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Effect of VC and Impact Fund Involvement on IPO Underpricing

Evidence from the UK

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ABSTRACT

This thesis investigates the effect of Venture Capital (VC) and Impact Fund involvement on IPO underpricing in the UK. Using a sample of 568 IPOs listed on the London Stock Exchange from 2007 to 2023, the analysis employed two cross-sectional OLS regression models to examine the effect of VC and Impact Fund involvement. The results show that both VC- and Impact Fund-backed IPOs experience significantly lower underpricing compared to non-backed IPOs. This suggests that the involvement of these funds serves as a certification of quality, by reducing information asymmetry between investors and companies, which results in less perceived investment risk. These findings provide crucial insights for investors and policymakers, highlighting the importance of fund involvement in enhancing IPO pricing efficiency and stability.

Keywords: IPO, underpricing, VC, impact fund

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CHAPTER 1 Introduction

When firms decide to go public by means of IPO, they systematically offer their shares at a relatively low price, resulting in an increase in price at the end of the first trading day. This phenomenon is known as underpricing (Tanda & Manzi, 2020). One factor that may determine whether an IPO is underpriced or not, is the involvement of venture capitalists (VCs). VC-backed IPOs may be regarded as relatively low-risk by investors, which means that low prices are not necessary to attract investors (Megginson & Weiss, 1997). Moreover, VCs have to maintain a trustworthy reputation if they want to keep bringing firms to the IPO market. This is an incentive for VCs to be transparent about the company's quality (Brav & Gompers, 1997). This paper will thus investigate the effect of VC involvement on underpricing in the UK. With the rise of impact investment funds, the effect of these specific type of VC funds on underpricing in the UK will be investigated as well. It can be valuable for investors, companies, and governments to understand how venture capitalists affect the IPO market. For example, this understanding enables investors and companies to better asses the risks of an IPO. Moreover, it enables governments to better regulate the IPO market.

Researchers have been particularly interested in the effect of venture capitalist involvement on IPO underpricing, resulting in a lot of theoretical and empirical literature. Results often contradict each other, caused by differences in geographical area for example (Tanda & Manzi, 2020). Therefore this study will solely focus on the UK. Belghitar & Dixon (2012) show that in the UK between 1992 and 1996, venture capitalists negatively affected the degree of underpricing of an IPO. They found this result by running a cross-sectional regression of a dummy variable that takes value 1 if the IPO was backed by a VC on the degree of underpricing. Their sample consisted of 546 IPO's that were floated on the London Stock Exchange (LSE). Coakley et al. (2009) found the same result, except for the years 1998-2000. This implies that in times of economic recession (the bubble years), the effect of VCs on underpricing is not present. They used a sample of 591 IPO's on the LSE between 1985 to 2003. Most scholars explain this negative effect of VC involvement on underpricing by means of the certification theory. This theory suggest that the information asymmetry between the company and the investors is reduced due to the VC involvement. These VCs can certify the quality of a certain firm, because the VCs have a market reputation to maintain. As a result, investors are willing to pay more for the shares and underpricing is reduced (Jamaani & Alidarous, 2019).

Eventhough a vast amount of research has been done already on the effect of VC involvement on the degree of underpricing in the UK, most of these studies are pretty old. Moreover, Coakley et al. (2009) found that the effect changed during the dot-com bubble in the late 1990s. This raises the question if the negative effect of VC involvement on the degree of underpricing in the UK is robust to changes in economic environment, such as the financial and Covid-19 crisis. Therefore I will study this same

relationship, using a more recent dataset of UK IPO's between 2007 to 2023. Furthermore, the specific effect of involvement of impact venture capital funds on underpricing has not yet been studied. Impact funds are funds that make investments with measurable social impact, while still offering the potential for financial return on the investment (Clarkin & Cangioni, 2016). This effect is interesting to study, since Barber et al. (2021) show that impact funds yield lower returns on average than traditional funds. This implies that the certification theory might not hold for IPO's backed by impact funds, since investors are not certified of the quality of the firm in terms of financial returns. Therefore, the research question that this thesis aims to answer is: 'How does the involvement of venture capital and impact funds affect the underpricing of IPO's in the UK?'

Similar to the study by Belghitar & Dixon (2012) a cross-sectional OLS regression of VC involvement on underpricing will be performed. VC involvement is a dummy variable that takes value one if the IPO was backed by a venture capital fund and zero otherwise. Underpricing is measured as the difference between the closing price and the offering price on the first trading day, divided by that offering price. The sample contains all IPO's on the London Stock Exchange (LSE) between 2007 and 2023. This data about share prices and VC involvement is collected from LSEG workspace. Since VCs do not randomly choose the firms to invest in, controls have to be taken into account to tackle the issue of endogeneity. These control variables can be categorized as firm-specific, and market-momentum variables. Lastly, another OLS regression with underpricing as dependent and impact fund as independent variable is performed. Impact fund is a dummy variable that takes value one if the IPO was backed by an impact fund (and zero otherwise). In order to be regarded as an impact fund, the selection criteria as stated by dealroom.co have to be met.

Analogous to the results from previous studies in the UK, I hypothesize that VC involvement will have a negative effect on underpricing in the UK. In my analysis, this should become apparent through the significance of the VC involvement dummy variable in my first regression model. Moreover, I hypothesize that the effect of impact funds on underpricing will be negative in the UK, because investors might perceive these IPOs as relatively low-risk (due to the rising importance of ESG reporting for example). Practically, I expect significance and negativity of the value of the impact fund dummy variable in the second regression model. Jamaani & Alidarous (2019) have pointed out that underpricing can be explained by at least 13 theoretical models. For that reason, this study will most likely not give the final answer as to why underpricing happens in the UK. However, this study will provide insights in to one of the factors that determines underpricing in the UK, thereby providing one part of the puzzle of underpricing.

The results of the two models show that VC and Impact Fund involvement have a significant negative effect on the degree of underpricing of an IPO. However, the R-squared of both models was relatively low, which is in line with all the different available theories in the literature that can explain IPO

underpricing. This study therefore concludes that both the involvement of venture capitals funds and involvement of impact funds negatively affect the degree of IPO underpricing in the UK. This suggests that investors perceive IPOs that were backed by VC/Impact Funds as relatively low risk since these funds certify the economic value of the company.

The remainder of this thesis is structured as follows. Section 2 discusses the relevant literature and previous research. Section 3 outlines the dataset that was used for the analysis. Section 4 discusses the empirical methodology. Section 5 presents the main results of the analysis, including a test of the hypotheses and a discussion of the main findings. Section 6 discusses the main limitations of this study. Section 7 provides a summary and conclusion of the research. Lastly, additional supportive materials are provided in the Appendix.

CHAPTER 2 Theoretical Framework

2.1 IPO Underpricing

2.1.1 Why and how do firms go public?

An Initial Public Offering (IPO) is the process of selling stock to the public for the first time (Berk & DeMarzo, 2020). This raises the question why firms would want to go public in the first place. In many cases, their primary reason is the desire to raise equity capital and to create a public market in which the founders and other shareholders can convert their equity stakes into cash in the future. Non-financial reasons, such as increased publicity, play a much smaller role in the decision for firms to go public (Ritter & Welch, 2002).

Besides these advantages, an IPO has some disadvantages as well. For example, an IPO comes with many legal and administrative obligations for the firm, such as disclosure requirements (Ritter, 1987). Moreover, firms have to bear the direct costs of an IPO in the firm of listing fees, underwriting fees, accounting fees and many more (Loughran & Ritter, 2002). This can be explained by the fact that the IPO process is an extensive process that needs a lot of preparation, which can take up to more than year (Ritter, 1987). In order to understand this process, the three main parties of an IPO are explained below.

Three parties are involved in the process of an IPO: the issuing firm, the investors and the underwriter (Ljungqvist, 2007). The main goal of the issuing firm is to sell their shares for the highest possible price in order to raise as much equity as possible. The underwriter (usually an investment bank) is appointed by the issuing firm to help set up a good offering price and to prepare all the necessary documentation in compliance with legal requirements. The underwriter thus has to do a thorough analysis of the firm in order to set up a share price range that enables the IPO to be successful. In return for these services, the underwriter receives underwriting fees, known as the 'underwriting spread' (Chen & Mohan, 2002). Lastly, the investors are the ones buying the IPO shares. The long-term investors tend to hold these shares for a relatively long period of time (T. Jenkinson & Ljungqvist, 2001). On the other hand, the short-term-investors seek a quick financial return by flipping the shares on the first listing day (Ljungqvist, 2007). These short-term investors are often successful in making these quick returns, because IPO shares are often underpriced.

2.1.2 Evidence of underpricing

IPO underpricing refers to the phenomenon that share prices of newly listed firms increase on the first trading day. It has been one of the financial phenomena that has gathered a lot of attention from scholars, media, the business world and the public (Jamaani & Alidarous, 2019). The degree of underpricing can be calculated by taking the difference between the share price on the first trading day and the price that the initial investors paid for the price, divided by this initial price ((Ljungqvist,

2007). Over the years a lot of evidence has been found for this phenomenon. For example, Loughran et al. (1994) found that that average country-level underpricing ranged from 3,3% to 270,1% across 54 countries during a period of 30 years. Moreover, Coakley et al. (2009) found evidence of IPO underpricing in the UK between 1985 and 2003. Lastly, Ritter & Welch (2002) found that underpricing on the US market has become even more extreme over time: from an average 7,4% in the 1980s to 65% during the bubble years (late 1990s). Besides these three studies, there is much more evidence of IPO underpricing, which implies that underpricing takes place in both developed and developing countries.

This underpricing is interesting to study, because it means that the issuers of the shares have 'left money on the table'. If the shares had been sold at the closing market day price instead of the initial issue price, then the issuers could have raised a lot more money, equal to the amount left on the table. In fact, between 1990 and 1998, 27 billion dollars was left on the table on the US market due to underpricing. This amount was twice as large as the 13 billion dollars that the issuers paid as underwriting fees (Loughran & Ritter, 2002). Underpricing can thus be seen as a big cost of going public for companies. Yet, IPOs and underpricing still regularly happen.

2.2 Theoretical explanations of IPO underpricing

All this evidence of underpricing raises the question why underpricing still happens, considering the fact that it is a big cost for the issuing company. Scholars have come up with many theories that can explain this phenomenon. Jamaani & Alidarous (2019) have reviewed many of these underpricing theories and have categorized them in four categories: information asymmetry, institutional, ownership & control and behavioural theories. I will now give a short explanation of these theories, which enables us to better understand how VC funds can affect underpricing.

2.2.1 Information asymmetry theories

The information asymmetry theories are based on the information asymmetry between the parties involved in an IPO: between the issuer and underwriter, and between the investor and underwriter. Majority of the studies attributes this information asymmetry as the main reason for underpricing (Katti & B V, 2016).

For example, the signalling theory states that issuers know the quality of their firm and have private information about the future cash flows and intrinsic value of the firm. However, investors do not have access to this kind of information, which makes it hard for investors to differentiate between the low- and high-quality firms. To tackle this problem, issuers offer their shares for a relatively low price to 'signal' the high quality to potential investors (Allen & Faulhaber, 1989). There has been a lot of debate in the literature whether this theory really holds in real life. For example, Liu & Ritter (2011) argue that it is unclear why underpricing would be a better signal than advertisements for example.

Secondly, the ex-ante uncertainty hypothesis states that investors demand underpricing in case of ex-ante uncertainty (Beatty & Ritter, 1986). This ex-ante uncertainty can include matters of the use of IPO proceeds for example. In other words, if there is information asymmetry between investors and issuers, the investors will demand underpricing to compensate for the higher uncertainty. This hypothesis has been empirically supported by some studies, but it is argued in many papers that this hypothesis cannot fully explain the matter of underpricing (Jamaani & Alidarous, 2019).

Thirdly, Rock (1986) has introduced the 'winner's curse hypothesis', which states that there is information asymmetry between uninformed and informed (institutional) investors. In fact, these institutional investors have even more information about the intrinsic value of the firm than the issuers and underwrites themselves. Therefore, the institutional investors will only bid on underpriced shares, whereas the uninformed investors are left with the overpriced shares. In order to tackle this issue and make sure that the uninformed investors will still invest in the IPO firm, the IPO firm will underprice the shares. This theory has been backed with empirical evidence by various studies, but it is still questioned to what degree underpricing can be explained by this theory (Jamaani & Alidarous, 2019).

Fourthly, the certification theory states that the IPO issuers are aware of the investors' concerns about the intrinsic value of the firm. Therefore issuers employ reputable underwriters, who can effectively certify the fair value of the share prices, which functions as a third party guarantee to the investors. As an effect, the degree of underpricing will be less severe if reputable underwriters are involved in the IPO process. This can be explained by the fact that the underwriters have a reputation that they want to maintain, so they cannot afford to underprice the shares too severely (Booth & Smith, 1986). Carter et al. (1998) have indeed found empirical evidence that shows that underpricing is less severe for IPOs with reputable underwriters, compared to IPOs with regular underwriters. They examined 2200 IPOs from 1979 to 1991. On the other hand, Marisetty & Subrahmanyam (2010) have found empirical evidence of high degrees of underpricing in India, even when reputable underwriters are involved. They studied 2713 IPOs in India between 1990 and 2004. This implies that the certification theory might not hold for developing countries.

Lastly, Baron (1982) has introduced the principal-agent theory, that focuses on the information asymmetry between the issuer and the underwriter. The author argues that the underwriter makes use of his superior market knowledge by underpricing the shares, thereby reducing the marketing costs. This theory implies that there should be no underpricing if firms underwrite their own IPOs. However, Muscarella & Vetsuypens (1989) have found empirical evidence that there is no difference in underpricing between these self-underwritten and other IPOs. For this study, they looked at 38 IPOs of investment banks in the period from 1970 to 1987. This result implies that the principal-agent theory cannot fully explain underpricing.

To sum up, all the theories based on asymmetric information state that the degree of underpricing is positively correlated to the degree of asymmetric information (Ritter & Welch, 2002). However, the theories differ in the kinds of asymmetric information. Much evidence has been found that both supports and disputes these different theories. Therefore it is very likely that underpricing can be explained by various asymmetric information theories, instead of one universal theory.

2.2.2 Institutional theories

There are also theories based on symmetric information that can explain IPO underpricing. For example, the literature discusses many institutional theories. The three main institutional-based theories are explained below.

Firstly, the lawsuit avoidance theory states that issuers deliberately underprice their shares to avoid possible litigation risk by disappointed investors. This litigation risk means that investors who are disappointed by the post-IPO performance of a firm can sue the firm, resulting in both direct and indirect costs for the firm, such as legal fees and reputational damages (Ibbotson, 1975; Logue, 1973). A study by Lowry & Shu (2002) shows that in the US, firms with higher litigation risk indeed underprice their shares more severely. They studied this by running an OLS regression of litigation risk on underpricing, using a total of 1841 US IPOs between 1988 and 1995. However, it is often argued in the literature that this theory is typical for US underpricing and not for underpricing in general. In fact, a study by Jenkinson (1990) shows that there is no significant effect of litigation risk on underpricing in the UK.

Secondly, the price stabilization theory states that underwriters offer price support services in order to stabilize the post-IPO price of the shares. These services mean that underwriters buy shares in the secondary market in order to avoid big drops in the share prices in the first few days after the IPO (Booth & Smith, 1986). The problem with this theory is that it is very hard to test empirically, since it cannot be observed by investors which firms receive this price support and to what degree they receive this support (Jenkinson & Ljungqvist, 2001).

Lasty, there is the tax argument. This theory is based on the trade-off between tax benefits and IPO underpricing (Jamaani & Alidarous, 2019). Rydqvist (1997) has empirically tested this trade-off between tax benefits and IPO underpricing by examining 251 IPOs on the Swedish market. Before 1990, the employment income taxes were higher than taxes on capital gains in Sweden, which motivated managers to pay their employees by means of appreciating assets instead of wages. Underpriced shares are an example of such appreciating assets. As soon as the tax system changed in 1990, which increased the tax rate on such capital gains, the degree of underpricing dropped in Sweden: from 41% in 1980-1989 to 8% in 1990-1994. This is strong evidence for this tax argument.

On the contrary, there is evidence of high degrees of underpricing in tax-free countries (Uddin & Raj, 2012). This implies that this theory can at least not fully explain IPO underpricing.

2.2.3 Ownership and control theories

The first of two 'ownership and control theories' is the entrenchment of managerial control hypothesis. This theory states that owners or managers of firms use IPO underpricing as a tool to ensure that their control over the firm is maximized. This works as follows: when shares are underpriced, excess demand for the shares is created on the market. As a result, the ownership of the firm is very fragmented. Because of this high ownership fragmentation, external monitoring by all these small investors is reduced. This enables the managers or initial owners of the firm to exert a great level of control over the management of the firm. They can then use this control for their own private benefits (Shleifer & Vishny, 1989). Brennan & Franks (1997) have examined 69 IPOs from 1986-1989 on the UK market and found that there is indeed a significant relationship between the degree of underpricing and the oversubscription of shares. This implies that underpricing is indeed used to ensure excess demand and rationing in the share allocation to prevent investors from getting too much control over the firm.

The other theory in this category is the agency costs hypothesis. The prediction of this theory is the exact opposite of the previous one. The agency cost hypothesis proposes that there is a agency problem between the shareholders and mangers due to the separation of ownership and control. As an effect, the initial owners of IPO firms will underprice the shares in order to attract large investors who will monitor the managers, thereby minimizing the agency problems between managers and shareholders. As a result, agency costs are minimized and post-IPO value of the firm is maximized (Stoughton & Zechner, 1998). Evenhough this theory may sound valid, no supporting evidence has yet been found of the relation between underpricing and post-IPO shareholding (Field & Sheehan, 2004).

2.2.4 Behavioural theories

Lastly, many scholars argue that behavioural explanations should be taken into account when trying to explain IPO underpricing. The main argument for these explanations is that there are irrational investors on the market who bid up the prices of shares beyond their true value (Jamaani & Alidarous, 2019).

For example, Welch (1992) has come up with a model where investors bid sequentially. So if an investor sees some successful sales by other investors, this investor will make the same investment regardless of their own information or beliefs. If however an investor sees some unsuccessful sales by other investors, this investor will refrain from making the investment, even though they believe it could be a good investment. This leads to a snowball-effect, where demand for shares is either low or high. As a result, early investors can demand underpricing, which commits them to buying the shares and thereby initiating the positive snowball effect.

To conclude, there are many theories in the literature that can explain IPO underpricing. Most of these theories are based on the assumption of information asymmetry, but not all of them are based on this assumption. Much empirical evidence has been found already that both supports and questions these theories. Therefore it is likely that most of these theories are only one part of the puzzle that can explain IPO underpricing, which results in a full puzzle when all of these theories are combined.

2.3 Venture capital involvement

2.3.1 Venture capital funds

Venture Capitalists (VCs) are a form of private equity, which means that the investors have invested their money in a private company and cannot trade the investment on the public market. Within this private equity market, VCs mainly invest in young companies with a high growth potential. VCs act as a financial intermediary with three main functions: (1) screening potential investments, (2) closely monitoring these companies and providing services to them and (3) exiting their investment (by means of an IPO for example). In the screening stage, VCs may screen hundreds of firms to find the firms with the highest growth potential. In the monitoring stage, VCs closely work together with the firm through board meetings, recruiting and any other advice. This provides the VC with the opportunity to add value to the company in order to make the investment successful. The final stage is then to exit the company by selling the stakes (Metrick & Yasuda, 2011).

A VC can be seen as a financial intermediary, because it is structured as a limited partnership. In this partnership, the venture capital acts as the General Partner (GP) and the (institutional) investors act as the limited partners (LP). The GP invests the money of the LPs in all kinds of entrepreneurial companies. If the investments went well, the GP can sell the stakes in the companies and the profits are returned to the LPs. Often, the compensation for the GP is structured in such a way as to incentivize the GP to maximize the financial returns. For example, the LPs can agree to give the GP 20% of the realized profits, which is called the 'carried interest'. As a result, the agency problems are tackled and incentives are aligned between LPs and GPs (Metrick & Yasuda, 2011).

Besides the agency problems between LPs and GPs, there may also be agency problems between the VC and the firm due to information asymmetry. Scholars have identified multiple solutions how VCs deal with this problem in practice, such as contracting and staging (Gompers, 1995). With contacting, the information asymmetry is reduced because the contract can force the firm to send inside information about the firms performance to the VC on a regular basis. This enables the VC to better monitor the firm (Gompers & Lerner, 1996). Moreover, staging allows the VC to reevaluate the investment at multiple moments in time, which reduces the risk for the VC. This allows VCs to gather information and better monitor the progress of the firm, while maintaining the option to abandon in case of poor progress. Usually VCs use this staging to invest increasing amounts of money in the firm as time progresses (Gompers, 1995). As a result of this contracting and staging, we can assume that

VCs hold valuable information about their companies. Most other market participations do not have access to this kind of information.

2.3.2 Effect of VC involvement on underpricing: theoretical discussion

Now that we know how VCs exactly operate and what theories can explain IPO underpricing, we can try to understand how VC involvement affects the degree of IPO underpricing. In order to do so, I will first provide a theoretical discussion on how VCs affect underpricing. Then I will provide an empirical discussion of previous research on this topic. On basis of these two discussions, I will formulate my hypothesis for this research.

Most research attributes the effect of VC involvement on underpricing to the certification theory. For example, Gompers (1994) argued that VCs have a reputation to maintain because they are involved in IPO's all the time. Therefore they do not want to be associated with IPO failures, because it can negatively affect their chances of a successful IPO in the future. As a consequence, investors are certified of the quality of the shares due to this 'third-party guarantee'. Moreover, Barry et al. (1990) argued that VCs have more specific information about the firms performance and opportunities than the investors. VCs have access to this kind of information due to contracting and close monitoring for example. Investors will rely on VCs to provide this information about the firm, which again functions as a third-party guarantee of the quality of the shares. As a result, underpricing is less severe.

Secondly, the signalling theory plays less of a role in case of VC involvement. As argued by Megginson & Weiss (1997), investors deem VC-backed IPO's as less risky than non-VC-backed IPO's. This can be explained by the fact that VCs use screening, close monitoring and staging to find the high-quality firms. As a result, firms do not have to underprice their shares to signal high quality.

Lastly, the GPs of a VC have an incentive to sell their stakes in the firm at the highest possible price due to the carried interest that they can earn. The way of selling their stakes is by means of an IPO. This means that VCs have no interest in underpricing the shares, because their income is directly linked to the price of the shares.

To conclude, VCs reduce information asymmetry between investors and firms because of their certifying role of the quality of the firm. This certifying role can explained by the fact that VCs have a reputation to maintain and have access to more information about the firm than other market participants. So according to the literature, underpricing should be less severe for VC-backed IPO's compared to non-VC-backed IPO's.

2.3.3 Effect of VC involvement on underpricing: empirical discussion

Many scholars have empirically investigated what the effect is of VC involvement on IPO underpricing. I will solely discuss the literature about the UK IPO market, since results differ across countries due to the maturity of capital markets for example. In fact, results even contradict each other due to differences in geographical area (Tanda & Manzi, 2020).

Belghitar & Dixon (2012) show that in the UK from 1992-1996, venture capitalists negatively affected the degree of underpricing of an IPO. They used a sample of 546 IPO's from the London Stock Exchange (LSE) and ran an OLS regression. Underpricing was used as dependent variable and a dummy variable that takes value 1 if the IPO was VC-backed was used as independent variable. Coakley et al. (2009) did a similar study and came to the same conclusion. They used a sample of 591 IPO's from the LSE between 1985-2003. Interestingly, VC involvement had no significant effect on IPO underpricing from 1998-2000. This implies that in times of economic recession (the bubble years), VCs do not affect the degree of underpricing in the UK.

Eventhough results of different studies about the effect of VC involvement on underpricing are ambiguous, the two studies from the UK share the same conclusion: VC involvement reduces IPO underpricing. This is in line with the certification hypothesis, which states that VCs function as a third-party-guarantee for investors with respect to the quality of the firm. Based on this theoretical and empirical literature, I expect to find the following result in my research with a more recent dataset:

Hypothesis 1: Venture capital funds reduce the degree of IPO underpricing in the UK.

2.4 Impact Fund involvement

Impact funds are funds that make investments with measurable social impact, while still offering the potential for financial return on the investment (Clarkin & Cangioni, 2016). The effect of impact funds on IPO underpricing has not been studied yet. However, the average returns of impact funds have been studied: these returns are on average lower for impact funds than for traditional funds (Barber et al., 2021). This might imply that the certification theory does not hold for impact funds, since investors are not certified of the quality of the firm in terms of financial returns.

Eventhough the specific effect of impact funds on IPO underpricing has not been studied, the effect of ESG factors on IPO underpricing has been studied. For example, a study by Ferri et al. (2023) has explored the effect of publishing a sustainability report before an IPO on the underpricing of the IPO, using a sample of 100 European IPOs from 2017-2021. The results show that publishing such a report reduces the degree of underpricing. Another study by Fenili & Raimondo (2021) shows that higher levels of ESG disclosure in the prospectus results in lower IPO underpricing, using a sample of 783 IPOs in the US. Both studies indicate that investors perceive companies that follow ESG standards to be less risky. Since impact funds can certify that companies follow ESG standards, IPOs that are backed by impacts funds are likely to be perceived as less risky by investors as well.

Despite the fact that the returns of impact funds are on average lower than the returns of the traditional funds, impacts funds do have a certifying role with respect to the ESG practices of a company. For that reason, investors are likely to perceive these companies as less risky. Therefore, I expect to find the following result in my research:

Hypothesis 2: Impact investment funds reduce the degree of IPO underpricing in the UK.

2.5 Other factors affecting underpricing

To tackle the issue of endogeneity, control variables are used. All these controls are variables that may affect both the level of underpricing and whether the IPO was backed by a VC/Impact Fund or not. For that reason, omitting these control variables would lead to an omitted variable bias. These controls can be divided into two different categories: firm- and economy-specific factors. I will now explain the variables in these categories in more detail.

2.5.1 Firm-specific factors

Firstly, the variable *age* is added to the model to account for the effect of information asymmetry (Belghitar & Dixon, 2012). Prior studies have found evidence that younger firms exhibit larger underpricing (Carter et al., 1998). This could be in line with the ex-ante uncertainty hypothesis, because investors might face more information asymmetry when investing in a relatively young firm. Moreover, *age* and whether a company is backed by an (impact) VC fund are likely to be correlated, because Venture Capitalists invest in young companies. To sum up, we expect the effect of age on underpricing to be negative.

For the same reason concerning information asymmetry, *size* is added to the model. *Size* is measured as the market capitalization of the company (Belghitar & Dixon, 2012). Prior studies have shown that smaller firms exhibit greater ex-ante uncertainty and may therefore experience greater underpricing (Ritter, 1991). Furthermore, *size* and whether an IPO was backed by an (impact) VC fund are likely to be positively correlated, because companies that were backed by a VC have received substantial (financial) support from that VC before the IPO, which allowed them to grow more rapidly than non-VC-backed companies. In conclusion, we expect the effect of size on underpricing to be negative.

The last variable in this category is *industry*. This control is added, because some industries might face more severe levels of underpricing due to higher levels of uncertainty in that industry as a whole for example. In fact, a previous study has found that IPO's in industries with high expected skewness, such as the technology industry, show higher underpricing. This can be explained by higher demand and more perceived growth potential (Cho & Kim, 2023). Moreover, *industry* and whether an IPO was backed by an (impact) VC fund might be correlated, because some industries attract more investors and VCs than others. To conclude, we expect the effect of a certain industry on the degree of underpricing to differ per industry.

2.5.2 Economy-specific factors

The first variable in this category is the *market return*. The *market return* is a proxy for the market sentiment at time of the IPO (Belghitar & Dixon, 2012). This control variable is added to the model because of the theory of market timing. This theory states that in 'hot' market periods (when average returns are high for example) many IPO's take place compared to the 'cold' market periods (Katti & B V, 2016). In fact, prior studies have found evidence that underpricing is more severe during these 'hot'

market periods (Ritter, 1984). Since VCs and Impact Funds have a financial incentive to sell the IPO shares at the highest possible price, *market return* and whether an IPO is backed by an (impact) VC fund are likely to be correlated as well. To sum up, we expect the effect of market return on underpricing to be positive.

The other variable in this category is *market volatility*. This is another proxy for market sentiment, that accounts for the effect of the market timing theory (Belghitar & Dixon, 2012). Therefore, the expectation is that the effect of *market volatility* on underpricing is positive as well.

CHAPTER 3 Data

3.1 Sample description

Most of the data that is used in the analysis is gathered from LSEG Workspace. LSEG Workspace is a financial database that provides real-time market data for finance professionals, that has been developed by the London Stock Exchange Group (LSEG). In order to get the right IPO data, I first filtered on all IPO's on the London Stock Exchange. Moreover, I filtered that the IPO had to have taken place between 2007-2023. After this, I filtered on live IPO's in order to remove the cancelled IPO's for example. This initial sample consisted of 737 IPO's. Next, all the IPO's with missing data (about share prices or IPO dates for example) were deleted. To check whether a VC fund can be considered an Impact Fund, dealroom.co has been used. Lastly, data about FTSE100 returns and variance was gathered from YahooFinance. The final sample consists of 557 observations.

3.2 Variables

As dependent variable, *underpricing* is used. *Underpricing* refers to the percentage change from the initial price that investors paid for the IPO shares to the closing price of these shares on the first trading day. It is calculated by the formula below.

$$Underpricing = \frac{P_{closing} - P_{IPO}}{P_{IPO}}$$

In this formula, $P_{closing}$ refers to the closing price of the shares on the first trading day and P_{IPO} refers to the initial price that investors paid for the shares. The data about these share prices is retrieved from LSEG workspace.

As independent variable, *VC-backed* is used. This is a dummy variable that takes value 1 if the IPO was backed by a Venture Capitalist and takes value 0 if the IPO was not backed by a Venture Capitalist. This data was directly retrieved from LSEG workspace as well.

In the second regression model, *ImpactFund* is used as independent variable. This is a dummy variable that takes value 1 if the IPO was backed by an Impact Fund and zero otherwise. In order to be categorized as Impact Fund, the following criteria had to be met: The self-reported 'mission statement' of the investor is about impact investing, the investor has a specific fund for climate tech, social impact or diversity and inclusion and the fund has invested in multiple impact companies. The names of the VC funds were directly retrieved from LSEG Workspace and in order to check whether a VC fund had met these criteria, dealroom.co has been used.

3.3 Control variables

3.3.1 Firm-specific factors

The first control variable that has been used is *age*. This variable aims to measure the age of the company. *Age* is defined as the natural logarithm of the difference in days between the date of the IPO

and the founding date of the company. These dates have been retrieved from LSEG workspace. I have used the natural logarithm to account for the high standard deviation due to outliers.

The second control variable, *size,* aims to measure the size of the company. *Size* is measured by multiplying the number of shares outstanding by the initial price of the IPO shares, and taking the natural logarithm of that number This data is again gathered from LSEG Workspace. I have taken the natural logarithm for the same reason as with *age*: in order to treat the outliers better.

The last variable in this category is *industry.* This variable consists of 12 dummy variables that take the value 1 if the firm is active in that industry and 0 otherwise. The information about these different industries is gathered from LSEG workspace. The following 13 industries have been identified in the model: Utilities, Technology, Real Estate, Institutions, Industrials, Healthcare, Government activity, Financials, Energy, Consumer Non-Cyclicals, Consumer Cyclicals, Basic Materials and Academic & Educational Services.

3.3.2 Economy-specific factors

Market return is a control variable that is used as proxy for the market sentiment at time of the IPO. *Market return* corresponds to the monthly return on the Financial Times Stock Exchange (FTSE) all share index in the month that the IPO took place. The monthly data about the share prices of this index is gathered from YahooFinance. This data is then used to calculate the monthly return.

The other variable in this category that is used as proxy for market sentiment is *market volatility*. *Market volatility* is measured by calculating the standard deviation of the FTSE all share index on the 60 days prior to the IPO date. This data is again gathered from YahooFinance. The standard deviation is calculated by using the daily prices of the index on all 60 days prior to the month that the IPO took place.

3.4 Descriptive statistics

In Table 1 below, descriptive statistics about all variables in the model are shown. The first thing that's interesting about this, is that only 6.3% of the IPO's in the sample was VC-backed. This corresponds to 36 IPO's. Secondly, we can see that only 0.4% of the IPO's in the sample were backed by an Impact Fund. This means that from the 36 VC-backed IPO's, only 2 of them were backed by an Impact Fund. Thirdly, we see that on average underpricing indeed takes place on the UK IPO market, with an average underpricing of 11.33%. However, the level of underpricing differs greatly in the sample from -84.5% to 270%. A fourth interesting thing to notice is that the values of both *Age* and *Size* are difficult to interpret, because both variables are natural logarithms. This transformation has been performed in order to deal with the outliers in the age and size of companies. Fifthly, we see that the Financials sector is by far the biggest sector in the sample: 26.1% of IPO's in the sample took place in the Financials sector. Besides this sector, the Technology, Industrials and Consumer Cyclicals are quite large in the sample as well. All the other industries play a much smaller role. Lastly, the

number of observations of both *market return* and *market volatility* is lower than for the other variables. This can be explained by the fact that only data from 2007-2023 has been used. For January 2007, the historical prices in 2006 were not included in the dataset, so there is missing date with respect to these two variables in early 2007.

In Table 2, the descriptive statistics of underpricing are separately shown for the VC-backed and non-VC-backed IPO's. This shows that on average, the underpricing of VC-backed IPO's is 5.4% lower than for the non-VC-backed IPO's. This indicates that VCs might indeed have a negative effect on the level of underpricing of an IPO. This effect will be further analysed using the right statistical methods, which is explained in the next chapter.

Table 1: Descriptive statistics

Variable	Obs.	Avg.	Min.	Max.	Std.dev.
Underpricing (%)	568	11.327	-84.5	280	21.952
VC	568	0.063	0	1	0.244
ImpactFund	568	0.004	0	1	0.059
Size (Ln)	568	3.618	-3.511	8.099	1.855
Age (Ln)	568	7.522	2.398	10.653	1.639
Market Return (%)	565	0.182	-9.461	12.427	2.944
Market Volatility	554	74.026	29.076	183.807	31.123
Academic Services	568	0.004	0	1	0.059
Basic Materials	568	0.058	0	1	0.234
Consumer Cyclicals	568	0.169	0	1	0.375
Consumer Non-Cyclicals	568	0.037	0	1	0.189
Energy	568	0.046	0	1	0.209
Financials	568	0.261	0	1	0.434
Government Activity	568	0.005	0	1	0.073
Healthcare	568	0.081	0	1	0.273
Industrials	568	0.141	0	1	0.348
Institutions	568	0.002	0	1	0.042
Real Estate	568	0.040	0	1	0.197
Technology	568	0.146	0	1	0.353
Utilities	568	0.011	0	1	0.102

Note: The table above depicts the descriptive statistics of all variables of interest and control variables in the model. Of every variable, the number of observations, the average, the minimum value, the maximum value and the standard deviation is depicted.

Table 2: Descriptive statistics of Underpricing for VC-backed and non-VC-backed IPO's

	VC-backed					Non-VC-backed				
Variable	**Obs.**	**Avg.**	**Min.**	**Max.**	**Std.dev.**	**Obs.**	**Avg.**	**Min.**	**Max.**	**Std.dev.**
Under-pricing	36	6.29	-26.28	33.43	11.01	532	11.67	-84.5	280	22.47

Note: In the table above, the descriptive statistics of the underpricing variable are separately shown for the group of IPO's that were VC-backed and the group of IPO's that were non-VC-backed. For both groups, the number of observations, average, minimum value, maximum value and standard deviation is depicted.

CHAPTER 4 Method

4.1 Method first hypothesis

In order to check my first hypothesis, an OLS regression is used with *underpricing* as dependent variable and *VC* as independent variable. The software package STATA was used to perform this regression analysis. The complete formula of the regression is depicted below:

$$(1)\ Underpricing_i = \beta_0 + \beta_1\, VC_i + \beta_2\, \boldsymbol{Control\ Variables} + \epsilon_i$$

In this formula, $Underpricing_i$ refers to the degree of underpricing (in %) for each company i in the sample. VC_i is a dummy variable that takes value 1 for each individual company i if the company's IPO was VC-backed, and 0 otherwise. **Control Variables** refer to the previously mentioned firm-specific and market-specific control variables. Lastly, β_0 is the constant and ϵ_i is the error term for each company i in the sample. This error terms captures all the variance in the degree of underpricing of a company's IPO that cannot be explained by the variables in the model.

The OLS regression will lead to a predictor for the effect of VC involvement on the degree of underpricing, by minimizing the sum of squared residuals between the predicted and actual value. In order to conclude whether this effect holds in real-life or only in the sample, a two-sided t-test is conducted. This t-test checks whether the null hypothesis that the coefficient of *VC* is equal to zero can be rejected at the 5% significance level. The closer the P-value of this coefficient is to zero, the more significant the effect is. Besides the t-test, we also look at the R-squared of the model. This R-squared shows how much of the variation in *underpricing* can be explained by the variables in the model. The closer the R-squared gets to 1, the better the model fits the actual data.

4.2 Method second hypothesis

In order to check my second hypothesis, STATA was used to run an OLS regression with *underpricing* as dependent variable and *ImpactFund* as independent variable. The complete formula of the regression is depicted below:

$$(2)\ Underpricing_i = \beta_0 + \beta_1\, ImpactFund_i + \beta_2\, \boldsymbol{Control\ Variables} + \epsilon_i$$

Formula 2 above is the exact same formula as formula 1, except for the independent variable. $ImpactFund_i$ is a dummy variable that takes value 1 for each individual company i if the company's IPO was backed by an Impact Fund, and 0 otherwise.

In order to conclude whether an Impact Fund affects the degree of IPO underpricing on the LSE, a two-sided t-test is conducted again. Besides this t-test, we will look at the R-squared of this model as well.

4.3 Assumptions of the models

Before we can draw any conclusions based on statistical tests of the model, the 5 OLS-assumptions of this model have to be met. These assumptions are explained and checked below.

The first assumption of the model states that the average value of the errors should be zero. This assumption is only relevant if you are interested in the constant of your model. Since we are not interested in the constant of our model, but only in the effect of VC involvement and Impact Fund involvement on IPO underpricing, this assumption is irrelevant for this model.

The second assumption is about homoskedasticity. Homoskedasticity means that the variance of the errors is constant across all levels of the independent variables. The White Test can be employed to check if this assumption holds. This test assesses whether the variance of the errors is related to the regressors. This is done by regressing the squared residuals of the initial regression on the initial regressors, their squares and cross-products. Then the test statistic, that follows a chi-squared distribution, is analysed. The null hypothesis of this test states that that there is homoskedasticity, and the alternative hypothesis refers to heteroskedasticity. Since the p-value of this test corresponding to the first formula equals 0.0083 and for the second formula 0.0084 , the null hypothesis can be rejected at the 5% significance level for both models. The exact results of this test can be found in Appendix A. This means the models suffer from heteroskedasticity. Even though the OLS estimators remain unbiased under heteroskedasticity, the standard errors are biased which results in incorrect statistical inferences. To account for this heteroskedasticity, robust (Huber-White) standard errors are used in the final model. These robust errors are increased relative to the usuals OLS standard errors, which results in more conservative hypothesis testing.

Another assumption that has to be met in order to prevent the errors to be biased, which could lead to incorrect statistical inferences, is that the errors should be uncorrelated. However, correlation of errors is very difficult to detect for a cross-sectional dataset. By adding controls to the model and using robust standard errors, I have tried to limit the possibility of correlated errors. Therefore, I assume that this assumption has been met as well.

The fourth assumption is that errors follow a normal distribution. This can be visually verified by looking at the histogram of the residuals. As displayed in appendix B, we can see that the robust errors approximately follow a normal distribution for both models. This assumption has thus been met.

Lastly, the zero conditional mean assumption has to bet. This is the most important assumption, since not meeting this assumption means that the OLS estimators are biased. This assumption is also known as the exogeneity assumption and means that the independent variable in the model cannot be correlated with the error term. In this case, it means that the *VC* and *ImpactFund* variable cannot be correlated with the error term. This assumption is not directly testable, so strong theoretical reasoning is needed to assume exogeneity. In this study, I have used various control variables in order to ensure

exogeneity. These controls are variables that one the one hand affect the degree of underpricing and on the other hand are correlated with *VC/ImpactFund.* The exact reasoning behind these controls has already been discussed in the theoretical framework. To sum up, adding these controls limits the chances of omitted variable bias and therefore ensures that the exogeneity assumption is met.

Apart from the general OLS assumptions, it is necessary to check whether the model suffers from multicollinearity. Multicollinearity means that several variables in a linear regression are significantly correlated to not only the dependent variable, but also each other. As an effect, significant variables in the analysis will be statistically insignificant (Shrestha, 2020). In order to check this, I have looked at the correlations between all variables in the analysis. This correlation matrix can be found appendix C. Generally, collinearity is likely to exist if the correlation coefficient reaches 0.8 (Young, 2018). Since all of our correlation coefficients are much smaller than 0.8, we can conclude that the model does not suffer from multicollinearity.

In conclusion, all 5 OLS assumptions have been met for both models and both models do not suffer from multicollinearity.

CHAPTER 5 Results & Discussion

5.1 Results & Discussion VC funds

The model was estimated using an Ordinary Least Squares Regression (with robust standard errors). This means that the coefficient of the independent and control variables should be interpreted as a linear effect. For example, the coefficient of *VC* shows the change in percentage underpricing when an IPO is VC-backed compared to non-VC-backed. The coefficient of *VC* is the effect that we are most interested in, in order to give an answer to hypothesis 1.

In table 3 below, the results of the 6 OLS regressions (with VC as independent variable) are outlined. The 6 models have been estimated using the Specific-to-General approach. This means that with every new model, a new control variable is added to the model and the effect of this variable is analysed. With every control variable that is added to the model, we can see that the coefficient of *VC* changes. This indicates that the control variables are indeed good controls and reduce omitted variable bias in the model. The most complete and thus final model is shown in column 6 of this table.

As shown in Table, the R-squared of the final model is 0.095, which means that 9.5% of the variance in the degree of underpricing can be explained by the variables that were included in the model. A model excluding all the relevant control variables yields an R-squared of 0.4%. Eventhough the final model thus yields a much larger R-squared than the most basic model, the R-squared is still pretty low. This indicates that there are many more variables that determine the degree of underpricing, which is in line with all the different theories that have been discussed before.

In all columns of Table 3, we test whether the *VC* coefficient is equal to zero. We can reject this null hypothesis in all columns, since the coefficient is different from zero at the 5% significance level and we assume that all the OLS-assumptions of the model hold. Since this coefficient is negative, we can conclude that on average the VC-backed IPO's face less severe underpricing than the non-VC-backed IPO's on the LSE. To be exact, in the sample the non-VC-backed IPO's faced on average 7.6% greater underpricing than the VC-backed IPO's. The lower bound of the 95% confidence interval of the VC effect equals -13.44 and the upper bound equals -1.68. Considering all the OLS assumptions hold, we can conclude with 95% certainty that the actual effect of VC involvement on the degree of underpricing is somewhere in between those two bounds. Based on these results, the first hypothesis that stated that VC involvement reduces the degree of underpricing on the UK IPO market, can be accepted. This finding is similar to previous studies that studied a comparable context, such as Belghitar & Dixon (2012) and Coakley et al. (2009).

The effect of the control variable *size* on *underpricing* is negative, which is in line with the expectation. This effect is significant at the 1% level, so we can conclude that the size of a company reduces the degree of underpricing on the UK IPO market. To be more precise, it can be concluded that on average an 1% increase in the size of the company leads to a reduction in IPO underpricing of

0.027% in the sample. The effect of *age* on *underpricing* is positive, which is not in line with the expectation. However, this variable is not significant so we cannot draw any conclusions on the effect of age on underpricing.

With respect to the industry dummy variables, we see that adding those to the model leads to a big change in the coefficient of *VC*. Therefore, these variables are very important to reduce omitted variable bias. Only the coefficient of the *Healthcare* dummy is significant at the 5%-level, which shows that the level of underpricing is on average higher for companies that are active in the healthcare industry, compared to companies that are active in other industries in the UK. Since the other dummy variables are not significant, we cannot draw any conclusion about those industries.

With respect to *market return* and *market volatility*, we see that both coefficients are positive. This is in line with the expectation. However, both coefficients are not significant so we cannot draw a conclusion on the effect of market volatility or market returns on the degree of underpricing.

Table 3: Results OLS regression VC funds

	Underpricing (1)	**Underpricing (2)**	**Underpricing (3)**	**Underpricing (4)**	**Underpricing (5)**	**Underpricing (6)**
VC	-5.379***	-3.879**	-4.407**	-7.641**	-7.682***	-7.565***
	(2.058)	(1.924)	(1.934)	(3.030)	(3.020)	(2.994)
Size		-2.727***	-2.775***	-2.787***	-2.817***	-2.713***
		(0.527)	(0.534)	(0.574)	(0.578)	(0.594)
Age			0.332	0.094	0.118	0.262
			(0.507)	(0.555)	(0.553)	(0.543)
Academic Services				-0.936	-1.980	-1.258
				(4.120)	(4.339)	(4.657)
Basic Materials				2.742	2.369	1.756
				(5.182)	(5.450)	(5.999)
Consumer Cyclicals				4.848	4.859	4.973
				(4.287)	(4.531)	(4.929)
Consumer Non-Cyclicals				15.148	14.541	13.782
				(13.904)	(13.998)	(13.854)
Energy				-3.284	-2.909	-2.619
				(4.270)	(4.731)	(5.114)
Financials				2.459	2.642	2.475
				(4.081)	(4.330)	(4.745)
Government Activity				-5.873	-5.707	-6.615
				(5.157)	(4.886)	(5.979)
Healthcare				12.017**	12.223**	12.085**
				(6.051)	(6.236)	(6.415)
Industrials				4.078	4.032	4.093
				(4.123)	(4.382)	(4.797)
Institutions				-7.815*	-7.017	-5.497
				(4.564)	(4.780)	(5.111)
Real Estate				3.764	3.771	0.478
				(5.583)	(5.730)	(5.033)
Technology				1.960	2.078	2.056
				(4.067)	(4.327)	(4.742)
Market return					0.417*	0.390
					(0.253)	(0.257)
Market volatility						0.061
						(0.045)

Constant	11.668*** (0.975)	21.439*** (2.505)	19.127*** (4.347)	17.244*** (6.000)	17.010*** (6.154)	11.112 (7.155)
N	568	568	568	568	565	554
R^2	0.004	0.058	0.059	0.087	0.090	0.095

Note: The table above depicts the regression results, using OLS. In columns 1-6, *underpricing* (in %) is used as dependent variable and *VC* is used as independent variable. VC is a dummy variable that takes value 1 if the IPO was VC-backed and zero otherwise. In every column, a new control variable is added to the model. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

5.2 Results & Discussion Impact Funds

In table 4 below, the results of the 6 OLS regressions (with *ImpactFund* as independent variable) are outlined. This model has been estimated with the Specific-to-General method as well, using the exact same control variables as in the previous model. We are most interested in the coefficient of *ImpactFund* in order to answer the second hypothesis.

Again, we can see that with every control variable that is added to the model, the coefficient of *ImpactFund* changes. This indicates that the control variables are good controls and reduce omitted variable bias in the model. The most complete and thus final model is shown in column 6 of this table.

In all columns of Table 4, we test whether the *ImpactFund* coefficient is equal to zero. We can reject this null hypothesis in all columns, since the coefficient is different from zero at the 5% significance level and we assume that all the OLS-assumptions of the model hold. Since this coefficient is negative, we can conclude that on average the IPO's that were backed by an Impact Fund face less severe underpricing than the other IPO's on the LSE. To be exact, in the sample the IPO's that were backed by Impact Funds faced on average 24.39% less severe underpricing than the other IPO's. The lower bound of the 95% confidence interval of the *ImpactFund* effect equals -38.67 and the upper bound equals -10.11. Considering all the OLS assumptions hold, we can conclude with 95% certainty that the actual effect of Impact Fund involvement on the degree of underpricing is somewhere in between those two bounds. Based on these results, the second hypothesis that stated that Impact Fund involvement reduces the degree of underpricing on the UK IPO market, can be accepted. This finding is similar to previous studies that studied a slightly different relationship (between ESG reporting and IPO underpricing), such as Fenili & Raimondo (2021) and Ferri et al. (2023).

In the sample, the effect of Impact Funds on underpricing was greater than the effect of VC involvement on underpricing. However, we cannot generally conclude whether the effect of VC or Impact Fund involvement on underpricing is greater on the LSE, since there is overlap between the confidence intervals of the two models.

Since the exact same control variables have been used in this model, these coefficients will not be interpreted again. The sign and significance of these coefficients is very similar to the coefficients in the previous model.

Table 4: Results OLS regression Impact Funds

	Underpricing (1)	**Underpricing (2)**	**Underpricing (3)**	**Underpricing (4)**	**Underpricing (5)**	**Underpricing (6)**
ImpactFund	-21.823***	-16.801***	-16.944***	-22.560***	-23.433***	-24.391***
	(2.466)	(4.088)	(4.168)	(6.621)	(6.676)	(7.268)
Size		-2.732***	-2.776***	-2.808***	-2.838***	-2.732***
		(0.531)	(0.538)	(0.578)	(0.582)	(0.598)
Age			0.296	0.066	0.090	0.239
			(0.505)	(0.557)	(0.554)	(0.545)
Academic Services				-0.977	-2.054	-1.321
				(4.132)	(4.360)	(4.713)
Basic Materials				2.685	2.328	1.690
				(5.195)	(5.469)	(6.042)
Consumer Cyclicals				5.154	4.162	4.282
				(4.289)	(4.545)	(4.959)
Consumer Non-Cyclicals				14.778	14.186	13.459
				(13.938)	(14.029)	(13.891)
Energy				-3.305	-2.916	-2.611
				(4.483)	(4.755)	(5.160)
Financials				2.337	2.567	2.397
				(4.097)	(4.355)	(4.793)
Government Activity				-5.903	-5.729	-6.671
				(5.184)	(4.908)	(5.874)
Healthcare				10.176*	10.381*	10.934*
				(5.829)	(6.021)	(6.285)
Industrials				3.977	3.939	3.965
				(4.131)	(4.399)	(4.837)
Institutions				-7.917*	-7.085	-5.508
				(4.589)	(4.811)	(5.154)
Real Estate				3.739	3.684	0.489
				(5.591)	(5.744)	(5.079)
Technology				1.308	1.428	1.417
				(4.068)	(4.338)	(4.777)
Market return					0.431*	0.409
					(0.252)	(0.256)
Market volatility						0.063
						(0.045)

Constant	11.404***	21.271***	19.201***	17.521***	17.298***	11.194
	(0.923)	(2.496)	(4.357)	(6.023)	(6.181)	(7.185)
N	568	568	568	568	565	554
R^2	0.004	0.058	0.084	0.084	0.087	0.093

Note: The table above depicts the regression results, using OLS. In columns 1-6, *underpricing* (in %) is used as dependent variable and *ImpactFund* is used as independent variable. *ImpactFund* is a dummy variable that takes value 1 if the IPO was backed by an impact fund and zero otherwise. In every column, a new control variable is added to the model. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

5.3 Robustness checks

The effect of VC/Impact Fund involvement on underpricing is significant at the 5%-level for all 6 model specifications, which is an indication that both OLS regressions are quite robust. In order to further test the robustness of these 2 models, I have estimated the model on different subsets of the data by chronologically dividing the data in 3 subsets (of approximately 5 years per subset). The results of these robustness tests are in appendix D and these indicate that the results are not robust. Both the coefficients of *VC* and *ImpactFund* are not significant anymore in the different subsets. However, this can probably be explained by the fact that *VC* and *ImpactFund* have a relatively low amount of observations.

Furthermore, I have identified and removed influential observations (those with very high Cook's distance) and re-estimated the two models. The threshold for removing an observation was if the Cook's distance was greater than 4/N. This is a commonly used threshold in the literature for large sample sizes (Cook, 1977). For the first model (with *VC* as independent variable) this led to 31 dropped observations and for the second model (with *ImpactFund* as independent variable) this led to 27 dropped observations. The results of these re-estimated models are in appendix D and show that both *VC* and *ImpactFund* still have a significant negative effect on *underpricing.* This is evidence that my results remain robust.

CHAPTER 6 Limitations

The primary limitation of this study is the likelihood of omitted variable bias in the models, which can lead to endogeneity. Numerous variables can influence both the degree of underpricing and the likelihood of a company being backed by a VC or impact fund. For instance, the reputation of a VC fund or the underwriter can play a significant role. However, accurately measuring this reputation poses a challenge. Additionally, data regarding underwriters was not accessible through the LSEG Workspace. Consequently, future research should focus on collecting comprehensive data on these control variables to reduce the likelihood of omitted variable bias.

Another limitation is the small number of IPOs in the sample that were backed by impact funds, with only two such cases. This limited sample size results in large standard errors and less precise estimates. Therefore, it would be beneficial to conduct a similar study in the future when more data on IPOs backed by impact funds becomes available.

Furthermore, there may have been measurement errors concerning the age of the companies. The dataset included several outliers with unrealistically low ages. Due to time constraints, a manual verification of the ages of all companies in the dataset was not feasible. Thus, the natural logarithm of the age variable was used. Assuming these measurement errors are random rather than systematic, their impact on the analysis should be minimal.

Lastly, regarding external validity, the findings of this study are not generalizable to all IPOs globally, as it focuses solely on the UK IPO market. Empirical studies on IPO underpricing often yield different results depending on the geographical area (Tanda & Manzi, 2020). Therefore, the conclusions of this study are applicable only to the UK IPO market.

In conclusion, future research could re-examine the effect of VC and impact fund involvement on IPO underpricing when more data is available, explore this relationship in different geographical contexts, and include additional control variables to mitigate the risk of endogeneity in the models.

CHAPTER 7 Conclusion

In this thesis, I have examined the influence of venture capital (VC) and impact fund involvement on IPO underpricing in the UK. Existing research indicates that numerous factors contribute to the underpricing of IPOs. Notably, prior studies have demonstrated that VC involvement tends to reduce IPO underpricing in the UK. However, these studies are somewhat dated. To determine whether this conclusion still holds amidst varying economic conditions, such as the COVID-19 pandemic and the financial crisis, I analyzed a more recent dataset spanning from 2007 to 2023. Until now, no research has explored the effect of involvement of impact funds on IPO underpricing. Given the recent rise in existence of these funds, I found it pertinent to investigate this relationship as well. Understanding both relationships is crucial for investors, companies, and governments, as it aids in better assessing IPO risks and regulating the IPO market. Therefore, this thesis addresses the following research question: "How does the involvement of venture capital funds and impact funds affect the underpricing of IPOs in the UK?"

To answer this question, I utilized a dataset comprising 568 IPOs on the London Stock Exchange (LSE) between 2007 and 2023. I conducted two cross-sectional linear regression analyses (OLS), with underpricing as the dependent variable and VC and impact fund involvement as the independent variables. To mitigate omitted variable bias, relevant control variables were incorporated into the models. The results indicated that both VC and impact fund involvement significantly reduce IPO underpricing. Nevertheless, the R-squared values of both models were relatively low, reflecting the large number of theories in the literature that explain IPO underpricing.

This study concludes that both VC and impact fund involvement negatively influence IPO underpricing in the UK. When combined with previous research findings and theoretical discussions, this suggests that investors perceive IPOs backed by VC or impact funds as relatively low risk, given that these funds certify the economic value of the company. This insight is valuable for all stakeholders seeking to comprehend IPO pricing. However, it is important to recognize that this is only one aspect of a multifaceted issue, as numerous factors contribute to IPO underpricing.

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Appendix A: White Test Results

Table 5: Results White Test model 1 (VC funds)

Source	Chi2	Df	P-value
Heteroskedasticity	107.34	75	0.0083
Skewness	32.92	17	0.0115
Kurtosis	1.80	1	0.1801
Total	142.15	93	0.0008

Table 6: Results White Test model 2 (Impact funds)

Source	Chi2	Df	P-value
Heteroskedasticity	97.81	67	0.0084
Skewness	32.64	17	0.0125
Kurtosis	1.81	1	0.1784
Total	132.26	85	0.0008

Appendix B: Histogram residuals

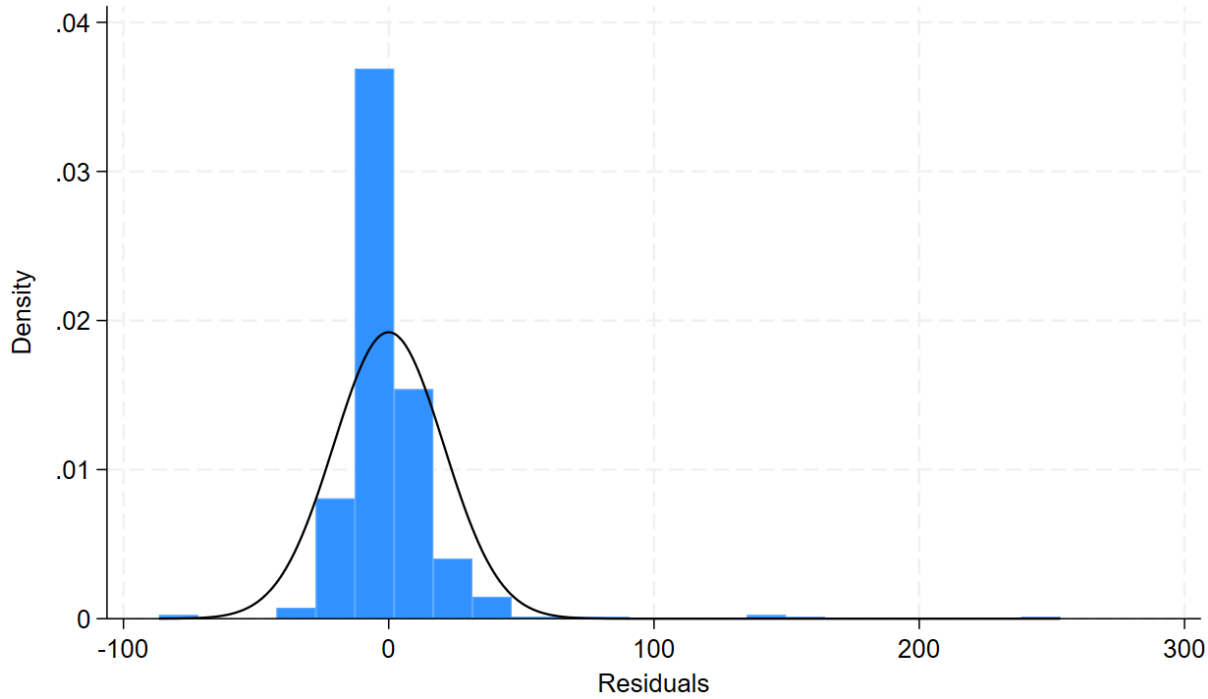

Figure 1 histogram residuals model 1

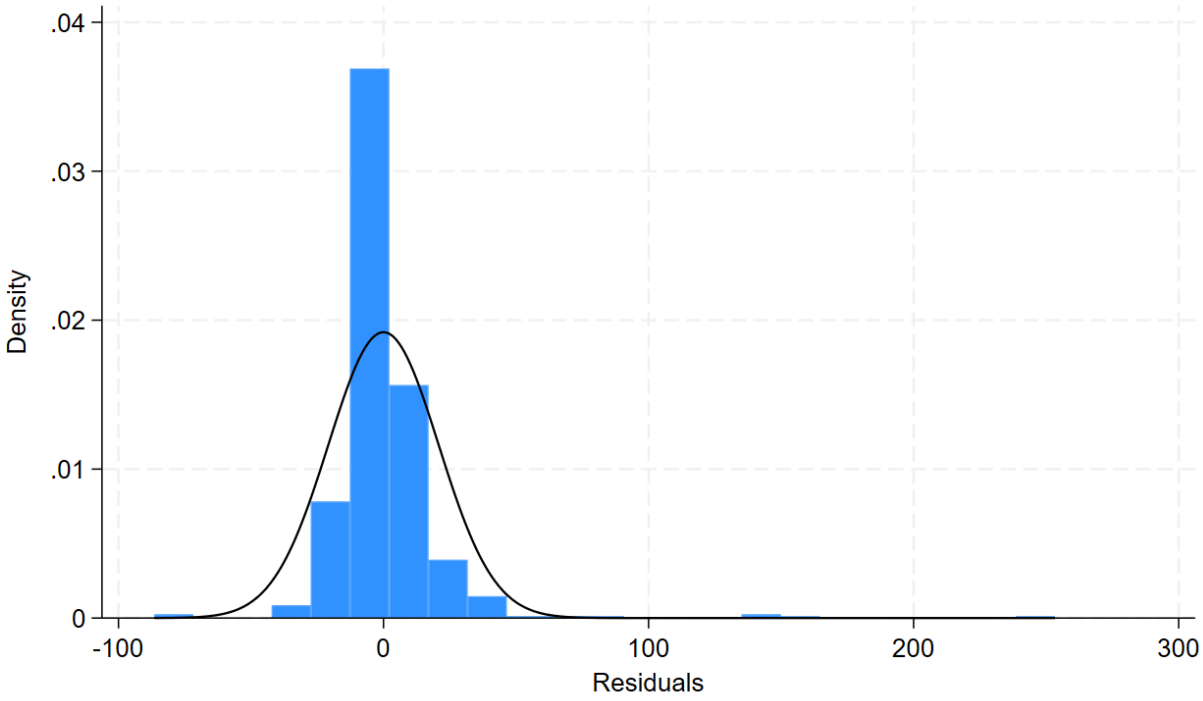

Figure 2 histogram residuals model 2

Appendix C: Correlation Matrix

Table 7: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) underpricing	1.00																		
(2) VC	-0.06	1.00																	
(3) ImpactFund	-0.06	0.23	1.00																
(4) size	-0.24	0.07	0.06	1.00															
(5) age	-0.02	0.09	0.03	0.17	1.00														
(6) industry_1	-0.01	-0.02	0.00	-0.02	-0.02	1.00													
(7) industry_2	0.02	-0.06	-0.01	-0.13	-0.05	-0.01	1.00												
(8) industry_3	-0.02	0.06	-0.03	0.14	0.21	-0.03	-0.11	1.00											
(9) industry_4	0.09	0.10	0.15	0.00	0.09	-0.01	-0.05	-0.09	1.00										
(10) industry_5	-0.06	-0.06	-0.01	-0.02	-0.04	-0.01	-0.05	-0.10	-0.04	1.00									
(11) industry_6	-0.03	-0.14	-0.04	0.01	-0.26	-0.04	-0.15	-0.27	-0.12	-0.13	1.00								
(12) industry_7	-0.02	-0.02	0.00	-0.06	0.02	0.00	-0.02	-0.03	-0.01	-0.02	-0.04	1.00							
(13) industry_8	0.10	0.21	-0.02	-0.03	0.00	-0.02	-0.07	-0.13	-0.06	-0.07	-0.18	-0.02	1.00						
(14) industry_9	0.00	-0.02	0.06	0.01	0.08	-0.02	-0.10	-0.18	-0.08	-0.09	-0.24	-0.03	-0.12	1.00					
(15) industry_10	0.00	-0.01	0.00	-0.08	-0.02	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	0.00	-0.01	-0.02	1.00				
(16) industry_11	0.00	-0.05	-0.01	0.02	-0.09	-0.01	-0.05	-0.09	-0.04	-0.04	-0.12	-0.01	-0.06	-0.08	-0.01	1.00			
(17) industry_12	-0.03	0.04	-0.02	-0.05	0.07	-0.02	-0.10	-0.19	-0.08	-0.09	-0.25	-0.03	-0.12	-0.17	-0.02	-0.08	1.00		
(18) Market return	0.05	0.02	0.06	0.05	0.01	0.05	0.04	0.02	0.11	-0.06	-0.05	-0.01	-0.03	0.02	-0.03	0.02	-0.02	1.00	
(19) Market volatility	0.10	-0.01	0.03	0.00	-0.02	-0.02	0.07	-0.06	0.06	-0.02	0.05	0.04	0.02	-0.03	-0.03	-0.08	-0.01	0.01	1.00

Note: This table depicts the correlation coefficients between all variables in both models. None of the correlation coefficients exceed 0.8, so there is no multicollinearity.

Appendix D: Robustness checks

Table 8: Robust regression results VC funds

	(1) Underpricing (2007-2011)	(2) Underpricing (2012-2017)	(3) Underpricing (2018-2023)
VC	3.77	-1.94	-13.77*
	(2.91)	(3.41)	(7.08)
Size	-3.74**	-3.27***	-1.90***
	(1.58)	(1.22)	(0.66)
Age	1.07	-0.12	0.93
	(1.45)	(0.73)	(0.84)
Academic & Educational Services	-2.55	3.69	0.00
	(7.80)	(7.40)	(.)
Basic Materials	-3.71	17.83**	1.39
	(9.27)	(8.73)	(7.61)
Consumer Cyclicals	4.46	9.00	4.17
	(11.01)	(7.33)	(2.82)
Consumer Non-Cyclicals	-21.49**	11.04	46.01
	(9.79)	(7.96)	(41.62)
Energy	2.10	-1.14	-11.41*
	(7.74)	(7.83)	(6.28)
Financials	-4.06	10.75	3.56
	(8.49)	(8.83)	(3.62)
Government Activity	0.00	-5.01	-3.78
	(.)	(7.13)	(6.19)
Healthcare	-6.90	9.04	32.62***
	(8.52)	(8.08)	(10.87)
Industrials	1.48	8.57	4.89
	(7.89)	(8.10)	(3.00)
Institutions, Associations & Organizations	0.00	0.00	-1.09
	(.)	(.)	(4.28)
Real Estate	-7.17	7.33	-0.42
	(9.13)	(8.00)	(5.32)
Technology	-5.46	6.99	3.53
	(8.35)	(7.32)	(3.65)
Market return	1.01*	-0.11	0.30
	(0.56)	(0.52)	(0.38)
Market volatility	-0.03	0.04	0.09
	(0.09)	(0.05)	(0.06)
Constant	18.28	12.24	0.53
	(14.94)	(9.39)	(8.89)
N	120	221	215
R^2	0.17	0.14	0.21
Adjusted R^2	0.05	0.08	0.15

Note: The table above depicts the regression results, using OLS. In columns 1-3, *underpricing* (in %) is used as dependent variable and *VC* is used as independent variable.*VC* is a dummy variable that takes value 1 if the IPO was backed by an VC and zero otherwise. In column 1 only the IPO's from 2007-2011 have been used, in column 2 the IPOs from 2012-2017 and column 3 the IPOs from 2018-2023. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Robust regression results Impact Funds

	(1) Underpricing (2007-2011)	(2) Underpricing (2012-2017)	(3) Underpricing (2018-2023)
ImpactFund	11.89	-21.01***	0.00
	(7.66)	(4.23)	(.)
Size	-3.73**	-3.25***	-1.97***
	(1.59)	(1.21)	(0.67)
Age	1.07	-0.12	0.80
	(1.45)	(0.73)	(0.85)
Academic & Educational Services	-2.38	3.54	0.00
	(7.68)	(7.32)	(.)
Basic Materials	-3.71	17.87**	1.09
	(9.16)	(8.65)	(7.56)
Consumer Cyclicals	4.86	8.84	2.46
	(10.79)	(7.23)	(2.92)
Consumer Non-Cyclicals	-24.05**	10.69	43.37
	(10.23)	(7.89)	(41.23)
Energy	1.98	-1.18	-11.60*
	(7.62)	(7.74)	(6.25)
Financials	-4.14	10.73	2.96
	(8.38)	(8.76)	(3.63)
Government Activity	0.00	-4.90	-4.10
	(.)	(7.04)	(6.65)
Healthcare	-5.07	8.61	31.30***
	(8.09)	(7.87)	(11.05)
Industrials	1.94	9.19	4.29
	(7.74)	(8.05)	(2.97)
Institutions, Associations & Organizations	0.00	0.00	-1.77
	(.)	(.)	(4.31)
Real Estate	-7.24	7.23	-0.55
	(9.02)	(7.92)	(5.38)
Technology	-5.26	6.84	1.66
	(8.23)	(7.22)	(3.57)
Market Return	0.98*	-0.11	0.19
	(0.56)	(0.52)	(0.37)
Market Volatility	-0.04	0.04	0.09
	(0.10)	(0.05)	(0.06)
Constant	18.63	12.43	1.64
	(15.09)	(9.33)	(8.84)
N	120	221	215
R^2	0.17	0.15	0.20
Adjusted R^2	0.05	0.08	0.14

Note: The table above depicts the regression results, using OLS. In columns 1-3, *underpricing* (in %) is used as dependent variable and *ImpactFund* is used as independent variable. *ImpactFund* is a dummy variable that takes value 1 if the IPO was backed by an Impact Fund and zero otherwise. In column 1 only the IPO's from 2007-2011 have been used, in column 2 the IPOs from 2012-2017 and column 3 the IPOs from 2018-2023. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Regression Results VC funds after deleting most influential observations

	(1) **Underpricing**
VC	-3.44**
	(1.76)
Size	-1.40***
	(0.23)
Age	0.44*
	(0.27)
Academic & Educational Services	4.41
	(7.72)
Basic Materials	9.70**
	(4.56)
Consumer Cyclicals	6.15
	(4.25)
Consumer Non-Cyclicals	4.16
	(4.71)
Energy	3.09
	(4.59)
Financials	4.81
	(4.20)
Government Activity	-2.55
	(7.75)
Healthcare	7.59*
	(4.42)
Industrials	5.83
	(4.27)
Institutions, Associations & Organizations	2.74
	(10.14)
Real Estate	2.53
	(4.63)
Technology	5.92
	(4.26)
Market Return	0.21
	(0.14)
Market Volatility	0.02
	(0.01)
Constant	3.74
	(4.70)
N	511
R^2	0.12
Adjusted R^2	0.09

Note: The table above depicts the OLS regression results, after deleting the observations with high Cook's distance. *Underpricing* (in %) is used as dependent variable and *VC* is used as independent variable. *VC* is a dummy variable that takes value 1 if the IPO was backed by an VC and zero otherwise. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 11: Regression Results Impact Funds after deleting most influential observations

	(1) **Underpricing**
ImpactFund	-18.28**
	(8.45)
Size	-1.70***
	(0.28)
Age	0.29
	(0.33)
Academic & Educational Services	3.87
	(9.82)
Basic Materials	10.12*
	(5.68)
Consumer Cyclicals	6.21
	(5.39)
Consumer Non-Cyclicals	6.95
	(5.93)
Energy	1.40
	(5.77)
Financials	5.96
	(5.34)
Government Activity	0.22
	(8.60)
Healthcare	9.90*
	(5.55)
Industrials	6.57
	(5.42)
Institutions, Associations & Organizations	0.00
	(.)
Real Estate	3.50
	(5.86)
Technology	5.90
	(5.41)
Market Return	0.17
	(0.17)
Market Volatility	0.00
	(0.02)
Constant	7.28
	(5.94)
N	541
R^2	0.11
Adjusted R^2	0.08

Note: The table above depicts the OLS regression results, after deleting the observations with high Cook's distance. *Underpricing* (in %) is used as dependent variable and *ImpactFund* is used as independent variable. *ImpactFund* is a dummy variable that takes value 1 if the IPO was backed by an Impact Fund and zero otherwise. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.01.