion and international growth. Today this scope is expanded towards small to medium-sized companies located in the BENELUX and their neighboring countries (France, Switzerland, and Germany).

D'leteren

D'leteren was part of the BEL20 during the periods 1998-2006 and 2012-2016. D'leteren started its activities as a manufacturer of car bodies and distributor of cars and trucks. However, they quickly started widening their scope by renting out cars under the name AVIS and acquiring BELRON which is specialized in window repair and replacement. This trend of diversification continued and led to the d'leteren group as an investment company.

Quest for Growth

Quest for Growth is an investment company that invests 70% in quoted and at least 25% in private growth companies. Their geographical focus is mainly European companies. One of the characteristics that distinguishes them from other holdings is their strategy of creating a tax advantage for their investors through a legal structure which is called a Privak.

Sofina

A holding founded by the Boël family and part of the BEL 20. In the past, Sofina got the nickname "sleeping beauty". This referred to the fact that they quoted at a discount year after year due to a lack of transparency and communication towards their investors. However, Sofina worked on this weakness and flourished during the COVID period. Today, their mission is to make entrepreneurs and family companies grow by providing expertise and funding in the most patient way possible. They split this strategy into 3 pillars: long-term minority investments, Sofina growth, and Sofina private funds.

Tinc

Tinc is one of the youngest holdings listed on the Exchange of Brussels. Tinc is an atypical holding since it mainly invests in infrastructure and real estate. They finance projects like wind farms offshore, road infrastructure, and locks, ...

Brederode

Brederode always tries to balance its portfolio between private equity and listed participations through stock picking. They argue that private equity provides higher returns than the market, but listed securities are necessary to have a proper finance reserve. Over the past 10 years, Brederode was one of the few Belgian companies to outperform the oracle of Oklahoma better known as Warren Buffet.

Categorization

To create actionable insights on the industry composition of the holdings. The sample is categorized based on activities. Firstly, infrastructure & resources takes all activities into account regarding providing electricity, building roads, building locks, ... but also everything related to supplying and distributing commodities. In short every activity needed to make society operable. Secondly, industry look at every company that focuses on producing goods/services at a large scale. Also included under this category is maritime engineering. Consumer goods look at companies that have a business-to-consumer business model. Their focus lies on producing tangible goods ready for consumption. Health care focuses on the longevity of the society through prevention, diagnosis, and treatment of diseases. Financial services, technology, and education are straightforward and cover the following activities respectively: providing financial products/ services, application of scientific knowledge to practical use cases, and teaching. Real estate covers the interest in land property and any permanent structures build upon these. Lastly, growth capital are funds provided to companies to reach their full potential. When activities of the holding companies were unknown or didn't fall under one of the earlier mentioned categories they were included as "other" in Table 2.

Table 2 shows the results when applying these categorizations to the sampled Holdings. Floridienne and D'leteren don't disclose any information on their activities so no categorization could be made for either of them.

Table 2: Summarizing table of all sectors across holding (own categorization)

Holdings	Sectors									
	Infrastructure & resources	Industry	Consumer goods	Health care	Financial services	Technology	Education	Real estate	Growth capital	Other
Ackermans & Van Haaren	7.2%	31.0%	-	-	33.5%	-	-	10.3%	18%	-
Bois du sauvage	-	11%	49.1%	-	8.8%	-	-	25.4%	-	5.7%
Floridienne	-	-	-	-	-	-	-	-	-	100%
GBL	-	13%	35%	12%	16%	6%	-	-	18%	-
GIMV	32.4%	-	13.6%	27.6%	-	26.5%	-	-	-	-
D'leteren	-	-	-	-	-	-	-	-	-	100%
Quest for Growth	-	-	-	14.9%	-	45%	-	-	34.6%	5.5%
Sofina	-	-	18.0%	6.9%	-	11.1%	5.8%	-	47%	11.1%
TINC	81%	-	-	-	-	-	-	19%	-	-
Brederode	5%	-	5.5%	3.1%	5.3%	12.2%	-	-	67.4%	1.6%

3.3 Variables

Selecting the relevant variables and proxies is a crucial step in an empirical study. This dissertation considers the Holdco discount as its dependent variable. As explained in section 2.1.5, the discount is calculated as the net asset value minus the market capitalization divided by the net asset value. So, a positive value for this variable refers to a discount and a negative value refers to a premium. Furthermore, every hypothesis is tested by including an explanatory variable to verify the ex-ante expectations. This leads to ten explanatory variables.

As mentioned before Bloomberg (2023) established a framework that distinguishes four categories as main drivers for the closed-end fund discount. This framework can be applied to explain the holding company discount. To account for market sentiment this dissertation will focus on the interest rate. The interest rate can be captured by using the interest rate on the Belgian 3-month T-bills as a proxy. The higher the interest rate, the higher the attractiveness of other asset classes and the higher the Holdco discount. The second dimension of investor sentiment can be captured by the European area economic sentiment indicator as a starting point for the sentiment variable (European Commission, 2024). The economic sentiment indicator (ESI) is a composite indicator published by the European Commission and is a

weighted average of the outcomes of a monthly survey addressed to both firms and consumers. The selected firms are active in the following sectors: industry (weight 40 %), services (30 %), consumers (20 %), retail (5 %) and construction (5 %). The variable is the difference between the percentages of respondents giving positive and negative replies with a long-term mean of 100. Thus, values above 100 indicate above-average investor sentiment and vice versa.

The third dimensions consist of those variables related to the corporate actions of a firm. The higher the dividends, the smaller the discount which is captured by dividend yield as a proxy. Also, the more listed participations a holding company has, the more tempted the investor is in replicating the company's portfolio rather than invest directly in it. This can be measured by what percentage of the portfolio's assets is listed. The expenses of the holdings are often perceived as the efficiency in monitoring and managing funds. Expenses can be measured by looking at the total operating expenses of each holding. Lastly, the use of leverage increases the risk and exposure to the macroeconomic environment. Leverage is measured by dividing the total debt of a holding by its total assets managed.

The manager & firm dimension looks at arguments related to the track record of the fund manager but also its performance on the stock market. Firstly, ownership concentration will be captured by the fraction of shares owned by blockholders as a proxy of ownership concentration. Blockholders are those shareholders who own more than 5% of the shares of a company. Ownership concentration tries to capture the likelihood of the occurrence of agency problems, which will result in an additional discount. Secondly, the listing history will be captured by the number of days since the holding of its IPO. The longer a holding is listed the more well-known it becomes to investors and the smaller the discount. Thirdly, when the assets under management start to increase, holdings enjoy economies of scale and access to capital. This is captured by the total net assets as a proxy for size. Lastly, the liquidity of a holding affects the probability that the market is going to stay in a non-equilibrium. This is captured by the proxy share turnover. All explanatory variables and their proxies can be found in Table 3.

Table 3: Summary of variables and their proxies

Explanatory variables	Ex ante relationship	Proxies
Market sentiment		
Interest rate	Positive	Belgian 3-month T-bills
Investor sentiment		
Investor sentiment	Negative	The natural logarithm of the Euro Area Economic Sentiment Indicator
Fund specific		
Dividends	Negative	Dividend yield (%): $\frac{\text{Dividend per share}}{\text{NAV per Shares}}$
Expenses	Positive	Expenses as a % of the NAV: $\frac{\text{Total operating expenses}}{\text{Net asset value}}$
Number of listed companies	Positive	Listed fraction of portfolio (%): $\frac{\text{Assets invested in listed subsidiaries}}{\text{Total assets}}$
Leverage	Positive	Leverage (%): $\frac{\text{Total debt}}{\text{Total assets}}$
Manager & Firm		
Size of the holding	Negative	The natural logarithm of total net assets
Maturity	Negative	The natural logarithm of days since IPO
Ownership concentration	Positive	The fraction of shares owned by blockholders
Liquidity	Negative	Share turnover (%): $\frac{\text{Volume traded}}{\text{Common shares outstanding}}$

3.4 Descriptive Statistics

In this section, there will be a look at whether there are no multicollinearity problems between the explanatory variables. Moreover, the descriptive statistics of the dependent variable will be discussed from two perspectives. On the one hand, from the perspective of the discount averaged over all the Holdings included in the sample. On the other hand, from the perspective of the categorized holdings based on industry composition. The same categorization will be used for the cross-sectional analysis as well. Lastly, the descriptive statistics of the independent variables will be analyzed.

3.4.1 Multicollinearity

There is no significant high correlation between the explanatory variables as shown in Table 4 and as a result, multicollinearity is absent. At first sight, the strongest negative correlation can be found between the expenses and the discount of a holding (-0.39), opposing the expectations. Similarly, ownership concentration also shows a negative correlation with the discount variable (-0.22), indicating that block ownership might benefit the Holdco discount, opposing the ex-ante expectation. Furthermore, the sign of the correlation between leverage (-0.28) and the Holdco discount opposes the expectations. This is not the case for dividends (-0.03), maturity (-0.24), number of listed participations (0.42), interest rate (0.08), and investor sentiment (-0.24). All the previously mentioned variables are in line with their ex-ante relationships. Finally, the correlation matrix suggests that liquidity (0.08) and size (0.23) have a positive correlation with the Holdco discount. This would mean being more liquid and having more assets under management are associated with higher discounts. Even though these pairwise correlations give preliminary indications they do not control for the effect of the other explanatory variables, potentially leading to incorrect preliminary conclusions about the relationship.

Table 4: Correlation matrix

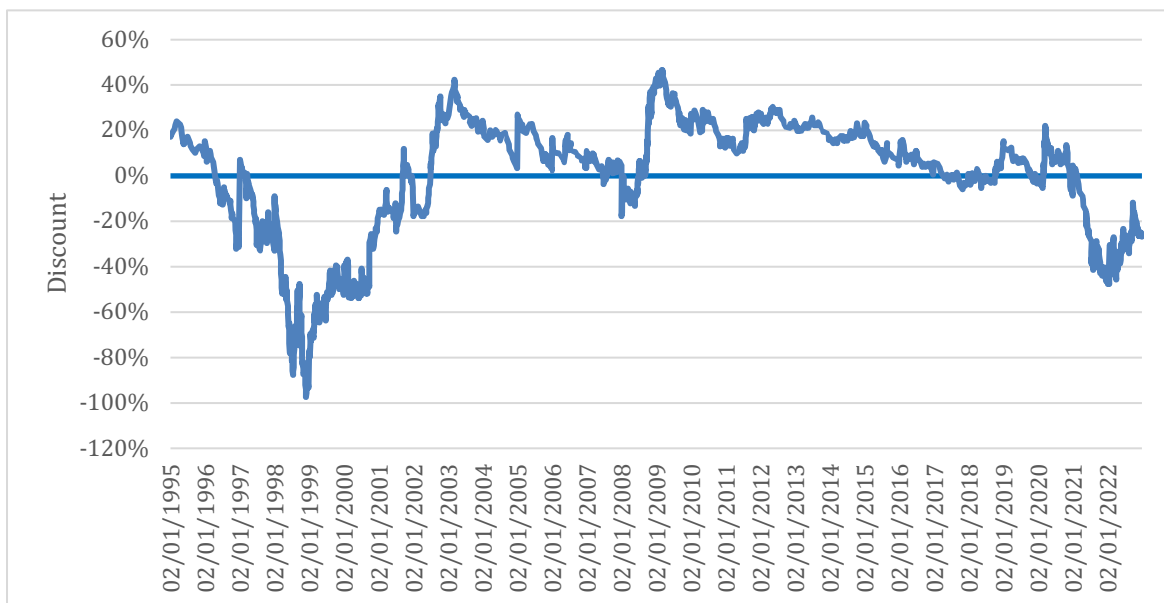
		1	2	3	4	5	6	7	8	9	10	11
1	Discount	1.00	-0.03	0.08	-0.24	0.42	0.23	0.08	-0.24	-0.39	-0.22	-0.28
2	Dividend		1.00	0.05	-0.19	-0.11	-0.12	-0.11	0.04	-0.09	-0.35	-0.16
3	Liquidity			1.00	-0.05	0.21	0.32	0.08	0.01	-0.15	-0.25	-0.03
4	Maturity				1.00	-0.16	0.24	-0.16	-0.01	0.59	0.69	0.22
5	Listed					1.00	0.60	0.22	-0.03	-0.45	-0.19	-0.06
6	Size						1.00	-0.04	0.04	-0.21	0.00	-0.03
7	Interest rate							1.00	-0.12	-0.15	-0.05	-0.02
8	Sentiment								1.00	-0.01	-0.04	-0.05
9	Expenses									1.00	0.66	0.58
10	Ownership										1.00	0.24
11	Leverage											1.00

3.4.2 Dependent variable

Overall analysis

Figure 3 shows that Belgian Holdcos trade at a small discount rather than a premium. When investigating this figure more in detail the years 1999, 2003, 2009, and 2021 stand out from the others. Holdcos traded at a premium of 100% during 1999. The years 2003 and 2009 were the periods where Holdcos traded at the highest discount being on average 40%. In 2021 this discount turned into a premium of 40%. Overall, the flow of the discrepancy between the NAV and the market capitalization seems to be a premium in the first eight years followed by a period of a discount that continued to persist until 2021. All this information indicates that the Holdco discount phenomenon is a dynamic variable.

Figure 3: Average Belgian Holdco discounts from 1995 to 2022



The numbers in Table 5 correspond with the insights in Figure 3. The average Holdco discount accounted for 0.63% (column average). However, the data is negatively skewed and has fat tails indicating a non-normal distribution. This constatation is in line with a large dispersion between the minimum and maximum illustrating the presence of outliers. Outliers can have an enormous impact on the average, driving the value up or down, and therefore it is also interesting to consider the median. For this sample, the median is as high as 12.97% making it even more clear that there is an undervaluation of the Belgian Holdings on average. When looking at the discount of the holdings individually both Floridienne and D'leteren show abnormal behavior by trading at a premium of approximately 30%. The other holdings included in the sample trade at a discount or a very small premium which can be considered as the expected behavior of a holding.

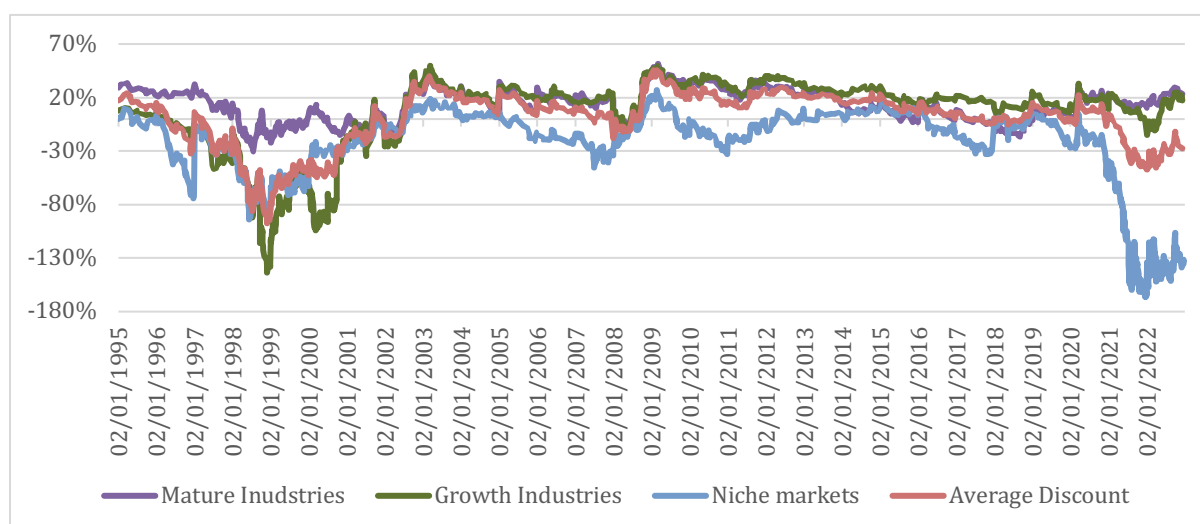
Table 5: Discount per holding and sector from 1995 to 2022

	A&H	BDS	FLO	GBL	GIMV	DIET	QFG	SOF	TINC	BRE	Average
Sector	Construction & engineering	Consumer goods	Chemicals	Consumer goods	Technology	Automotive	Technology	Growth capital	Infrastructure	Growth capital	-
Avg Discount	-3.78%	20.60%	-31.35%	24.28%	6.38%	-30.61%	-1.53%	21.09%	-2.43%	13.13%	0.63%
Median	5.46%	28.50%	-18%	26.40%	7.26%	-16.73%	22.43%	24.54%	-2.05%	22.03%	12.97%
Min	-130%	-47%	-333%	-27.54%	-236%	-228%	-341.9%	-57.90%	-18.51%	-87.78%	-341.87%
Max	48.50%	60%	63.17%	56.26%	49%	64.71%	63.87%	54.91%	9.65%	63%	64.71%
Skewness	-1.33	-0.69	-2.80	-1.05	-2.38	-1.41	-2.58	-1.50	-0.16	-1.25	-2.92
Kurtosis	1.23	-0.45	7.81	1.62	5.8	1.38	6.67	2.21	0.06	0.92	11.69

Groupwise analysis

The holding companies can also be separated into groups based on industry composition (own categorization) as discussed in section 3.2. This way the fluctuation of the average Holdco discount can be further investigated by looking at the discount across these groups. The first group is those types of holdings that are mainly invested in mature industries like energy & resources, consumer goods, construction, financial services, and real estate. This group is made up of the following holdings: Ackermans & Van Haaren, Bois Du Sauvage, and GBL. The second group of Holdings is more focused on industries that have been growing over the past decade like technology, education, health care, and growth capital. Companies mainly invested in these types of industries are GIMV, Quest for Growth, Sofina, and Brederode. The last group consists of Holdings that don't diversify across industries and focus on being an expert in niche activities. Holdings that suit this description are Floridienne, D'leteren, and Tinc.

Figure 4: Groupwise Holdco discounts from 1995 to 2022



When taking both Table 6 and Figure 4 into account it becomes clear that there might be a relation between the industry composition and the Holdco discount (Detournay, 2003). Holdings invested in mature industries have on average a discount of 13.7% as visible in Table 6 (column mature industries). This discount is significantly higher than the average discount over all the holding companies. In particular, Bois Du Sauvage and Group Bruxelles Lambert have an above-average discount. Table 6 shows the same situation counts for companies invested in growth industries as well with an average discount of 9.77% (column growth industries). Whereas Quest For Growth traded on average at a small premium of -1.5%, Sofina traded at a discount of 21.08%. This indicates there is quite a dispersion between the companies included in the category growth companies. Lastly, companies invested in mainly niche activities trade on average at a premium of 21.46%. Table 6 (column niche activities) shows especially Floridienne and D'Ieteren trade at a high premium. In the period from 2020-2022, the stock price of both companies grew at an exponential rate, which is reflected in an additional premium compared to their NAV as visible in Figure 4.

Table 6: Discount per group of holdings from 1995 to 2022

	Mature industries			Growth industries				Niche markets		
	A&H	BDS	GBL	GIMV	QFG	SOF	BRE	FLO	DIET	TINC
Avg Discount	-3.78%	20.60%	24.28%	6.38%	-1.5%	21.08%	13.13%	-31.35%	-30.6%	-2.43%
Discount of group	13.70%	13.70%	13.70%	9.77%	9.77%	9.77%	9.77%	-21.46%	-21.46%	-21.46%
Median	5.46%	28.50%	26.40%	7.26%	22.43%	24.54%	22.03%	-18%	-16.73%	-2.05%
Min	-130%	-47%	-27.54%	-236%	-341.9%	-57.90%	-87.78%	-333%	-228%	-18.51%
Max	48.50%	60%	56.26%	49%	63.87%	54.91%	63%	63.17%	64.71%	9.65%
Skewness	-1.33	-0.69	-1.05	-2.38	-2.58	-1.50	-1.25	-2.80	-1.41	-0.16
Kurtosis	1.23	-0.45	1.62	5.8	6.67	2.21	0.92	7.81	1.38	0.06

3.4.3 Independent Variables

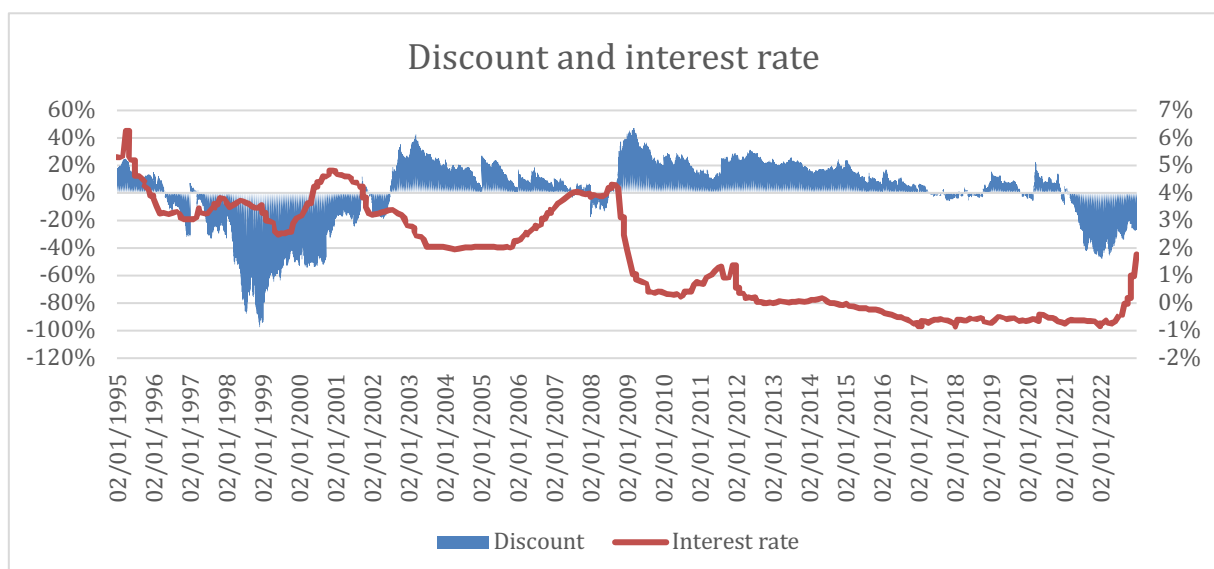
In this section, the relevant summary statistics of the independent variables will be discussed. The data shown in Table 7 are averages over all the holding companies and all years included in the data frame. To gain additional insights the relationship between the independent variable and the average Holdco discount will be plotted.

Market sentiment

Interest rate

The interest rate went down substantially over time. In 1995 the interest on the Belgian 3-month T-bills was around 6.25% while for example in 2017 the interest rate on the T-bills in Belgium accounted for -0.88%. This is due to monetary policy enforced by central banks who like to keep the interest rate as low as possible to make borrowing money attractive. This policy stimulates the economy and is also known as monetary expansion. However, during times of high inflation, they try to tackle this problem by increasing the interest rate and making it more expensive to borrow money. As shown in Table 7 the short-term interest accounted for an average of 1.60% during the period 1995-2022. Figure 5 reveals that the relation between the Holdco discount and the short-term rate is not a one-on-one relationship but that there is a positive relationship to be found. From 2009 to 2021 the interest rate and the discount on holdings went down simultaneously. This confirms the ex-ante relationship as stated earlier.

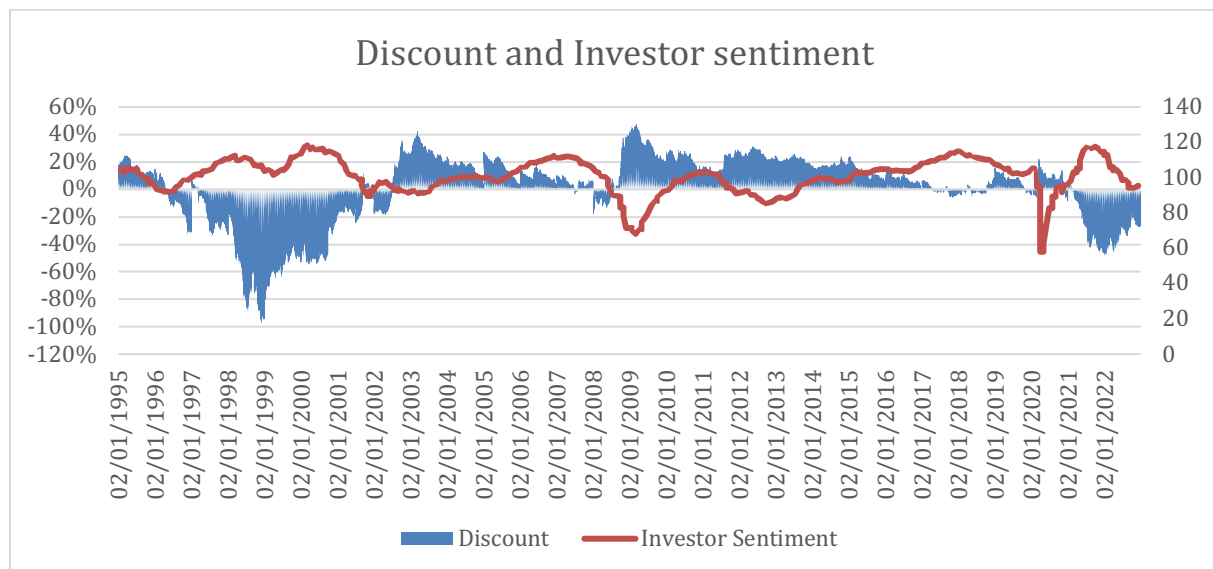
Figure 5: Relationship between the Holdco discount and the interest rate



Investor sentiment

The investor sentiment, captured by the economic sentiment indicator, predicts the economic outlook for the eurozone. Values above 100 indicate a bullish market and when it takes on values below 100 this indicates a bearish market. Figure 6 shows that during periods of crisis like 2008 and 2020 the ESI indicator takes a bearish value and during periods when the economies thrive like 2018 and 2021 the ESI indicator takes a bullish value. During the timeframe 1995-2022, a neutral sentiment of 100.8 was the standard (as shown in Table 7). The relationship between the Holdco discount and investor sentiment is adverse. When the economy is struggling, discounts on holding companies are high. This confirms the ex-ante relationship as stated before.

Figure 6: Relationship between the Holdco discount and investor sentiment

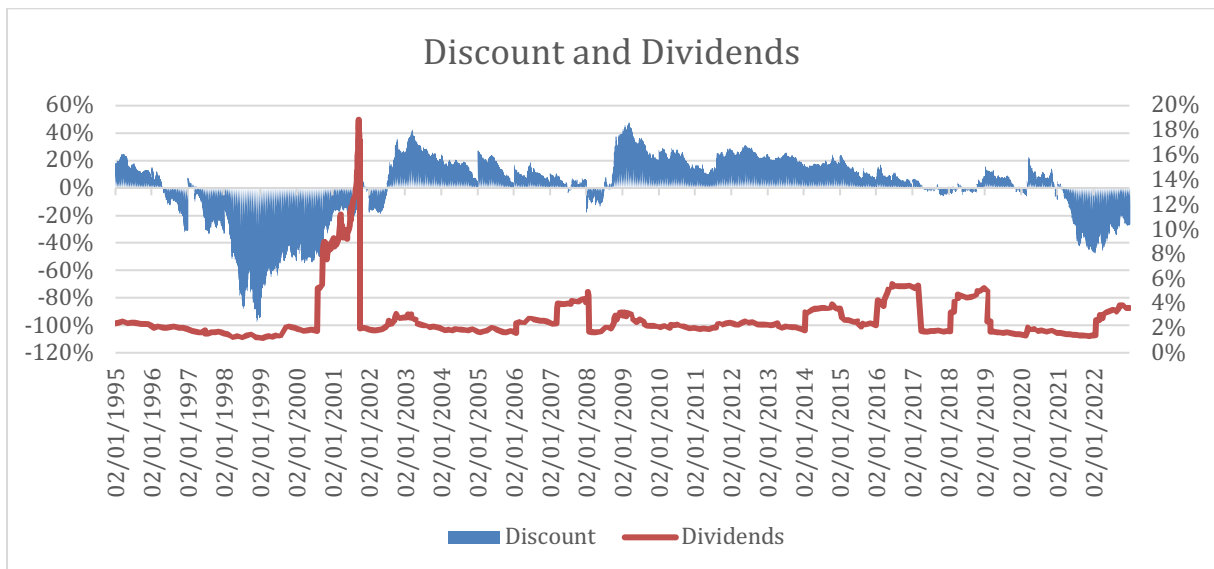


Fund specific

Dividend

The dividend yield given by the sampled holdings to their shareholders can be considered as a steady variable. Shareholders can expect grosso modo a dividend yield of 2.80% on top of the capital gains as a return on their investment (as shown in Table 7). However, sporadically Holdings can give a significantly higher dividend, this happened in the following years: 2001, 2008, 2017, and 2019 (Figure 7). Companies make these corporate decisions to raise their attractiveness in the stock markets. The effect of these decisions is the most powerful during periods when these companies might be less appealing to their investors. The relationship between the Holdco discount and dividends is rather random based on visual inspection.

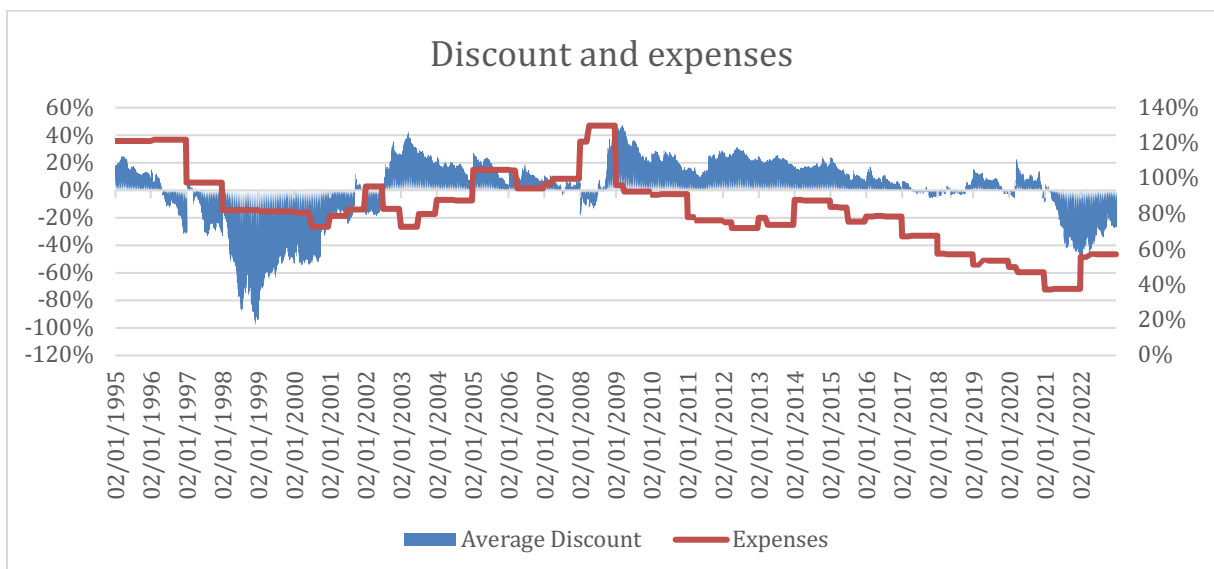
Figure 7: Relationship between the Holdco discount and dividend



Expenses

The expenses of a holding expressed as a percentage of their net asset value were on average 84.23% (Table 7). The expenses of a holding should be as low as possible since every euro that is spent by the holding is one that cannot be distributed as a dividend or will be reflected as a capital gain for the investor. This can be translated into a positive relationship between the two variables which corresponds with Figure 8. During the period 2008-2021, the relative expenses went down simultaneously with the discount. However, the period 2003-2005 differs from this expected behavior. Despite the expenses going down during this period the discount remained standing. Overall, it can be concluded that the statistics and figures confirm the ex-ante relationship as stated before.

Figure 8: Relationship between the Holdco discount and expenses



Listed

The more listed participations a holding company has, the more tempted the investor is to replicate the company's underlying portfolio. On average 32% of the portfolios of the sampled holdings consist of listed subsidiaries (Table 7). This means most of the holdings invest in non-quoted subsidiaries rather than listed subsidiaries. This common corporate decision of the holdings might be to protect their replicability and so the discount on these holdings. During the period 2008 to 2022, the percentage of listed subsidiaries followed the trend of the Holdco discount quite accurately (Figure 9). As a result, the relationship between the Holdco discount and listed subsidiaries can be considered as in line with the ex-ante expectations.

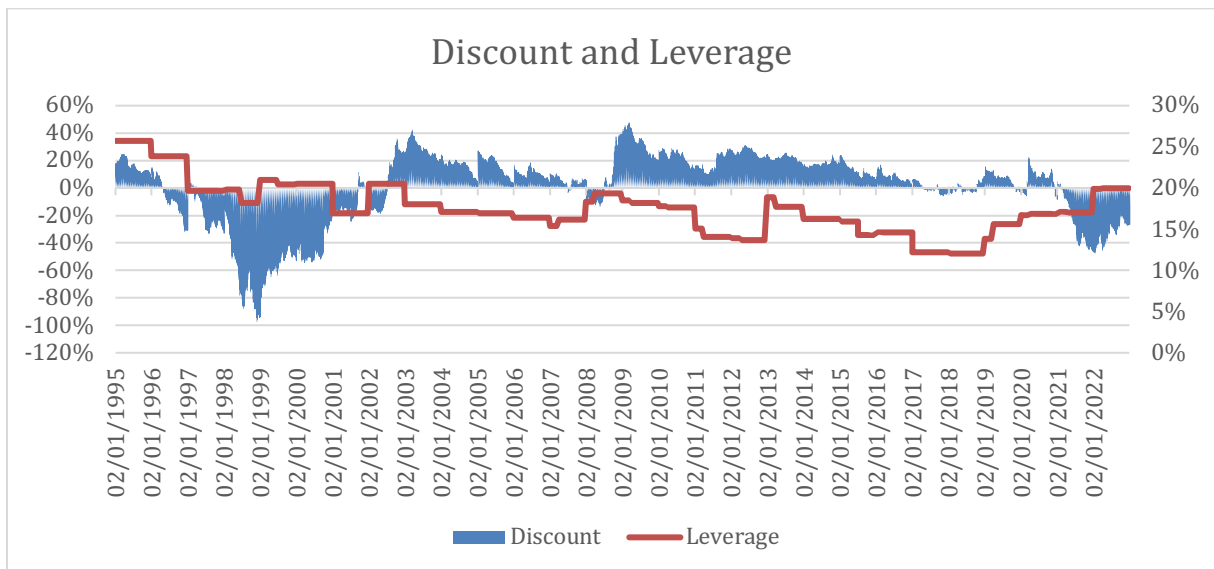
Figure 9: Relationship between the Holdco discount and % of the portfolio invested in listed companies



Leverage

The percentage of the assets financed with debt is a quite stable variable. Over the years both Figure 10 and Table 7 confirm that the optimal capital structure for a Holdings demands the use of 17.4% debt for financing their operations. This makes sense since the use of leverage can boost the return on equity but also causes an increased exposure to the macroeconomic environment. This can conflict with their long-term strategy and so the achievement of their goals namely providing their subsidiaries to grow in a financially durable environment. Remarkable is that during financial crises (like for example 2002, 2008, 2012, and 2022) there is always a slight increase in the usage of debt. Overall, there is a positive relationship to be found between the use of leverage and the Holdco discount. However, some fluctuations make this relationship ambiguous. For example, during 2021 the use of leverage went up while the discount went down.

Figure 10: Relationship between the Holdco discount and the usage of leverage



Manager & Firm

Size

Size is captured by total net assets as a proxy for enjoying economies of scale and access to capital. The average size of the sampled holdings over the investigated period is 2,554,500 euros (Table 7). However, this data is positively skewed and has fat tails. This means that some holdings are considerably larger than the others. This makes the average value less reliable due to outliers. All holdings grow steadily over the years (Figure 11) and only sporadically lose value. This makes it difficult to find a relationship between the size and the discount of a holding. So based on visual inspection there is no relationship to be found.

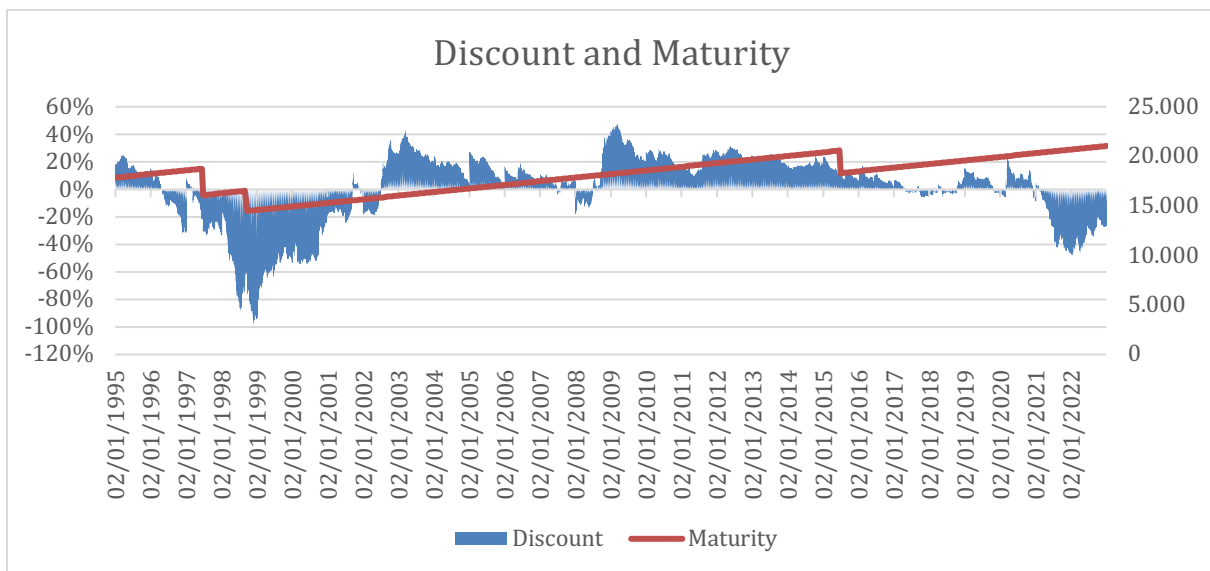
Figure 11: Relationship between the Holdco discount and the size of a holding



Maturity

The listing history of a holding can make the company more familiar to its investors and can lower the discount. This is captured by the number of days since the holdings made their IPO on Euronext Brussels. Holdings quote on average 16.825 days on Euronext Brussels (Table 7). This indicates that most Belgian holdings are quite mature since they already have a track record of 46 years. This could be expected since most of the Belgian holdings helped form the Belgian economy as known up until today. Based on visual inspection there is no relationship to be found between the Holdco discount and maturity (Figure 12).

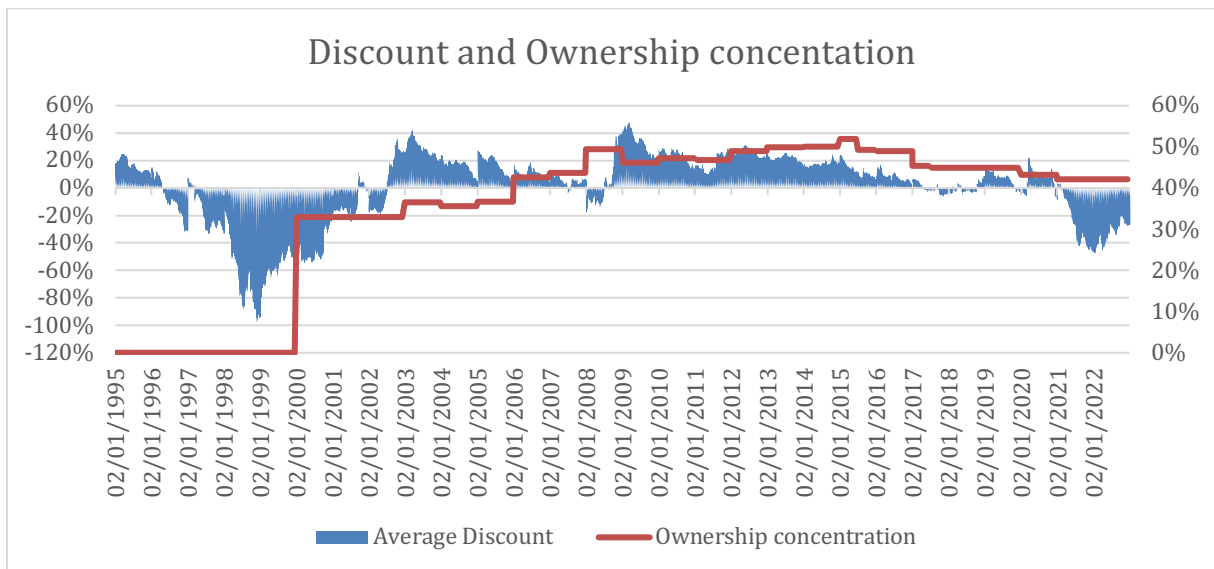
Figure 12: Relationship between the Holdco discount and the maturity of a holding



Ownership concentration

Controlling shareholders can generate private benefits of control for themselves at the expense of minority shareholders by holding a majority of the shares. This phenomenon is better known as a principal-principal problem. However, those controlling shareholders are also necessary to monitor managers within the firm and so avoiding a principal-agency problem. This explains the steady trend of ownership concentration which finds a sweet spot when controlling shareholders own 45.41% of the shares (Table 7). This is measured by the percentage of shares held by blockholders. However, this steady trend makes it challenging to find a relationship between the Holdco discount and ownership concentration (Figure 13).

Figure 13: Relationship between the Holdco discount and ownership concentration



Liquidity

The more liquid a holding is, the less likely it is that the market is going to stay in a non-equilibrium. This is captured by the proxy share turnover. Figure 14 shows that during periods with a remarkable discount or premium, the number of shares traded is also significantly higher. This constataion can be confirmed by Table 7 since the data for liquidity is positively skewed and has fat tails. As shown in Figure 14 examples of such periods are in 1998, 2012, and 2022. On average 0.06% of the outstanding shares of holdings were traded on a daily basis. The relationship between the Holdco discount and liquidity is rather random since there is no straightforward relationship to be found in Figure 14.

Figure 14: Relationship between the Holdco discount and liquidity

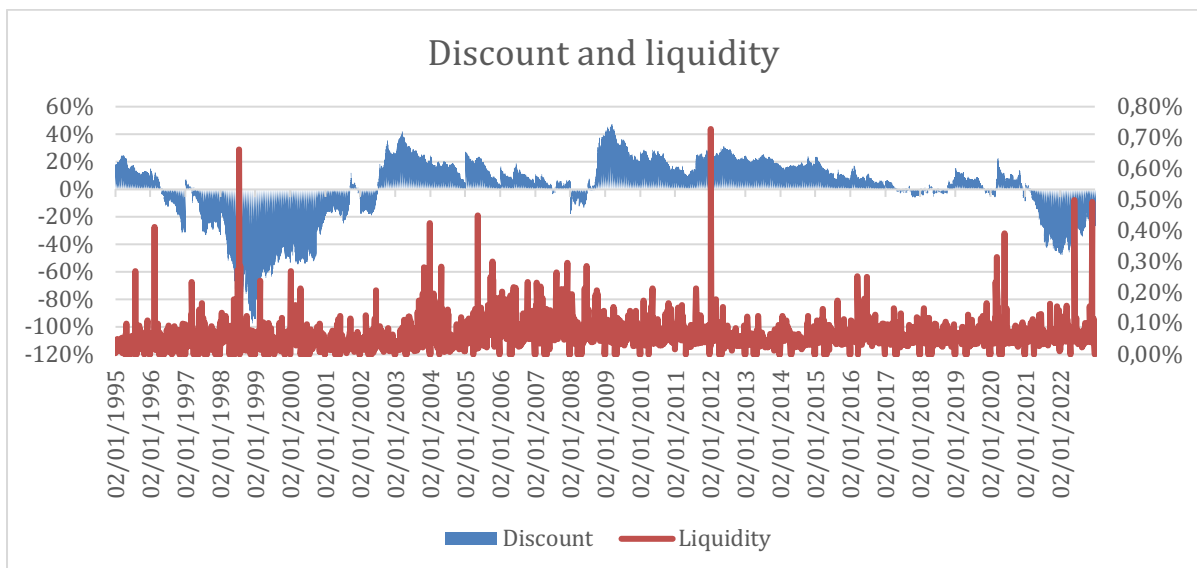


Table 7: Summary table of descriptive statistics over all holding companies

	Mean	Median	Min	Max	Skewness	Ex kurtosis
Short-term rate (%)	1.60%	1.92%	-0.88%	6.25%	0.21	-1.38
Investor sentiment	100.80	101.70	58.20	118.40	-0.99	2.09
Dividends (%)	2.80%	1.64%	0%	205.82%	14.57	247.44
Liquidity (%)	0.06%	0.04%	0%	6.14%	16.7	745
Maturity	16,825	9,775	0	44,103	0.50	-1.31
Number of listed companies (%)	31.99%	24.88%	0%	100%	0.51	-1.14
Size of the holding	2,554,500	922,910	22,473	21,788,000	2.65	6.74
Expenses (%)	84.23%	18.91%	0%	560.24%	1.65	1.61
Ownership concentration (%)	45.41%	48.23%	12.07%	84.95%	0.36	-0.12
Leverage (%)	17.40%	12.13%	0%	56.21%	0.58	-1.07

3.5 Methodology

This section describes the methodology of the different models to test the hypotheses as described under section 2.3. Firstly, the fixed-effect model will be suggested to test the hypotheses by looking at the average Holdco discount over all the sample companies and the all-time period. Secondly, some robustness checks will be performed on this fixed-effect model. Lastly, a cross-sectional will be included to gain some additional insights.

3.5.1 Fixed-effect model

This master's dissertation considers the fixed effect model as the general model to investigate ex-ante expectations. The Holdco discount is included as the dependent variable. The variation in the dependent variable will be explained by a set of explanatory variables. The model can be specified as follows:

$$\text{Discount}_{i,t} = \beta_0 + \beta_1 \text{ interest rate} + \beta_2 \text{ Investor sentiment}_{i,t} + \beta_3 \text{ Dividends}_{i,t} + \beta_4 \text{ liquidity}_{i,t} + \beta_5 \text{ maturity}_{i,t} + \beta_6 \text{ \# listed companies}_{i,t} + \beta_7 \text{ size}_{i,t} + \beta_8 \text{ leverage}_{i,t} + \beta_9 \text{ Expenses}_{i,t} + \beta_{10} \text{ Ownership concentration}_{i,t} + \varepsilon_{i,t}$$

From an economic point of view, the choice for a fixed effect model can be motivated by the fact that the selection of data is not representative of the population. The total population would be Belgian Holding companies, but a selection is made within the population. Only large listed Holding companies are chosen based on the selection used by Mampaey (2021). From an econometric point of view, this method takes individual heterogeneity of the holdings into account. This is necessary since every holding has a different strategy and focuses on different core activities and cannot be considered homogenous. Also, the fixed-effect model allows working with an unbalanced panel dataset and controls for time-invariant Holdco-specific attributes (Rahman, 2022).

It is also essential to consider econometric pitfalls that could potentially bias the regression results. Firstly, this paper opts to work with panel data which makes the data less sensitive to unit roots applicable to all holdings. Most of the variables in this paper are stationary and in this case unit root tests don't provide enough evidence to conclude whether all series have a unit root or whether all are stationary (Karlsson and Löthgren, 2000). Besides this, the focus is on explaining why the Holdco discount differs between holdings rather than explaining unexpected shocks in the Holdco discount. That's why this paper doesn't take the first differences of its variables into account, this is in line with scholars like Park & Shin (2022).

Secondly, the Wald and the Wooldridge tests are performed to test the data for heteroscedasticity and residual autocorrelation respectively. The tests show that there is both heteroscedasticity and residual autocorrelation present in the data. Also, as explained under section 2.2 there are behavioral patterns that do affect the Holdco discount. Hoechle (2007) argues that these patterns can result in cross-sectional dependence and make the coefficient estimates of panel data estimators inefficient. This is also confirmed when performing a cross-sectional dependence test on the data. One way to resolve this problem is working with clustered standard errors likewise Chan et al. (2008), Park & Shin (2022), and Rahman (2022). Another solution discussed by Hoechle (2007) is using the “spatial correlation consistent” standard errors by Driscoll and Kraay (1998). That’s why different models will be reported depending on the standard errors used: clustered standard errors at the firm level, clustered standard errors by time, and the spatial correlation consistent standard errors.

Thirdly, as described in descriptive statistics in section 3.4.1 there was no correlation between the variables higher than 0.9 and as a result there is no risk for multicollinearity. Also, including a large spectrum of explanatory variables discussed in the literature makes sure there is no omitted variable bias present in the data.

3.5.2 Robustness checks

Exclusion of data (1 year after the IPO)

In the first year after Holdings make their IPO, they’re often quoted at a premium which turns into a discount in the years after. This closed-end fund cycle has been discussed extensively under section 2.2. As a result, it might be insightful to see whether the results of the fixed-effect model remain robust when excluding the years during which those holdings quote at a premium.

Alternative estimation method

A pooled OLS regression model will be considered to provide an alternative estimation method and increase the robustness of the results. The pooled OLS model is used frequently in the literature when working with panel data (Park & Shin, 2022). The specification of the model is the same as the fixed effect model:

$$Discount_{i,t} = \beta_0 + \beta_1 interest\ rate + \beta_2 Investor\ sentiment_{i,t} + \beta_3 Dividends_{i,t} + \beta_4 liquidity_{i,t} + \beta_5 maturity_{i,t} + \beta_6 \# \text{ listed companies}_{i,t} + \beta_7 size_{i,t} + \beta_8 leverage_{i,t} + \beta_9 Expenses_{i,t} + \beta_{10} Ownership\ concentration_{i,t} + \varepsilon_{i,t}$$

Alternative proxies

Alternative proxies will be used for the fixed-effect model to test whether the variables are measured correctly by their respective proxies. The problem is that most of the variables do not have a lot of alternative proxies than the ones used in this dissertation. Also, the use of some proxies is limited due to the availability of data. For example, expenses could have been measured by the selling, general, and administrative expenses (SG&A) instead of total operating expenses. However, the data is not provided for each holding by both the ORBIS and Refinitiv databases. This leads to the decision to only include an alternative proxy for the variables: interest rate, investor sentiment, and size. The interest rate will be measured by the Belgium government benchmark bid yield of 10 years instead of the Belgian 3-month T-bills rate. The same is done for investor sentiment by including the SENTIX indicator instead of the Euro Area Economic Sentiment Indicator. The European SENTIX sentiment indicator gives an average six-month economic outlook based on a survey performed on thousands of private and institutional investors and analysts. It is calculated as the ratio of the difference between the number of bullish and bearish investors to the total number of participants. Lastly, total assets will be used as a proxy for size instead of net assets.

Table 8: Summary of Alternative Proxies

Alternative proxies	Ex ante relationship	Proxies
Interest rate	Positive	Belgium government benchmark bid yield 10 years
Investor sentiment	Negative	The natural logarithm of the SENTIX indicator
Size of the holding	Negative	The natural logarithm of total assets

3.5.3 Subperiod analysis

A subperiod analysis will be made for the past 10 years which gives a time frame going from 2013 to 2022. This might provide additional insights since the recent past might be a better estimator of the current determinants of the Holdco discount than the far past.

3.5.4 Cross-sectional analysis

To finish up the fixed effect model will be estimated for the different categorizations of holdings as under section 3.4.2. This way it can be tested whether the determinants on the Holdco discount deviate due to the industry composition of holdings.

4 Results

4.1 Fixed-effect model

As explained under section 3.5.1 different models of the fixed-effect model are reported. That's why there needs to be made a choice on which version of the fixed-effect model makes the most sense econometrically. The column "fixed effect model" in Table 9 shows the uncorrected results of the panel regression. However, as mentioned before there are econometric pitfalls in the data which is why standard errors need to be used. Econometrically it makes most sense to either use clustered standard errors at the firm level or the standard errors by Driscoll and Kraay (1998). Both are robust for cross-sectional dependence, so the choice depends on which model has the highest efficiency. When taking the accuracy of the predictions into account the fixed-effect model using Driscoll and Kraay standard errors is preferred since the standard errors are the lowest. Also, there are way more time periods than holdings and in this case the Driscoll and Kraay standard errors lead to the most robust results.

Based on Table 9 (Column: spatial consistent SE), investor sentiment has a significant ($P=0.00$) negative impact on the Holdco discount. Whenever there is a bullish sentiment present in the market noise traders are extra optimistic about the returns of the holding company which is why the discount will go down. Based on the coefficient in Table 9 the discount decreases by 0.77 % whenever the investor sentiment becomes more bullish by 1% *ceteris paribus*. Moreover, dividends negatively affect the Holdco discount as well ($P= 0.0020$). Dividends encourage rational arbitrageurs to reduce closed-end fund discounts since dividends lower the holding costs for these arbitrageurs. Whenever an additional dividend yield of 1% on the net asset value is given to the investors then the Holdco discount decreases with 0.62% *ceteris paribus*. Furthermore, Table 9 (Column: spatial consistent SE) shows that when the expenses of a holding decrease by 1% then the discount decreases by 0.33% as well. This positive relation ($P= 0.00$) can be explained by the fact that the cash flow of the company increases and so does the profit distribution. This leads to investors buying the Holding since the expected return is positively affected. Increasing the importance of listed companies within the investment strategy of Holdcos is significant ($P=0.00$). Whenever the proportional value of listed companies within the portfolio is increased by one percentage point then the discount goes up by 0.30 percentage points, *ceteris paribus*. Lastly, when holdings increase their net assets by 1% then the discount decreases by 0.09% ($P=0.0031$). This is in line with hypothesis 7, which argued that when Holdings become larger the funds will enjoy economies of scale and will have better access to capital.

Remarkable is that the use of leverage negatively affects the Holdco discount ($P = 0.00$). This could be somehow expected since a significant part of the literature suggested this relationship. They argued that the use of leverage creates an interest tax shield, debt discipline for managers and facilitates investment opportunities (Ramadorai, 2012; Elton et al., 2013; Dam et al., 2023). However, the use of too much debt still causes problems since this enlarges the exposure to the macroeconomic environment (Cherkes et al., 2008). However, when a holding decides to increase the use of debt by 1% then the Holdco discount decreases by 0.64% (*ceteris paribus*). Whereas the literature provided an explanation for the unexpected relationship between leverage and the Holdco discount this is not the case for interest rates. According to Table 9, the interest rate has a significant ($P = 0.0058$) negative relationship with the Holdco discount. This relationship is not in line with the *ex-ante* expectations. When the short-term rate increases by 1% then the share price deviates by 1.80% from the NAV per share *ceteris paribus*. So, this means that for example during times when inflation is high and the rate of the Belgian 3-month T-bills increases as a result, this reduces the Holdco discount. The LSDV-Squared in Table 9 indicates that 40.73% of the variation in the Holdco discount between holdings and over time can be explained by the selection of the independent variables. When only considering the variation of the Holdco discount over time then the within R-squared tells us that 15.72% can be explained by the explanatory variables.

Table 9: Results of fixed effect model for 1995-2022

	Fixed effect model	Clustered SE by unit	Clustered SE by time	Spatial consistent SE
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	4.8860 *** (0.00)	4.8860 *** (0.0010)	4.8860 *** (0.00)	4.8860 *** (0.00)
Interest rate	-1.7955 *** (0.00)	-1.7955 (0.5673)	-1.7955 *** (0.00)	-1.7955 *** (0.0058)
Investor sentiment	-0.7735 *** (0.00)	-0.7735 *** (0.0003)	-0.7735 *** (0.00)	-0.7735 *** (0.00)
Dividend	-0.6241 *** (0.00)	-0.6241 (0.3870)	-0.6241 *** (0.00)	-0.6241 *** (0.0020)
Expenses	0.3256 *** (0.00)	0.3256 ** (0.0182)	0.3256 *** (0.00)	0.3256 *** (0.00)
Listed participations	0.2954 *** (0.00)	0.2954 (0.1701)	0.2954 *** (0.00)	0.2954 *** (0.00)
Leverage	-0.6372 *** (0.00)	-0.6372 (0.1759)	-0.6372 *** (0.00)	-0.6372 *** (0.00)
Size of the holding	-0.0885 *** (0.00)	-0.0885 (0.6538)	-0.08845 *** (0.00)	-0.0885 *** (0.0031)
Maturity	-0.0133 (0.1032)	-0.0133 (0.9341)	-0.0133 ** (0.0461)	-0.0133 (0.5883)
Ownership concentration	-0.1411 *** (0.0014)	-0.1411 (0.8980)	-0.1411 *** (0.00)	-0.1411 (0.1972)
Liquidity	5.0486 * (0.0778)	5.0486 (0.7343)	5.0486 (0.1716)	5.0486 (0.3359)
LSDV R-squared	0.4073	0.4073	0.4073	0.4073
Within R-Squared	0.1572	0.1572	0.1572	0.1572

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.2 Robustness checks

The robustness checks as discussed in section 3.5.2 will be performed on the fixed-effect model using the standard errors by Driscoll and Kraay (1998).

Exclusion of data (1 year after the IPO)

When excluding data for the first year after the IPO, the results of the fixed-effect model estimated with the Driscoll and Kraay standard errors remain standing (Table 10, column: exclusion first year after IPO). This implies that the significance and the direction of the estimated coefficients remain unchanged and so add robustness to the findings.

Alternative estimation method

In this section, the same model specification will be estimated but now using the pooled OLS estimation technique in combination with the Driscoll and Kraay standard errors. The results differ to some extent from the fixed-effect model. Table 10 (column: pooled OLS) shows that the variables interest rate, investor sentiment, dividend, listed participations, and leverage their relationships with the Holdco discount remain significant and are in line with the fixed-effect model. However, the relationship between the discount of a holding and its expenses became insignificant ($P= 0.3380$). Remarkable as well is that the pooled OLS model suggests that the larger a holding becomes the higher the discount of that holding ($P= 0.0125$). More specifically when a holding increases its net assets by 1% then the discount increases by 0.02% (*ceteris paribus*). This contradicts hypothesis 7 and the fixed-effect model. One explanation might be that the larger a holding gets the more complex it becomes to manage them efficiently. This causes fund managers to be less engaged in stock selection (Chan et al., 2008; Rahman, 2022).

Furthermore, the pooled OLS model reports a significant relationship for maturity, ownership concentration, and liquidity as well. These relations were insignificant when estimated by the fixed-effect model. Table 10 shows that the fund age exhibits a negative relationship with the Holdco discount which is in line with the *ex-ante* relationship ($P= 0.0003$). When the number of days since the IPO increases by 1% then the Holdco discount decreases by 0.05% (*ceteris paribus*). Next up, block ownership and so ownership concentration is adversely related to the Holdco discount ($P= 0.0089$). When block holders hold one additional percentage of the shares of a holding then the discount decreases by 0.18% (*ceteris paribus*). Monteiro (2019) found such a relation in the Belgian market already and argued that high ownership concentration is inherent to this market due to the use of French-Civil law. Also, a certain degree of block ownership is necessary to incentivize and monitor the management of a

company (Eun et al., 2024). Lastly, liquidity has a negative impact on the Holdco discount ($P=0.0028$). This would mean if the shares of a holding are traded 1% more often on a daily basis then the discount decreases by 19.94% (*ceteris paribus*). Economically, this has a large significant impact but when taking the descriptive statistics into account as described under section 3.4.3 this only happens on rare occasions. On an average day, only 0.04% of the outstanding stocks are traded during that day. Overall, it can be concluded that liquidity plays an important role in explaining the Holdco discount according to the pooled OLS model. This is in line with the ex-ante expectations.

The pooled OLS estimation technique is often used in the literature for estimating the relationships between the Holdco Discount and its determinants and should be taken into account as a result (Park & Shin, 2022). The overall variation in the Holdco discount measured by the LSDV-squared is lower than the fixed-effect model when using the pooled OLS model (31.22%). However, variation in time can be better explained when using the pooled OLS model which is why the results in Table 10 (column pooled OLS) are a great addition to the robustness of the results.

Alternative proxies

When including the alternative proxies instead for the variables interest rate, investor sentiment, and size the fixed-effect model remains standing. Table 10 (column: Alternative proxies) shows that the variables investor sentiment, dividend, expenses, listed participations, and size of their relationships with the Holdco discount remain significant and are in line with the fixed-effect model. On the contrary, the relationship between the discount of a holding and the use of leverage became insignificant ($P=0.5997$).

Some parameters that need to be highlighted are interest rate, maturity, and ownership concentration. The relationship between the interest rate and the Holdco discount becomes positively significant ($P=0.00$) contrasting the estimated fixed-effect model but being in line with the ex-ante expectations. The economic impact of the parameter is also significantly large: whenever the long-term interest rate increases by 1% then the Holdco discount goes up by 5.64% (*ceteris paribus*). This raises questions regarding the robustness of the Belgian 3-month T-bills rate in measuring the impact of the interest rate. The ex-ante relation and the results estimated by the pooled OLS model are opposed by using alternative proxies for the variable maturity ($P=0.0156$). Based on Table 10 the Holdco discount increases by 0.05% when the number of days since the IPO increase by 1% (*ceteris paribus*).

Lastly, when block holders hold one additional percentage of the shares of a holding then the discount increases by 0.88% (ceteris paribus). This positive relationship (P=0.1089) confirms the ex-ante relationship but raises questions regarding the robustness of the results estimated by the pooled OLS model. Both the LSDV R-squared and within R-squared are lower than the original fixed-effect model, only 38.19% of the total variance and 14.02% of the time variance in the Holdco discount can now be explained by the included variables as shown in Table 10 (column: alternative proxies).

Table 10: Results of robustness tests on the fixed effect model

	Fixed effect model	Exclusion first year after IPO	Pooled OLS	Alternative proxies
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	4.8860 *** (0.00)	4.9420 *** (0.00)	4.2493 *** (0.00)	-0.0348 (0.8955)
Interest rate	-1.7955 *** (0.0058)	-1.854 *** (0.0049)	-1.5517 *** (0.0085)	5.6405 *** (0.00)
Investor sentiment	-0.7735 *** (0.00)	-0.7734 *** (0.00)	-0.8634 *** (0.00)	-0.0319 *** (0.0013)
Dividend	-0.6241 *** (0.0020)	-0.6313 *** (0.0019)	-0.9167 *** (0.0010)	-0.8673 *** (0.0001)
Expenses	0.3256 *** (0.00)	0.3254 *** (0.00)	0.0138 (0.3380)	0.2621 *** (0.00)
Listed participations	0.2954 *** (0.00)	0.2943 *** (0.00)	0.4837 *** (0.00)	0.1039 ** (0.0412)
Leverage	-0.6372 *** (0.00)	-0.6368 *** (0.00)	-0.6049 *** (0.00)	-0.0502 (0.5997)
Size of the holding	-0.0885 *** (0.0031)	-0.0866 *** (0.0055)	0.0193 ** (0.0125)	-0.0767 *** (0.0017)
Maturity	-0.0133 (0.5883)	-0.0222 (0.4943)	-0.0489 *** (0.0003)	0.0489 ** (0.0156)
Ownership concentration	-0.1411 (0.1972)	-0.1290 (0.2213)	-0.1804 *** (0.0089)	0.8845 *** (0.00)
Liquidity	5.0486 (0.3359)	5.01520 (0.3420)	-19.942 *** (0.0028)	-1.6920 (0.8289)
LSDV R-squared	0.4072	0.4073	0.3122	0.3891
Within R-Squared	0.1572	0.1571	0.3120	0.1402

***, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.**

4.3 Subperiod analysis

Now that it is checked whether the fixed effect model is a robust way of testing the hypotheses it might be interesting to see how the relationship between the discount and its determinants has evolved over the past 10 years. This gives us a new period of investigation that goes from 2013 to 2022. Over the past 10 years, Table 11 shows that when comparing the subperiod analysis to the full period analysis the results of all models are close to one another when leaving aside a few exceptions. Even more, in the subperiod analysis the fixed-effect model shows the same significant relationships when testing for alternative proxies and excluding the first year after IPO (columns: fixed effect model, exclusion first year after IPO, and alternative proxies). This adds significantly to the robustness of the findings. The following variables remained robust: investor sentiment, dividends, expenses, leverage, and size.

Some variables need to be highlighted. Firstly, when estimating the model specification with the Pooled OLS model a positive significant ($P=0.0319$) relationship between the interest rate and the Holdco discount is reported (Table 11: column pooled OLS). This same relationship is found when estimating the fixed-effect model with alternative proxies. A positive relationship would mean that for example during times when inflation is high and the interest rate increases as a result, this increases the Holdco discount. This is in line with the ex-ante expectations. Secondly, the relation between listed participations and the Holdco discount became a negative significant ($P=0.00$) one when using the fixed-effect model (Table 11: Fixed effect model, first year after IPO, and alternative proxies). This is surprising since this would mean that by increasing the fraction of listed participations in the total portfolio by 1% then the Holdco discount decreases by 1.05% (*ceteris paribus*). This contradicts the previous results and the ex-ante relationship.

Lastly, maturity ($P=0.00$) and ownership concentration ($P=0.00$) became significant (Table 11: Fixed effect model). When increasing the number of days since IPO by 1% then the Holdco discount increases by 0.458% (*ceteris paribus*). This contradicts the ex-ante relationship and the estimated coefficients by the pooled OLS model. There is no consensus found in the literature on a positive relationship between maturity and the Holdco discount. Lastly, ownership concentration is expected to have a positive relationship with the Holdco discount. This confirms the ex-ante relationship that when block holders hold too much shares of a holdings they will generate private benefits of control at the expense of minority shareholders.

Overall, all the estimated models have more explanatory power for both the LSDV R-squared and within R-squared in the subperiod analysis than over the full-time period. However, this must be put into perspective since a smaller timeframe is considered. This way it's easier to find durable relationships between the Holdco discount and its determinants than whenever a longer timeframe is considered.

Table 11: Results of fixed effect model for 2013-2022

Variables	Fixed effect model Coefficient (p-value)	Exclusion first year after IPO Coefficient (p-value)	Pooled OLS Coefficient (p-value)	Alternative proxies Coefficient (p-value)
Constant	10.3025 *** (0.00)	9.2713 *** (0.00)	2.7125 *** (0.0003)	6.65 *** (0.00)
Interest rate	-6.478 *** (0.00)	-7.3709 *** (0.00)	12.1052 ** (0.0319)	2.9377 ** (0.0212)
Investor sentiment	-0.7837 *** (0.00)	-0.7786 *** (0.00)	-0.5823 *** (0.0003)	-0.0524 *** (0.00)
Dividend	-1.560 *** (0.00)	-1.5297 *** (0.00)	-1.4586 *** (0.00)	-1.6501 *** (0.00)
Expenses	0.3649*** (0.00)	0.3540 *** (0.00)	0.1490 *** (0.00)	0.4284*** (0.00)
Listed participations	-1.0487 *** (0.00)	-1.099 *** (0.00)	0.6560*** (0.00)	-1.0292 *** (0.00)
Leverage	-2.5804 *** (0.00)	-2.6757 *** (0.00)	-1.2237 *** (0.00)	-1.6807 *** (0.00)
Size of the holding	-0.7842 *** (0.00)	-0.8748 *** (0.00)	0.0642 *** (0.00)	-0.740 *** (0.00)
Maturity	0.4579 *** (0.00)	0.7028 *** (0.00)	-0.0761 *** (0.0002)	0.4082 *** (0.00)
Ownership concentration	1.3687 *** (0.00)	1.3750 *** (0.00)	-0.4889 *** (0.00)	0.9071 *** (0.00)
Liquidity	-5.3390 (0.4007)	-5.3428 (0.4039)	-22.999 *** (0.0031)	3.337 (0.7919)
LSDV R-squared	0.5921	0.6009	0.3553	0.5484
Within R-Squared	0.3980	0.4109	0.3550	0.3644

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.4 Cross-sectional analysis

This section investigates whether the determinants of the Holdco discount deviate due to the industry composition of holdings. However, the results should be looked upon with some caution since the sampled companies are categorized into subsamples and so the panel regressions can lead to biased results. This is because a small set of Holdings for each category are only looked upon which makes them less representative of the population of Belgian Holding companies and their respective sector. Also, the categorization happened based on own interpretation whereas some holdings do not give full enclosure on their activities.

Table 12 shows the results of the fixed-effect models using Driscoll and Kraay standard errors over all sampled holdings (column: all holdings) and the categorized holdings (columns: mature industries, growth industries, and niche activities). The models are unanimous on the relationship between the Holdco discount and the following variables: interest rate, investor sentiment, and leverage. This means that the impact for most the determinants on the Holdco discount does differ based on industry composition. The dividend yield does seem to have a positive impact on the discount of holdings present in mature industries ($P=0.00$) and niche activities ($P=0.00$). On the contrary, increasing the dividend yield for holdings active in growth industries decreases the Holdco discount. Ex-ante, the opposite would be expected since giving a higher dividend could hinder further growth opportunities (especially for growth companies) resulting in a higher discount. This raises questions regarding the robustness of the results of the cross-sectional analysis. The same situation occurs for the variables expenses and listed participations. There is no straightforward explanation of how increasing the expenses (column: mature industries and growth industries) and increasing the number of listed participations (column: mature industries) might reduce the Holdco discount. Similarly, the positive relationships between maturity and the discount of holdings (column: niche activities), but also liquidity and the Holdco discount (column: niche activities) seem rather random. The relation between size and the discount of a holding follows the previous results and ex-ante expectations in growth industries ($P=0.00$) and niche activities ($P=0.00$). This is not the case in mature industries. This can be explained by the fact that in growth industries and niche activities better access to capital and economies of scale might benefit the company. In mature industries size mostly leads to complexity and difficulties in managing the company. This corresponds with the fact that a certain degree of monitoring by blockholders is necessary to incentivize the management of Holdings in mature industries. This can also be found in Table 12 where is suggested that ownership concentration has a negative impact on the Holdco discount ($P=0.00$).

Overall, it can be concluded that most of the determinants as estimated by the fixed-effect model over all the sampled holdings remain significant. Maturity and ownership concentration even become significant when being studied on an industry level even though they were not on an aggregate level. The directions of the relationships do differ according to the industry holdings are active in. This can be translated as that there might be a relation between industry composition and the Holdco discount. However, this needs some further investigation by enlarging the sample of Holdings since the robustness of the results can be put into question.

Table 12: Results of fixed effect models for cross-sectional analysis

	All holdings	Mature industries	Growth industries	Niche activities
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	4.8860 *** (0.00)	6.334 *** (0.00)	3.4708 *** (0.00)	18.1246 *** (0.00)
Interest rate	-1.7955 *** (0.0058)	-8.559 *** (0.00)	-2.9888 *** (0.00)	3.2658 (0.2380)
Investor sentiment	-0.7735 *** (0.00)	-0.806 *** (0.00)	-0.3850 *** (0.0013)	-1.4221 *** (0.00)
Dividend	-0.6241 *** (0.0020)	7.9062 *** (0.00)	-0.8242 *** (0.00)	12.859 *** (0.00)
Expenses	0.3256 *** (0.00)	-0.2155 *** (0.00)	-0.0621 ** (0.0458)	0.1367 ** (0.0202)
Listed participations¹	0.2954 *** (0.00)	-0.4120 *** (0.00)	0.5847 *** (0.00)	-
Leverage	-0.6372 *** (0.00)	-0.0947 * (0.0817)	-0.1696 ** (0.0267)	-3.399 *** (0.00)
Size of the holding	-0.0885 *** (0.0031)	0.6240 *** (0.00)	-0.0789 *** (0.0018)	-1.673 *** (0.00)
Maturity	-0.0133 (0.5883)	-1.2135 *** (0.00)	-0.1483 *** (0.00)	0.66 *** (0.00)
Ownership concentration	-0.1411 (0.1972)	-0.3354 *** (0.00)	1.9494 *** (0.00)	5.3706 *** (0.00)
Liquidity	5.0486 (0.3359)	9.3021 ** (0.0344)	0.7133 (0.8503)	17.455 (0.2185)
LSDV R-squared	0.4072	0.7122	0.6144	0.6856
Within R-Squared	0.1572	0.6317	0.4456	0.6680

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

¹ The holdings under the categorization “Niche activities” didn’t have any listed participations included in their portfolio. This is why the relationship between listed participations and the discount couldn’t be found.

4.5 Summary of results

In this section, the previous results and analysis will be summarized. Firstly, the interest rate seems to have a negative impact on the Holdco Discount based on Table 13. However, it's important to notice that when the interest rate is measured by the short-term interest a negative relation with the Holdco discount is found whereas measuring by the long-term interest leads to a positive relationship. This discrepancy needs further investigation which leads to the rejection of hypothesis 1. Next up, all models agree that investor sentiment dictates a negative relationship in relation to the Holdco discount so hypothesis 2 can be accepted. This is in line with the papers of De Long et al. (1990), Fujiwara (2006), and Lin et al. (2008). The same situation occurs for the relation between dividends and the Holdco discount resulting in the acceptance of hypothesis 3. This is in line with the literature (Yoon & Starks, 1995; Malkiel, 1995; Pontiff, 1996; Chan et al., 2008). When being estimated by fixed-effect models expenses always have a positive impact on the discount of a holding. The direction of this relationship switches when being measured by the pooled OLS model. However, the fixed-effect model is considered the most robust model of this paper leading to the acceptance of hypothesis 4. This is in line with the literature (Datar, 2001; Chan et al., 2008; Cherkas et al., 2008).

The replicability of the portfolio caused by the inclusion of listed participations has a positive impact on the Holdco discount. This relationship flipped during the last 10 years for indistinct reasons. Despite, needing some further investigation hypothesis 5 is accepted. This is in line with the literature (Pontiff, 1996; Park & Shin, 2022). Surprisingly, Table 13 argues that the use of leverage and the discrepancy between the NAV and the market price are negatively related to one another. Ex-ante was expected that leverage increased the exposure to the macroeconomic environment which could be translated into a positive relationship with the Holdco discount. However, the results found in this paper contradict hypothesis 6 and are in line with Ramadorai (2012), Elton et al. (2013), and Dam et al. (2023). The larger a holding the more access to capital and economies of scale can be enjoyed (Brounen & Laak, 2005; Park & Shin, 2022; Kumala et al., 2024). This consensus is shared by the results in Table 13 leading to the acceptance of hypothesis 7.

The ambiguity on the relationship between the Holdco discount and both maturity and ownership concentration led to the rejection of hypothesis 8 and hypothesis 9 respectively. Maturity was not found significant by the fixed-effect model unless estimated by alternative proxies or during the subperiod analysis. When estimated by the pooled OLS model a positive significant relationship was found. However, the results of these 3 models don't point in the same direction which is why no consensus can be made. The same situation occurs for ownership concentration. It might be an interesting research gap to find out why those relations became significant over the last 10 years while not being significant over the full-time period. Lastly, liquidity was not found to be significant during all analyses unless estimated by the pooled OLS. This leads to the rejection of hypothesis 10.

Table 13: Summary of the results

	Variable	Ex-ante	Fixed-effect	First year after IPO	Pooled OLS	Alternative proxies	Subperiod	Overall
H1	Interest rate	+	-	-	-	+	-	
H2	Investor sentiment	-	-	-	-	-	-	-
H3	Dividend	-	-	-	-	-	-	-
H4	Expenses	+	+	+		+	+	+
H5	Listed participations	+	+	+	+	+	-	+
H6	Leverage	+	-	-	-		-	-
H7	Size	-	-	-	+	-	-	-
H8	Maturity	-			-	+	+	
H9	Ownership concentration	+			-	+	+	
H10	Liquidity	-			-			

5 Discussion and Conclusion

5.1 Discussion

The Holdco discount and the closed-end fund puzzle are both a contradiction of the efficient market hypotheses written by Fama (1970). If markets were well-functioning then holdings should be priced in the market at their fair value. Therefore, this master's dissertation investigates whether the Holdco discount phenomenon also applies to the Belgian economy and what the determinants are that drive this discount. Based on a sample of ten Belgian Holdcos over the period from 1995-2022, this empirical study shows that on average the Holdco discount is 0.63%. However, this discount is subject to cross-sectional and time variation. Due to outliers present in the data, the median is a more robust estimate of the Holdco Discount which took a value of 12.97%.

Building upon the Blackrock framework and the existing literature related to the CEF puzzle (Lee et al., 1991) the most important drivers of the Holdco discount were chosen to be investigated. The results of the fixed effect model indicate that market sentiment is a significant driver of the Holdco discount. However, there needs to be some further investigation regarding the direction of this relationship and which proxies are most representative for measuring the interest rate. Investor sentiment is also a driver of the Holdco discount. The results showed when there is a bullish sentiment present in the market, the Holdco discount decreases as a result. This is in line with the literature and leads to the acceptance of hypothesis 2. The results remained standing in the robustness tests and the subperiod analysis.

The fund-specific dimension showed robust results as well. Firstly, the results indicated that there was a significant negative relationship between the Holdco discount and dividends given to investors. This is in line with the existing literature. The relation between the discount of a holding and the expenses was found to be positively significant. The same situation applies to the number of listed participations in relation to the Holdco discount. This leads to the acceptance of both hypotheses 4 and 5. Leverage showed a significant relationship with the Holdco discount that remained robust when conducting several tests. However, the direction of the relationship contradicts the existing literature of Brounen and Ter Laak (2005) and Park and Shin (2022). Where a positive relationship would be expected a negative relationship is found within the data of this dissertation. So, when the use of additional debt has a justified cause this can decrease the discount of a holding.

The manager & firm dimension showed some deviating results. Size is found to be positively related to the Holdco discount which is in line with the literature. The variable remained significant during the robustness checks and in the subperiod analysis leading to the acceptance of hypothesis 7. Both maturity and ownership concentration were not found to be significant in the fixed-effect model contradicting the literature. When estimating the model with alternative proxies and performing a sub-period analysis the results contradicted the ex-ante expectations (Chan et al., 2008; Charrón, 2009; Rahman, 2022). Even though a positive relationship was found between ownership concentration and the Holdco discount being in line with the literature (Barclay et al., 1993; Pontiff, 1993; Chan et al., 2008) there are still some questions regarding the robustness of the results. Both variables need some additional research leading to the rejection of hypotheses 8 and 9. Lastly, liquidity was found to be insignificant in all models except when estimating with a pooled OLS model. This is not in line with the literature so hypothesis 10 can be rejected (Datar, 2001; Chan et al., 2008; Cherkes et al., 2008).

The cross-sectional analysis focused on answering the question of whether there is a relation between the industry composition and the determinants of the Holdco discount. The significance of determinants having an impact on the Holdco discount are grosso modo similar across industries except for the variables interest rate, listed participations, and liquidity. However, the results show a large discrepancy on the direction of all variables across industries. This can be translated as that there might be a relation between industry composition and the Holdco discount. However, this needs some further investigation by enlarging the sample of Holdings since the robustness of the results in this paper can be put into question. This is because the sampled holdings are categorized into subsamples causing only a small set of Holdings available for each category making them less representative of the population of Belgian Holding companies and their respective sector.

Concluding, this master's dissertation offers the following insights to investors and Holdco management. On the one hand, a Holdco trading at a discount doesn't guarantee a high-yield investment opportunity. Discounts can persist and fluctuate throughout history. Mostly, investor sentiment and fund-specific characteristics play a crucial role in explaining these fluctuations. Discounts on Holdcos are reduced in periods during which a bullish investor sentiment is present in the market and vice versa. Therefore, investing in highly discounted Holdcos when sentiment is at its lowest might be beneficial as the performance of holdings will pick up again when those variables progress in the opposite direction. On the other hand, some fund-specific characteristics have an impact on the discount. Firstly, increasing the dividend yield and lowering the expenses can attract investors and arbitrageurs. Increasing

the dividend yield reduces holding costs for arbitrageurs making them more incentivized in picking up discounted holding. Cutting expenses of a holding also results in a lower discount since more profits can be distributed as a dividend or capital gain. Secondly, decreasing the number of listed participations and so increasing the private capital share of a portfolio makes investors more attracted to investing in Holding companies. This is because retail investors have limited access to the private market and so replicating the portfolio of these holdings becomes more difficult. Thirdly, when holdings increase the use of debt this can create an interest tax shield, debt discipline, and leveraged returns and so reduce the Holdco discount. Manager & firm characteristics were not able to provide insights on the Holdco discount except for the size of a holding. The results of this dissertation show that large holdings are associated with economies of scale and access to capital and so reduce the discount of holdings compared to their stock price.

5.1.1 Limitations and further research

Limitations are inherent to empirical research and this master's dissertation forms no exception. First, the results of this master dissertation rely on the correctness of the data extracted from databases and annual reports. Annual reports are required to be published according to accounting standards and guidelines which ensures unbiasedness and uniformity across time and all holdings. Besides this, annual reports are verified and checked by third parties which provides extra robustness. Since databases base themselves directly on those reports published by holdings the data should be reliable as a result. Second, most of the variables are only published on an annual basis which makes the estimation of the results less robust despite including the data on a daily basis. Thirdly, most of the variables cannot be extracted directly from the financial database and must be measured through proxies. The proxies chosen in this dissertation are frequently used but the dissertation still relies on the correctness of these proxies. Fourthly, some of the results are not in line with the literature and should be tested again in further research. Furthermore, the sample data suffer from heteroskedasticity and residual autocorrelation so the interpretation of the results should happen with caution.

This master's dissertation contributes to the limited academic research on the Holdco discount phenomenon. However, further research can complement this study in many ways. Firstly, the relation between the interest rate and the Holdco discount but also the robustness of its proxy led to some contradicting results. The same applies to the variables maturity, ownership concentration, and liquidity which deviated from the ex-ante expectations and the consensus in the literature. Moreover, the impact of the industry composition on the Holdco discount and its determinants should be further looked upon. This could be done by expanding the samples used for each industry to a sample that is representative of all Belgian holding companies. Besides investigating the rejected hypotheses scholars should also include other determinants on the Holdco discount, use other proxies to test the included variables, and expand the scope of the sample to a European level. Furthermore, this dissertation based itself on two estimation techniques namely the fixed effect model and the pooled OLS regression model. It might be insightful to use other estimation techniques for testing the relationship between the determinants and the Holdco discount.

5.2 Conclusion

Discovering and testing the determinants of the undervaluation of Belgian Holdings has been the focus of this master's dissertation. Despite its limitations, the regression results have been tested with caution and can be considered robust. The main conclusions of this dissertation are that holdings have traded at a discount throughout history and probably will in the future as well. Finding a straightforward answer to why Holdings trade at a discount remains impossible for now. However, specific determinants might partially explain this phenomenon. Investor sentiment and fund-specific characteristics do play a role in explaining the discount. Investor sentiment adversely affects the Holdco discount. Institutional investors require an additional return in the form of a discount due to the risk that noise traders create because of the sentiment present in the market. Furthermore, dividends and leverage affect the Holdco discount negatively. Whereas both the expenses and the number of listed participations does affect the Holdco discount positively. Manager & firm factors are too ambiguous to find characteristics that explain the discount for all holdings. Only, size is an exception to this rule with a negative impact on the Holdco discount.

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7 Appendix

Attachment 1.1: Results of pooled OLS model for 1995-2022

	Pooled OLS	Clustered SE by unit	Clustered SE by time	Spatial consistent SE
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	4.2493 *** (0.00)	4.2493 *** (0.0054)	4.2493 *** (0.00)	4.2493 *** (0.00)
Interest rate	-1.5517 *** (0.00)	-1.5517 (0.5337)	-1.5517 *** (0.00)	-1.5517 *** (0.0085)
Investor sentiment	-0.8634 *** (0.00)	-0.8634 *** (0.0021)	-0.8634 *** (0.00)	-0.8634 *** (0.00)
Dividend	-0.9167 *** (0.00)	-0.9167 * (0.0614)	-0.9167 *** (0.00)	-0.9167 *** (0.0010)
Expenses	0.0138 *** (0.0024)	0.0138 (0.9067)	0.0138 *** (0.0049)	0.0138 (0.3380)
Listed participations	0.4837 *** (0.00)	0.4837 *** (0.0083)	0.4837 *** (0.00)	0.4837 *** (0.00)
Leverage	-0.6049 *** (0.00)	-0.6049 (0.1435)	-0.6049 *** (0.00)	-0.6049 *** (0.00)
Size of the holding	0.0193 *** (0.00)	0.0193 (0.2504)	0.0193 *** (0.00)	0.0193 ** (0.0125)
Maturity	-0.0489 *** (0.00)	-0.0489 (0.3679)	-0.0489 *** (0.00)	-0.0489 *** (0.0003)
Ownership concentration	-0.1804 *** (0.00)	-0.1804 (0.4096)	-0.1804 *** (0.00)	-0.1804 *** (0.0089)
Liquidity	-19.942 *** (0.00)	-19.942 (0.2751)	-19.942 *** (0.00)	-19.942 *** (0.0028)
R-squared	0.3122	0.3122	0.3122	0.3122
Adjusted R-Squared	0.3120	0.3120	0.3120	0.3120

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 1.2: Results of fixed effect model (1 year after IPO excluded) for 1995-2022

	Fixed effect	Clustered SE by unit	Clustered SE by time	Spatial consistent SE
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	4.9420 *** (0.00)	4.9420 *** (0.0097)	4.9420 *** (0.00)	4.9420 *** (0.00)
Interest rate	-1.854 *** (0.00)	-1.854 (0.5408)	-1.854 *** (0.00)	-1.854 *** (0.0049)
Investor sentiment	-0.7734 *** (0.00)	-0.7734 *** (0.0056)	-0.7734 *** (0.00)	-0.7734 *** (0.00)
Dividend	-0.6313 *** (0.00)	-0.6313 (0.4066)	-0.6313 *** (0.00)	-0.6313 *** (0.0019)
Expenses	0.3254 *** (0.0011)	0.3254 ** (0.0429)	0.3254 *** (0.00)	0.3254 *** (0.00)
Listed participations	0.2943 *** (0.00)	0.2943 (0.2163)	0.2943 *** (0.00)	0.2943 *** (0.00)
Leverage	-0.6368 *** (0.00)	-0.6368 (0.2095)	-0.6368 *** (0.00)	-0.6368 *** (0.00)
Size of the holding	-0.0866 *** (0.00)	-0.0866 (0.6840)	-0.0866 *** (0.00)	-0.0866 *** (0.0055)
Maturity	-0.0222 ** (0.0293)	-0.0222 (0.9177)	-0.0222 ** (0.0116)	-0.0222 (0.4943)
Ownership concentration	-0.1290 *** (0.0042)	-0.1290 (0.9072)	-0.1290 *** (0.00)	-0.1290 (0.2213)
Liquidity	5.01520 * (0.0817)	5.0152 (0.7467)	5.0152 (0.1771)	5.01520 (0.3420)
LSDV R-squared	0.4073	0.4073	0.4073	0.4073
Within R-Squared	0.1571	0.1571	0.1571	0.1571

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 1.3: Results of fixed-effect model (alternative proxies) for 1995-2022

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	-0.0348 (0.7778)	-0.0348 (0.9762)	-0.0348 (0.6772)	-0.0348 (0.8955)
Interest rate	5.6405 *** (0.00)	5.6405 (0.2739)	5.6405 *** (0.00)	5.6405 *** (0.00)
Investor sentiment	-0.0319 *** (0.0013)	-0.0319 (0.1753)	-0.0319 *** (0.00)	-0.0319 *** (0.0013)
Dividend	-0.8673 *** (0.0001)	-0.8673 (0.3842)	-0.8673 *** (0.000)	-0.8673 *** (0.0001)
Expenses	0.2621*** (0.00)	0.2621 (0.1377)	0.2621*** (0.00)	0.2621 *** (0.00)
Listed participations	0.1039 *** (0.00)	0.1039 (0.6928)	0.1039 *** (0.00)	0.1039 ** (0.0412)
Leverage	-0.0502 (0.2006)	-0.0502 (0.9141)	-0.0502 * (0.0916)	-0.0502 (0.5997)
Size of the holding	-0.0767 *** (0.00)	-0.0767 (0.5743)	-0.0767 *** (0.00)	-0.0767 *** (0.0017)
Maturity	0.0489 *** (0.00)	0.0489 (0.6510)	0.0489 *** (0.00)	0.0489 ** (0.0156)
Ownership concentration	0.8845 *** (0.1089)	0.8845 (0.6241)	0.8845 *** (0.1089)	0.8845 *** (0.00)
Liquidity	-1.6920 (0.6708)	-1.6920 (0.8764)	-1.6920 (0.6528)	-1.6920 (0.8289)
LSDV R-squared	0.3891	0.3891	0.3891	0.3891
Within R-Squared	0.1402	0.1402	0.1402	0.1402

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 2.1: Results of fixed-effect model for 2013-2022

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	10.3025 *** (0.00)	10.3025 *** (0.0046)	10.3025 *** (0.00)	10.3025 *** (0.00)
Interest rate	-6.478 *** (0.00)	-6.478 (0.3829)	-6.478 *** (0.00)	-6.478 *** (0.00)
Investor sentiment	-0.7837 *** (0.00)	-0.7837 *** (0.0052)	-0.7837 *** (0.00)	-0.7837 *** (0.00)
Dividend	-1.560 *** (0.00)	-1.560 * (0.0654)	-1.560 *** (0.00)	-1.560 *** (0.00)
Expenses	0.3649*** (0.00)	0.3649 ** (0.0159)	0.3649*** (0.00)	0.3649*** (0.00)
Listed participations	-1.0487 *** (0.00)	-1.0487 (0.1549)	-1.0487 *** (0.00)	-1.0487 *** (0.00)
Leverage	-2.5804 *** (0.00)	-2.5804 * (0.0551)	-2.5804 *** (0.00)	-2.5804 *** (0.00)
Size of the holding	-0.7842 *** (0.00)	-0.7842 ** (0.0279)	-0.7842 *** (0.00)	-0.7842 *** (0.00)
Maturity	0.4579 *** (0.00)	0.4579 * (0.0865)	0.4579 *** (0.00)	0.4579 *** (0.00)
Ownership concentration	1.3687 *** (0.00)	1.3687 (0.5457)	1.3687 *** (0.00)	1.3687 *** (0.00)
Liquidity	-5.3390 (0.1149)	-5.3390 (0.6836)	-5.3390 (0.1463)	-5.3390 (0.4007)
LSDV R-squared	0.5921	0.5921	0.5921	0.5921
Within R-Squared	0.3980	0.3980	0.3980	0.3980

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 2.2: Results of pooled OLS model for 2013-2022

Variables	Pooled OLS Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	2.7125 *** (0.00)	2.7125 * (0.0930)	2.7125 *** (0.00)	2.7125 *** (0.0003)
Interest rate	12.1052 *** (0.00)	12.1052 * (0.0789)	12.1052 *** (0.00)	12.1052 ** (0.0319)
Investor sentiment	-0.5823 *** (0.00)	-0.5823 ** (0.0284)	-0.5823 *** (0.00)	-0.5823 *** (0.0003)
Dividend	-1.4586 *** (0.00)	-1.4586 * (0.0568)	-1.4586 *** (0.00)	-1.4586 *** (0.00)
Expenses	0.1490 *** (0.00)	0.1490 (0.3859)	0.1490 *** (0.00)	0.1490 *** (0.00)
Listed participations	0.6560 *** (0.00)	0.6560 ** (0.0332)	0.6560 *** (0.00)	0.6560 *** (0.00)
Leverage	-1.2237 *** (0.00)	-1.2237 * (0.0655)	-1.2237 *** (0.00)	-1.2237 *** (0.00)
Size of the holding	0.0642 *** (0.00)	0.0642 * (0.0525)	0.0642 *** (0.00)	0.0642 *** (0.00)
Maturity	-0.0761 *** (0.00)	-0.0761 (0.3657)	-0.0761 *** (0.00)	-0.0761 *** (0.0002)
Ownership concentration	-0.4889 *** (0.00)	-0.4889 ** (0.0152)	-0.4889 *** (0.00)	-0.4889 *** (0.00)
Liquidity	-22.999 *** (0.00)	-22.999 (0.3272)	-22.999 *** (0.0001)	-22.999 *** (0.0031)
R-squared	0.3553	0.3553	0.3553	0.3553
Adjusted R-Squared	0.3550	0.3550	0.3550	0.3550

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 2.3: Results of fixed effect model (1 year after IPO excluded) for 2013-2022

Variables	Fixed effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	9.2713 *** (0.00)	9.2713 ** (0.0232)	9.2713 *** (0.00)	9.2713 *** (0.00)
Interest rate	-7.3709 *** (0.00)	-7.3709 (0.3433)	-7.3709 *** (0.00)	-7.3709 *** (0.00)
Investor sentiment	-0.7786 *** (0.00)	-0.7786 ** (0.0200)	-0.7786 *** (0.00)	-0.7786 *** (0.00)
Dividend	-1.5297 *** (0.00)	-1.5297 (0.1068)	-1.5297 *** (0.00)	-1.5297 *** (0.00)
Expenses	0.3540 *** (0.0011)	0.3540 ** (0.0356)	0.3540 *** (0.00)	0.3540 *** (0.00)
Listed participations	-1.099 *** (0.00)	-1.099 (0.1622)	-1.099 *** (0.00)	-1.099 *** (0.00)
Leverage	-2.6757 *** (0.00)	-2.6757 * (0.0674)	-2.6757 *** (0.00)	-2.6757 *** (0.00)
Size of the holding	-0.8748 *** (0.00)	-0.8748 ** (0.0445)	-0.8748 *** (0.00)	-0.8748 *** (0.00)
Maturity	0.7028 *** (0.00)	0.7028 (0.1089)	0.7028 *** (0.00)	0.7028 *** (0.00)
Ownership concentration	1.3750 *** (0.00)	1.3750 (0.5511)	1.3750 *** (0.00)	1.3750 *** (0.00)
Liquidity	-5.3428 (0.1145)	-5.3428 (0.6848)	-5.3428 (0.1463)	-5.3428 (0.4039)
LSDV R-squared	0.6009	0.6009	0.6009	0.6009
Within R-Squared	0.4109	0.4109	0.4109	0.4109

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 2.4: Results of fixed-effect model (alternative proxies) for 2013-2022

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	6.65 *** (0.00)	6.65 ** (0.0435)	6.65 *** (0.00)	6.65 *** (0.00)
Interest rate	2.9377 *** (0.00)	2.9377 (0.4503)	2.9377 *** (0.00)	2.9377 ** (0.0212)
Investor sentiment	-0.0524 *** (0.00)	-0.0524 * (0.0789)	-0.0524 *** (0.00)	-0.0524 *** (0.00)
Dividend	-1.6501 *** (0.00)	-1.6501 (0.1132)	-1.6501 *** (0.00)	-1.6501 *** (0.00)
Expenses	0.4284 *** (0.00)	0.4284 * (0.0506)	0.4284 *** (0.00)	0.4284 *** (0.00)
Listed participations	-1.0292 *** (0.00)	-1.0292 (0.2404)	-1.0292 *** (0.00)	-1.0292 *** (0.00)
Leverage	-1.6807 *** (0.00)	-1.6807 (0.2720)	-1.6807 *** (0.00)	-1.6807 *** (0.00)
Size of the holding	-0.740 *** (0.00)	-0.740 * (0.0554)	-0.740 *** (0.00)	-0.740 *** (0.00)
Maturity	0.4082 *** (0.00)	0.4082 (0.1266)	0.4082 *** (0.00)	0.4082 *** (0.00)
Ownership concentration	0.9071 *** (0.00)	0.9071 (0.7138)	0.9071 *** (0.00)	0.9071 *** (0.00)
Liquidity	3.337 (0.5128)	3.337 (0.8152)	3.337 (0.5871)	3.337 (0.7919)
LSDV R-squared	0.5484	0.5484	0.5484	0.5484
Within R-Squared	0.3644	0.3644	0.3644	0.3644

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 3.1: Results of fixed-effect model for mature industries

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	6.334 *** (0.00)	6.334 *** (0.0005)	6.334 *** (0.00)	6.334 *** (0.00)
Interest rate	-8.559 *** (0.00)	-8.559 *** (0.0063)	-8.559 *** (0.00)	-8.559 *** (0.00)
Investor sentiment	-0.806 *** (0.00)	-0.806 *** (0.00)	-0.806 *** (0.00)	-0.806 *** (0.00)
Dividend	7.9062 *** (0.00)	7.9062 (0.1508)	7.9062 *** (0.00)	7.9062 *** (0.00)
Expenses	-0.2155 *** (0.00)	-0.2155 *** (0.00)	-0.2155 *** (0.00)	-0.2155 *** (0.00)
Listed participations	-0.4120 *** (0.00)	-0.4120 *** (0.00)	-0.4120 *** (0.00)	-0.4120 *** (0.00)
Leverage	-0.0947 *** (0.00)	-0.0947 (0.5821)	-0.0947 *** (0.00)	-0.0947 * (0.0817)
Size of the holding	0.6240 *** (0.00)	0.6240 *** (0.00)	0.6240 *** (0.00)	0.6240 *** (0.00)
Maturity	-1.2135 *** (0.00)	-1.2135 *** (0.00)	-1.2135 *** (0.00)	-1.2135 *** (0.00)
Ownership concentration	-0.3354 *** (0.00)	-0.3354 (0.2026)	-0.3354 *** (0.00)	-0.3354 *** (0.00)
Liquidity	9.3021 *** (0.00)	9.3021 (0.1095)	9.3021 *** (0.00)	9.3021 ** (0.0344)
LSDV R-squared	0.7122	0.7122	0.7122	0.7122
Within R-Squared	0.6317	0.6317	0.6317	0.6317

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 3.2: Results of pooled OLS model for matures industries

	Pooled OLS	Clustered SE by unit	Clustered SE by time	Spatial consistent SE
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	7.4551 *** (0.00)	7.4551 (0.1183)	7.4551 *** (0.0004)	7.4551 *** (0.0047)
Interest rate	-10.246 *** (0.00)	-10.246 * (0.0959)	-10.246 *** (0.0005)	-10.246 *** (0.0060)
Investor sentiment	-0.8658 *** (0.00)	-0.8658 * (0.0629)	-0.8658 *** (0.0008)	-0.8658 ** (0.0102)
Dividend	0.2543 (0.6460)	0.2543 (0.9807)	0.2543 (0.7062)	0.2543 (0.9146)
Expenses	-0.2928 *** (0.00)	-0.2928 (0.1444)	-0.2928 *** (0.0010)	-0.2928 ** (0.0133)
Listed participations	-0.2123 *** (0.00)	-0.2123 (0.4242)	-0.2123 *** (0.0030)	-0.2123 ** (0.0381)
Leverage	0.1166 *** (0.00)	0.1166 (0.8043)	0.1166 ** (0.0287)	0.1166 (0.2514)
Size of the holding	0.4133 *** (0.00)	0.4133 (0.1861)	0.4133 *** (0.0003)	0.4133 *** (0.0041)
Maturity	-1.0461 *** (0.00)	-1.0461 (0.2222)	-1.0461 *** (0.0004)	-1.0461 *** (0.0055)
Ownership concentration	1.3310 *** (0.00)	1.3310 (0.3183)	1.3310 *** (0.0006)	1.3310 *** (0.0083)
Liquidity	21.044 *** (0.00)	21.044 (0.1937)	21.044 ** (0.0240)	21.044 * (0.0616)
R-squared	0.5288	0.5288	0.5288	0.5288
Adjusted R-Squared	0.5284	0.5284	0.5284	0.5284

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 3.3: Results of fixed effect model (1 year after IPO excluded) for mature industries

	Fixed effect	Clustered SE by unit	Clustered SE by time	Spatial consistent SE
Variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	6.334 *** (0.00)	6.334 *** (0.0005)	6.334 *** (0.00)	6.334 *** (0.00)
Interest rate	-8.559 *** (0.00)	-8.559 *** (0.0063)	-8.559 *** (0.00)	-8.559 *** (0.00)
Investor sentiment	-0.8060 *** (0.00)	-0.8060 *** (0.00)	-0.8060 *** (0.00)	-0.8060 *** (0.00)
Dividend	7.9062 *** (0.00)	7.9062 (0.1508)	7.9062 *** (0.00)	7.9062 *** (0.00)
Expenses	-0.2155 *** (0.00)	-0.2155 *** (0.00)	-0.2155 *** (0.00)	-0.2155 *** (0.00)
Listed participations	-0.4197 *** (0.00)	-0.4197 *** (0.00)	-0.4197 *** (0.00)	-0.4197 *** (0.00)
Leverage	-0.0947 *** (0.00)	-0.0947 (0.5821)	-0.0947 *** (0.00)	-0.0947 * (0.0817)
Size of the holding	0.6240 *** (0.00)	0.6240 *** (0.00)	0.6240 *** (0.00)	0.6240 *** (0.00)
Maturity	-1.214 *** (0.00)	-1.214 *** (0.00)	-1.214 *** (0.00)	-1.214 *** (0.00)
Ownership concentration	-0.3354 *** (0.00)	-0.3354 (0.2026)	-0.3354 *** (0.00)	-0.3354 *** (0.00)
Liquidity	9.302 *** (0.00)	9.302 (0.1095)	9.302 *** (0.00)	9.302 ** (0.0344)
LSDV R-squared	0.7122	0.7122	0.7122	0.7122
Within R-Squared	0.6317	0.6317	0.6317	0.6317

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 3.4: Results of fixed-effect model (alternative proxies) for mature industries

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	3.316 *** (0.00)	3.316 (0.1646)	3.316 *** (0.00)	3.316 *** (0.00)
Interest rate	-0.1514 (0.3678)	-0.1514 (0.9365)	-0.1514 (0.5372)	-0.1514 (0.8488)
Investor sentiment	-0.0216 *** (0.00)	-0.0216 (0.4132)	-0.0216 *** (0.00)	-0.0216 ** (0.0154)
Dividend	-2.925 *** (0.00)	-2.925 (0.4944)	-2.925 *** (0.00)	-2.925 (0.1436)
Expenses	-0.1945*** (0.00)	-0.1945 (0.1458)	-0.1945*** (0.00)	-0.1945*** (0.00)
Listed participations	-0.3949 *** (0.00)	-0.3949 (0.3787)	-0.3949 *** (0.00)	-0.3949 *** (0.00)
Leverage	0.6530 *** (0.00)	0.6530 ** (0.0448)	0.6530 *** (0.00)	0.6530 *** (0.00)
Size of the holding	0.1328 *** (0.00)	0.1328 (0.3275)	0.1328 *** (0.00)	0.1328 *** (0.00)
Maturity	-0.5437 *** (0.00)	-0.5437 (0.2297)	-0.5437 *** (0.00)	-0.5437 *** (0.00)
Ownership concentration	-0.0889 ** (0.0287)	-0.0889 (0.8549)	-0.0889 ** (0.0262)	-0.0889 (0.4896)
Liquidity	-1.8135 (0.4050)	-1.8135 (0.7877)	-1.8135 (0.4515)	-1.8135 (0.7133)
LSDV R-squared	0.6538	0.6538	0.6538	0.6538
Within R-Squared	0.5170	0.5170	0.5170	0.5170

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 4.1: Results of fixed-effect model for growth industries

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	3.4708 *** (0.00)	3.4708 *** (0.0010)	3.4708 *** (0.00)	3.4708 *** (0.00)
Interest rate	-2.9888 *** (0.00)	-2.9888 * (0.1000)	-2.9888 *** (0.00)	-2.9888 *** (0.00)
Investor sentiment	-0.3850 *** (0.0013)	-0.3850 *** (0.0084)	-0.3850 *** (0.00)	-0.3850 *** (0.0013)
Dividend	-0.8242 *** (0.00)	-0.8242 *** (0.0009)	-0.8242 *** (0.00)	-0.8242 *** (0.00)
Expenses	-0.0621*** (0.00)	-0.0621 (0.6100)	-0.0621*** (0.00)	-0.0621 ** (0.0458)
Listed participations	0.5847 *** (0.00)	0.5847 ** (0.0124)	0.5847 *** (0.00)	0.5847 *** (0.00)
Leverage	-0.1696 *** (0.00)	-0.1696 (0.5254)	-0.1696 *** (0.00)	-0.1696 ** (0.0267)
Size of the holding	-0.0789 *** (0.00)	-0.0789 (0.2277)	-0.0789 *** (0.00)	-0.0789 *** (0.0018)
Maturity	-0.1483 *** (0.00)	-0.1483 (0.1685)	-0.1483 *** (0.00)	-0.1483 *** (0.00)
Ownership concentration	1.9494 *** (0.00)	1.9494 ** (0.0207)	1.9494 *** (0.00)	1.9494 *** (0.00)
Liquidity	0.7133 (0.6412)	0.7133 (0.9152)	0.7133 (0.7804)	0.7133 (0.8503)
LSDV R-squared	0.6144	0.6144	0.6144	0.6144
Within R-Squared	0.4456	0.4456	0.4456	0.4456

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 4.2: Results of pooled OLS model for growth industries

Variables	Pooled OLS Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	2.4181 *** (0.00)	2.4181 ** (0.0228)	2.4181 *** (0.00)	2.4181 *** (0.0040)
Interest rate	-1.5537 *** (0.00)	-1.5537 ** (0.0235)	-1.5537 *** (0.0031)	-1.5537 * (0.0934)
Investor sentiment	-0.4756 *** (0.00)	-0.4756 *** (0.0015)	-0.4756 *** (0.0002)	-0.4756 *** (0.0071)
Dividend	-0.8562 *** (0.00)	-0.8562 *** (0.0007)	-0.8562 *** (0.0005)	-0.8562 ** (0.0184)
Expenses	-0.0012 (0.8409)	-0.0012 (0.9954)	-0.0012 (0.8626)	-0.0012 (0.9618)
Listed participations	0.3222 *** (0.00)	0.3222 ** (0.0307)	0.3222 *** (0.00)	0.3222 *** (0.0021)
Leverage	-0.1262 *** (0.00)	-0.1262 (0.8235)	-0.1262 *** (0.0089)	-0.1262 (0.1958)
Size of the holding	-0.0372 *** (0.00)	-0.0372 (0.5972)	-0.0372 *** (0.0027)	-0.0372 * (0.0850)
Maturity	0.0307 *** (0.00)	0.0307 (0.4223)	0.0307 *** (0.0015)	0.0307 * (0.0530)
Ownership concentration	0.3064 *** (0.00)	0.3064 (0.4247)	0.3064 *** (0.0005)	0.3064 ** (0.0205)
Liquidity	2.2497 (0.1672)	2.2497 (0.7961)	2.2497 (0.4878)	2.2497 (0.6344)
R-squared	0.5568	0.5568	0.5568	0.5568
Adjusted R-Squared	0.5565	0.5565	0.5565	0.5565

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 4.3: Results of fixed effect model (1 year after IPO excluded) for growth industries

Variables	Fixed effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	3.4708 *** (0.00)	3.4708 *** (0.0010)	3.4708 *** (0.00)	3.4708 *** (0.00)
Interest rate	-2.9888 *** (0.00)	-2.9888 * (0.1000)	-2.9888 *** (0.00)	-2.9888 *** (0.00)
Investor sentiment	-0.3850 *** (0.00)	-0.3850 *** (0.0084)	-0.3850 *** (0.00)	-0.3850 *** (0.00)
Dividend	-0.8242 *** (0.00)	-0.8242 *** (0.0009)	-0.8242 *** (0.00)	-0.8242 *** (0.00)
Expenses	-0.0621 *** (0.00)	-0.0621 (0.6100)	-0.0621 *** (0.00)	-0.0621 ** (0.0458)
Listed participations	0.5847 *** (0.00)	0.5947 ** (0.0124)	0.5947 *** (0.00)	0.5947 *** (0.00)
Leverage	-0.1696 *** (0.00)	-0.1696 (0.5254)	-0.1696 *** (0.00)	-0.1696 ** (0.0267)
Size of the holding	-0.0789 *** (0.00)	-0.0789 (0.2277)	-0.0789 *** (0.00)	-0.0789 *** (0.0018)
Maturity	-0.1483 *** (0.00)	-0.1483 (0.1685)	-0.1483 *** (0.00)	-0.1483 *** (0.00)
Ownership concentration	1.9493 *** (0.00)	1.9493 ** (0.0207)	1.9493 *** (0.00)	1.9493 *** (0.00)
Liquidity	0.7134 (0.6412)	0.7134 (0.9152)	0.7134 (0.7804)	0.7134 (0.8503)
LSDV R-squared	0.6144	0.6144	0.6144	0.6144
Within R-Squared	0.4456	0.4456	0.4456	0.4456

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 4.4: Results of fixed-effect model (alternative proxies) for growth industries

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	0.1361 (0.1963)	0.1361 (0.9282)	0.1361 (0.2809)	0.1361 (0.7322)
Interest rate	1.8457 *** (0.00)	1.8457 (0.4558)	1.8457 *** (0.00)	1.8457 ** (0.0171)
Investor sentiment	-0.0314 *** (0.00)	-0.0314 (0.1218)	-0.0314 *** (0.00)	-0.0314 *** (0.00)
Dividend	-0.7113 *** (0.00)	-0.7113 *** (0.0046)	-0.7113 *** (0.00)	-0.7113 *** (0.0001)
Expenses	-0.3420 *** (0.00)	-0.3420 (0.1213)	-0.3420 *** (0.00)	-0.3420 *** (0.00)
Listed participations	0.5677 *** (0.00)	0.5677 ** (0.0465)	0.5677 *** (0.2429)	0.5677 *** (0.00)
Leverage	0.0416 (0.2077)	0.0416 (0.8709)	0.0416 (0.2429)	0.0416 (0.7149)
Size of the holding	-0.0103 (0.1386)	-0.0103 (0.9322)	-0.0103 (0.3359)	-0.0103 (0.7625)
Maturity	-0.1344 *** (0.00)	-0.1344 (0.5513)	-0.1344 *** (0.00)	-0.1344 *** (0.0004)
Ownership concentration	2.7646 *** (0.00)	2.7646 (0.1533)	2.7646 *** (0.00)	2.7646 *** (0.00)
Liquidity	-3.128 (0.2254)	-3.128 (0.5182)	-3.128 (0.3462)	-3.128 (0.6196)
LSDV R-squared	0.5215	0.5215	0.5215	0.5215
Within R-Squared	0.3504	0.3504	0.3504	0.3504

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 5.1: Results of fixed-effect model for niche activities

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	18.1246 *** (0.00)	18.1246 * (0.0520)	18.1246 *** (0.00)	18.1246 *** (0.00)
Interest rate	3.2658 *** (0.00)	3.2658 (0.4935)	3.2658 *** (0.00)	3.2658 (0.2380)
Investor sentiment	-1.4221 *** (0.00)	-1.4221 * (0.0643)	-1.4221 *** (0.00)	-1.4221 *** (0.00)
Dividend	12.859 *** (0.00)	12.859 *** (0.0051)	12.859 *** (0.00)	12.859 *** (0.00)
Expenses	0.1367 *** (0.00)	0.1367 (0.8134)	0.1367 *** (0.00)	0.1367 ** (0.0202)
Listed participations	-	-	-	-
Leverage	-3.399 *** (0.00)	-3.399 (0.3463)	-3.399 *** (0.00)	-3.399 *** (0.00)
Size of the holding	-1.673 *** (0.00)	-1.673 (0.1575)	-1.673 *** (0.00)	-1.673 *** (0.00)
Maturity	0.66 *** (0.00)	0.66 (0.2539)	0.66 *** (0.00)	0.66 *** (0.00)
Ownership concentration	5.3706 *** (0.00)	5.3706 (0.3039)	5.3706 *** (0.00)	5.3706 *** (0.00)
Liquidity	17.455 ** (0.0182)	17.455 (0.2617)	17.455 ** (0.1549)	17.455 (0.2185)
LSDV R-squared	0.6856	0.6856	0.6856	0.6856
Within R-Squared	0.6680	0.6680	0.6680	0.6680

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 5.2: Results of pooled OLS model for niche activities

Variables	Pooled OLS Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	13.234 *** (0.00)	13.234 * (0.0694)	13.234 *** (0.0011)	13.234 ** (0.0117)
Interest rate	7.7568 *** (0.00)	7.7568 ** (0.0402)	7.7568 ** (0.0124)	7.7568 (0.1195)
Investor sentiment	-1.836 *** (0.00)	-1.836 (0.1396)	-1.836 *** (0.0022)	-1.836 ** (0.0237)
Dividend	15.6717 *** (0.00)	15.6717 * (0.0957)	15.6717 *** (0.0006)	15.6717 *** (0.0066)
Expenses	0.7304 *** (0.00)	0.7304 *** (0.0097)	0.7304 *** (0.0004)	0.7304 *** (0.0049)
Listed participations	-	-	-	-
Leverage	-6.8962 *** (0.00)	-6.8962 *** (0.0065)	-6.8962 *** (0.0002)	-6.8962 *** (0.0027)
Size of the holding	-0.3665 *** (0.00)	-0.3665 ** (0.0257)	-0.3665 *** (0.0005)	-0.3665 *** (0.0044)
Maturity	-0.1251 *** (0.00)	-0.1251 (0.4824)	-0.1251 *** (0.0038)	-0.1251 ** (0.0388)
Ownership concentration	1.1391 *** (0.00)	1.1391 (0.5362)	1.1391 *** (0.0027)	1.1391 ** (0.0299)
Liquidity	41.035 *** (0.00)	41.035 (0.3510)	41.035 (0.1319)	41.035 (0.1442)
R-squared	0.5947	0.5947	0.5947	0.5947
Adjusted R-Squared	0.5947	0.5947	0.5947	0.5947

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 5.3: Results of fixed effect model (1 year after IPO excluded) for niche activities

Variables	Fixed effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	17.763 *** (0.00)	17.763 *** (0.00)	17.763 *** (0.00)	17.763 *** (0.00)
Interest rate	1.5833 ** (0.0307)	1.5833 (0.5440)	1.5833 ** (0.0409)	1.5833 (0.5449)
Investor sentiment	-1.3379 *** (0.00)	-1.3379 *** (0.0048)	-1.3379 *** (0.00)	-1.3379 *** (0.00)
Dividend	13.025 *** (0.00)	13.025 *** (0.00)	13.025 *** (0.00)	13.025 *** (0.00)
Expenses	0.0566 *** (0.0005)	0.0566 (0.9108)	0.0566 *** (0.0007)	0.0566 (0.3157)
Listed participations	-	-	-	-
Leverage	-2.9913 *** (0.00)	-2.9913 (0.2879)	-2.9913 *** (0.00)	-2.9913 *** (0.00)
Size of the holding	-1.8858 *** (0.00)	-1.8858 *** (0.0052)	-1.8858 *** (0.00)	-1.8858 *** (0.00)
Maturity	0.9062 *** (0.00)	0.9062 ** (0.0478)	0.9062 *** (0.00)	0.9062 *** (0.00)
Ownership concentration	5.740 *** (0.00)	5.740 (0.1386)	5.740 *** (0.00)	5.740 *** (0.00)
Liquidity	10.6740 (0.1532)	10.6740 (0.3721)	10.6740 (0.3112)	10.6740 (0.4054)
LSDV R-squared	0.6966	0.6966	0.6966	0.6966
Within R-Squared	0.6817	0.6817	0.6817	0.6817

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Attachment 5.4: Results of fixed-effect model (alternative proxies) for niche activities

Variables	Fixed-effect Coefficient (p-value)	Clustered SE by unit Coefficient (p-value)	Clustered SE by time Coefficient (p-value)	Spatial consistent SE Coefficient (p-value)
Constant	-4.0807 *** (0.00)	-4.0807 (0.1110)	-4.0807 *** (0.00)	-4.0807 *** (0.0181)
Interest rate	33.3801 *** (0.00)	33.3801 *** (0.00)	33.3801 *** (0.00)	33.3801 *** (0.00)
Investor sentiment	-0.1659 *** (0.00)	-0.1659 *** (0.00)	-0.1659 *** (0.00)	-0.1659 *** (0.00)
Dividend	9.3205 *** (0.00)	9.3205 *** (0.0070)	9.3205 *** (0.00)	9.3205 *** (0.00)
Expenses	0.5829 *** (0.00)	0.5829 ** (0.0197)	0.5829 *** (0.00)	0.5829 *** (0.00)
Listed participations	-	-	-	-
Leverage	-4.8047 *** (0.00)	-4.8047 *** (0.0013)	-4.8047 *** (0.00)	-4.8047 *** (0.00)
Size of the holding	-0.3647 *** (0.00)	-0.3647 (0.1704)	-0.3647 *** (0.00)	-0.3647 *** (0.0058)
Maturity	0.3013 *** (0.00)	0.3013 (0.1411)	0.3013 *** (0.00)	0.3013 *** (0.00)
Ownership concentration	8.1387 *** (0.00)	8.1387 ** (0.0149)	8.1387 *** (0.00)	8.1387 *** (0.00)
Liquidity	38.2011 *** (0.0002)	38.2011 *** (0.0021)	38.2011 *** (0.0002)	38.2011 ** (0.0416)
LSDV R-squared	0.7740	0.7740	0.7740	0.7740
Within R-Squared	0.7581	0.7581	0.7581	0.7581

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.