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Monetary Policy Uncertainty: a transmission mechanism in the venture capital market

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Abstract

Leveraging the literature on text-based monetary policy uncertainty (MPU) measures, this study aims to investigate the role of MPU as an uncertainty transmission channel of monetary policy in the venture capital (VC) market. Using a recent sample of US VC funds and their portfolio companies, we first conclude that MPU positively affects the size of the VC fund. Second, drawing upon survival analysis techniques, MPU increases durations between staged financing rounds. Third, using competing risk analyses, we find positive and unique effects on the duration until a VC exit occurs, more prominently in successful exits. Results imply the unique and ubiquitous presence of MPU as a transmission mechanism in the VC market and the distinction between MPU and other economic policy uncertainties. This paper provides a stepping stone for further research into the scope and management of this uncertainty channel and may act as a warning for agents active in the VC market.

JEL Classification: E52, G24
Keywords: Monetary Policy Uncertainty, Policy Uncertainty, Transmission Channel, Venture Capital, Survival Analysis

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Uncertainty is not just a pervasive feature of the monetary policy landscape; it is the defining characteristic of that landscape - Greenspan (2004)

1 Introduction

In recent times, central banks of the major economies face a dichotomy, battling surging inflation rates while preventing further economic downturns after the economic tumultuous years during the COVID-19 crisis. Raising the respective policy interest rates as the main monetary policy intervention instrument may prevent a further rise in inflation, but can however negatively impact asset prices and economic growth in general. These conflicted interests among policymakers may induce a rise in uncertainty relating to the implementation and effectuation of these policy instruments perceived by economic agents. This is just one example of many monetary policy instruments having ambiguous consequences causing uncertainty about the true nature of the desired effect. Current monetary economics literature refers to this uncertainty as Monetary Policy Uncertainty (MPU), which is defined as the publicly perceived uncertainty about the implementation and effectuation of monetary policy by central banks. Current literature suggests that MPU can affect corporate actions via a unique and separate monetary transmission channel (Bauer, Lakdawala & Mueller, 2022), for uncertainty can have numerous behavioral implications. Alan Greenspan once noted: 'When confronted with uncertainty [...] human beings invariably attempt to disengage from medium- to long-term commitments in favor of safety and liquidity' (Greenspan, 2004). Given the wide scope and consequences of monetary policy (Di Maggio & Kacperczyk, 2017; Taylor, 2000), its second moment can also have far-reaching implications and can alter economic behavior. This has, however, not been subjected to large academic scrutiny and is only recently recognized as a separate and unique transmission channel of monetary policy itself (Bauer et al., 2022).

This paper aims at contributing to the knowledge of the practice of this new transmission channel of monetary policy by studying its effects on corporate behavior in the United States' venture capital market. Studying this new channel in this highly innovative market may prove to be of large economic relevance since venture capitalism is one of the main drivers behind economic innovation and growth (Gompers & Lerner, 2004). However, the extent to which MPU as a transmission mechanism of monetary policy affects corporate actions has not received much attention. The pioneering work by Adra, Barbopoulos and Saunders (2020) is one of the first to link the literature on MPU as monetary policy transmission and corporate finance. The authors investigate the impact of MPU on the value of an acquiring company in Merger & Acquisition outcomes using a sample of firms located in the United States. Employing data on a news-based MPU measure from Baker, Bloom and Davis (2016), the authors conclude that a rise in MPU increases the riskiness of acquirer's shares and thus negatively affects the stock market. They confirm their results by proving the uniqueness of *monetary* policy uncertainty amongst other policies.

However, not much work has been done in studying the scope of MPU as a transmission mechanism in other markets, especially the venture capital market. The recent study by Huang, Wu and Guo (2022) only assesses the importance of the broader Economic Policy Uncertainty (EPU) on the staged financing duration in Chinese venture capital investments. Resorting to the literature on survival analysis, the authors find that EPU negatively affects investments by inducing longer durations until new investments are pledged by venture capitalists in their portfolio companies. The authors do not consider MPU as a separate and unique part of all economic policy uncertainties.

Both Adra et al. (2020) and Huang et al. (2022) embed their results in the context of real options, where volatility as a proxy for uncertainty contributes to the value of this real option. Huang et al. (2022) argue that uncertainty relating to a wider set of economic policies (such as fiscal policy, monetary policy, national security, and sovereign debt[1]) has a positive effect on the value of the real option to abandon, for which an increased value implies that it is more profitable waiting to act. However, Adra et al. (2020)

[1]See Baker et al. (2016) for their full classification

conclude that it is only MPU that affects the value of this option, proving that this value-adding effect to the real option to abandon is unique among and not dampened by other economic policies. Building on the findings by Bauer et al. (2022) related to the new and unique uncertainty transmission channel of monetary policy, this suggests that Huang et al. (2022) may have possibly overlooked MPU as an important and unique predictor of venture capital actions. Together with this gap and contradiction in the existing literature and the need for further research into the effects of MPU as a transmission channel in the venture capital market, we, therefore, intend to answer the following research question in this thesis: How does monetary policy uncertainty affect venture capital activity, in particular its funding, investment, and exit outcomes? To the best of our knowledge, this is the first time these topics are studied in conjunction.

In answering this research question, data on news-based MPU is collected from Husted, Rogers and Sun (2020) and Baker et al. (2016) on the United States monetary policy stance[2]. It covers monthly time intervals and is measured as an index. Using text-analyzing techniques, both authors search a predefined number of newspapers for keywords relating to monetary policy and uncertainty, which differ marginally per author. Uncertainty related to monetary policy rises when the number of news articles relating to this increases. We also collect data on the macroeconomic conditions to address potential confounding effects with our main variable of interest. We, for instance, include measures of economic policy uncertainty, macroeconomic uncertainty, and investor-perceived risk. Data on venture capital activities are obtained through the Preqin database, focussing on United States' venture capital market ranging from 2000 to 2022. This database particularly contains detailed information on the fundraising, investment, and exit decisions of venture capitalists (VCs). Studying this particular trilogy results in a clearer picture of the transmission mechanisms of monetary policy via its uncertainty in most aspects of this highly innovative market.

First, the role of MPU in fundraising activities by VCs is analyzed. Particularly, we hypothesize that higher MPU results in larger venture capital funds due to the particular nature of the venture capital market. Current literature recognizes an uncertainty-reducing role by General Partners in screening and monitoring investments (Bellavitis, Fisch & Vismara, forthcomming). Outside investors may resort to this kind of investment when high MPU negatively affects other (financial) markets (Bauer et al., 2022), thus yielding increased fund sizes. The unit of analysis is venture capital partnerships looking to raise funds from outside partners to invest in high-innovative firms on their behalf. Using panel regression techniques and including a Heckman correction term to control for the conditional probability of raising a fund, we initially find weak indications of a positive relationship between MPU and the size of the fund. However, when allowing for interactions between MPU and macroeconomic uncertainty, we find more significant and positive relationships in times of high MPU. Furthermore, we find that EPU decreased the size of the VC fund. We thus confirm that increasing MPU induces a capital flight to venture capital funds.

Second, we investigate the potential effects of MPU on the investment behavior of VCs in their portfolio companies. We expect that higher MPU increases the duration between investment staging rounds and thus negatively affects the investments. We embed this expectation in a real options framework, arguing that MPU increases the value of waiting. The unit of analysis is the portfolio companies that receive staged funding by VCs drawing upon their previously raised funds. Using survival analysis techniques we find that MPU has a strong positive effect on the duration between staging rounds. We relate these findings to the study by Huang et al. (2022), arguing that it is not uncertainty related to all economic policies that negatively affect investments by VCs, but only those related to monetary policy. We find that only MPU increases investment durations, while other EPUs decrease these durations. These results are confirmed by including an interaction term between MPU and EPU.

Third, the exit strategy by VCs is analyzed, recognizing the particular combination of the choice of exit

[2]See the website http://policyuncertainty.com for an overview of all economic policy uncertainty indices

vehicle and the timing of the exit. We hypothesize that MPU increases the duration until a VC exits its investment. Based on the existing literature on MPU in the financial assets markets (Kroencke, Schmeling & Schrimpf, 2021), we predict that this effect is more pronounced for the choice of exit vehicle depending on these markets. We also embed these expectations in the real options framework, arguing that MPU - due to its particular nature - increases the value of waiting. Using survival analysis techniques in a competing risk environment, we also find highly significant results of the positive relationship between MPU and the duration until a VC exits. This relationship is more present for the IPO and Trade Sale/Merger exit vehicle, and less so for others. Relating to the findings by Huang et al. (2022) that EPU increases exit durations, we contradict these results and find that other EPUs negatively affect exit durations. These results are confirmed by including an interaction term between MPU and EPU and when employing alternative definitions of venture capital exits.

Generally, when analyzing the conclusions drawn in these three parts, we make several remarks concerning the MPU as a transmission channel of monetary policy in the venture capital market. First, we confirm earlier statements by Adra et al. (2020) and Bauer et al. (2022) that uncertainty related to monetary policy is unique and has particular consequences for corporate behavior. Secondly, in all three aspects of the venture capital market, we find opposite results concerning the relationship between venture capital outcomes and MPU, and other EPUs respectively. We explain these findings by noting that monetary policy, inter alia economic policies, has far-reaching implications for both financial and real economic markets (Di Maggio & Kacperczyk, 2017) and policymakers face apparent boundless constraints (Taylor, 2000). The scope of the second moment of monetary policy can thus also be far-reaching, implying that the best strategy for corporations is to wait and update beliefs on the future viability of the project. We refer to this as an increased value of the real option to abandon. Other policies do not have the same scope of (corporate) impact. Any uncertainty derived from these policy measures may imply that the best strategy for corporations is to act now, referred to as the real option to grow. Building on Horra, Perote and Fuente (2022), we argue that venture capitalism is akin to innovative markets, where increased volatility (i.e. uncertainty) implies possible boundless gains and limited losses due to the option to abandon the project. These observations imply a refinement of the conclusions drawn in Huang et al. (2022) and shed valuable insights into the heterogeneous impact of the transmission of economic policies.

Understanding how and to what extent MPU affects the actions and consequences of economic agents is both of high academic and social relevance. This paper may lay further the groundwork for a new field of research into this new transmission channel and may provide a stepping stone for monetary policymakers to improve and develop policy instruments aimed at reducing and containing uncertainty levels related to policy actions. This can contribute to a better assessment of the central bank's policy implications on economic activity, for venture capitalism can have extended implications to many economic markets (Di Maggio & Kacperczyk, 2017). It may also serve as a warning for economic agents active in the venture capital market acting in times of high MPU.

The rest of this paper is organized as follows. First, we present some related work in Section 2 to embed our research in a theoretical framework. After presenting the data employed in Section 3, we outline the methodological approaches in Section 4 and present our results in Section 5. We then draw conclusions and indicate further directions of future research in Section 6.

2 Theoretical Framework

2.1 Monetary Policy Uncertainty

Friedman (1968) advocated in his seminal presidential address to the American Economic Association on the role and limitations of monetary policy, that monetary authorities (i.e. central banks) should avoid large deviations in or propose adverse monetary policy directions. For relatively stable monetary policy

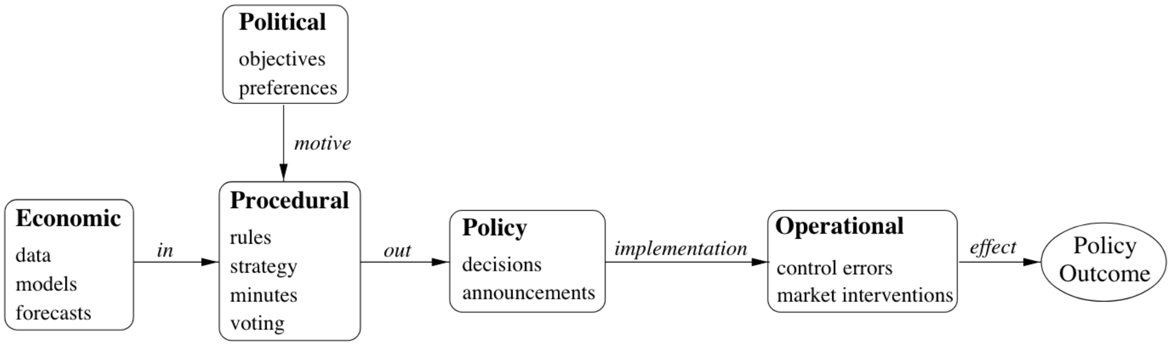

Figure 1: Conceptual framework for monetary policymaking and information process by central banks, of which uncertainty in the last two components is referred to as MPU. From Geraats (2001), Figure 1 page 8.

- as he argued - is associated with relatively stable economic conditions. With this, he was one of the first to address the potentially substantial consequences of uncertainty around monetary measures taken by the respective authorities on the real economy. It is only decades after his remarks that Greenspan (2004) concluded that uncertainty is 'the defining characteristic of the landscape' shaped by central bankers, confirming the uneasiness expressed by Friedman on the potential real effects of Monetary Policy Uncertainty (MPU).

Uncertainty can mutually inclusively encompass both 'Knightian' uncertainty, where the probability distribution is unknown, and risk, where the uncertainty of an outcome is delimited by its known probability distribution (Greenspan, 2004). MPU, or 'sharp swings in policy' as Friedman (1968) referred to it, therefore, relates to the uncertainty of a central bank's action and its consequences (Husted et al., 2020) perceived by economic agents (i.e. non-policy makers), which is contingent on both the chosen (set of) *known* monetary policy instruments and the *unknown* prevailing economic conditions. This uncertainty does not refer to the uncertainty among policymakers about certain economic parameters or of the choice of necessary instruments to alter the trajectory of these parameters[3]. Rather, it refers to the uncertainty about the policy implementation and effectuation, reflected by uncertainty relating to the chosen policy measure and its real consequences. See Figure 1 from Geraats (2001, p.8). Following the conceptual framework of central bank transparency and its policy-making process provided by Geraats (2001), this uncertainty, therefore, relates to the 'policy transparency' and 'operational transparency' of central banks. The first refers to the information disclosure on the chosen set of instruments and the future path of monetary policy, the latter refers to transparency on the implementation and effectuation of the transmission to the real economy in this future path. The second moment of the distribution of this future path is thus what we refer to as MPU. Figure 1 from Geraats (2001, p.8) summarizes this and shows a framework for the central bank's policy-making process and its information disclosure in these facets. This current study relates to the information disclosure in the policy decision & implementation parts and its operational effects, forming the tail of the policy-making process. Particularly, any uncertainty as previously defined resulting from these facets is considered as MPU. Building on the influential paper of Barro and Gordon (1983) on the reputation of monetary policy, Geraats (2001) argued that improvements in central bank transparency in these parts can enhance the central bank's reputation and therefore eliminate a part of the MPU.

[3]See for example the study by e.g. Cieslak, Hansen, McMahon and Xiao (2021)

2.1.1 MPU as transmission mechanism

This naturally raises the question of whether MPU itself plays a role in the transmission of monetary policy. Bekaert, Hoerova and Duca (2013) provide the first indications of a possible transmission channel of monetary policy relating to uncertainty. Investigating the risk-taking behavior in financial asset markets due to lax monetary policy, the authors uncover two main channels of volatility as a transmission channel; risk appetite and uncertainty. Bundick, Herriford and Smith (2017) add to this that forward guidance (aimed at managing uncertainty) by central bankers is enough to affect the term premia in the bond market since monetary policy uncertainty shocks materially alter economic activities. De Pooter, Favara, Modugno and Wu (2021) show that the level of uncertainty on the path of monetary policy is relevant for the transmission mechanisms of the main policy instrument; the interest rate. It is however recent academic work that recognized that MPU is a separate and unique channel of monetary transmission. Bauer et al. (2022) first referred to this channel as an 'uncertainty channel'. Building on the hypotheses of Kroencke et al. (2021), the authors create an MPU measure based on short-term interest volatility and conclude that MPU has a significant effect on asset prices in financial markets which can be (temporarily) managed by forward guidance announcement by the Federal Open Markets Committee (referred to as the 'FOMC uncertainty cycle').

These studies focus on the transmission channels playing a role in financial markets. However, not much academic evidence is present on the practice of this uncertainty transmission channel in the real economy. Pioneering work in this field by Adra et al. (2020) indicates that MPU can have far-reaching consequences on corporate activities. Studying the market of corporate control in the United States, the authors conclude that MPU negatively affects Merger & Acquisition outcomes, particularly by increasing the riskiness of the acquirer's stock. The authors further confirm, using principal-component analyses, that the discount investors require for holding shares under high MPU is unique amongst other policy uncertainties.

Possible explanations of why MPU may act as a transmission channel for monetary policy in the corporate context can be found in the literature on real options. Adra et al. (2020) argue that MPU negatively affects M&A outcomes using a real option rationale. Higher uncertainty related to monetary policy may also increase uncertainty about the future profitability of the project at hand, especially when its investments are irreversible. Uncertainty may add value to the real option to abandon, which temporarily may increase the returns of waiting for new information (Bernanke, 1983). By updating beliefs of future states of the world, agents can act better to the current circumstances. This is why Adra et al. (2020) found that the discount due to MPU is only temporary and can be overcome in the longer run.

However, uncertainty can also have different consequences using this same real options framework if it implies that it increases current payoffs. Bloom (2014) surveys the literature on real options and concludes that this latter effect (also referred to as the growth option) is particularly dominant when the investor faces potential limited losses and potential boundless gains when acting under high uncertainty. This implies a greater profit by acting now instead of waiting (in the option literature known as call-options). It is thus also plausible that uncertainty may add current gains and thus spur corporate activities. However, not much academic evidence is present on which of these options MPU might have an effect. The aim of this paper is thus to fill this apparent gap by investigating the effects of MPU and other policy uncertainties in the context of the venture capital market.

2.1.2 Monetary and Economic Policy Uncertainty

The literature on MPU is related to the broader literature on (economic) policy uncertainty, which is roughly divided into three branches; fiscal policy uncertainty, monetary policy uncertainty, and other/

political policy uncertainty.[4] It is Brainard (1967) who first paved the way for economists to consider uncertainty in their models to evaluate the impacts of economic policy. He showed that uncertainty on forecasts and on the public response can significantly alter the optimal policy choice. Bernanke (1983) later added that uncertainty, using the rationale of option pricing, can affect investment decisions. Combining these contributions, Rodrik (1991) developed an influential rational choice model in which he modeled investment behavior by the private sector in the context of uncertain consequences of policy reforms. He showed that policy uncertainty can act as a 'tax on investment', thus advocating for stable and sustainable policy measures to enhance the economy (Rodrik, 1991).

The vast literature on Economic Policy Uncertainty (EPU) considers multiple approaches to validate the abovementioned theoretical results empirically. The leading paper in this field of research is Baker et al. (2016). Understanding the importance of the real consequences of economic policy uncertainty, the authors developed a newspaper-based uncertainty index in which they track ten leading newspapers in the United States. They designated multiple keywords referring to the economic conditions and policy actions by the respective authorities and divided the broad concept of economic policy uncertainty into eleven different uncertainty branches. Using the frequency of these keywords, the authors establish an uncertainty index in which higher frequency results in a higher uncertainty stance. With this, they aim to capture the uncertainty about the *who, what,* and *when* of economic policy effects, both in the near- and long-term. After extensive audit studies, they confirmed the validity of this index. This provides suggestive evidence for the uniqueness of EPU effects as opposed to general economic uncertainty and gives indicative causal evidence of the negative relationship between economic policy uncertainty and - amongst others - private investments (Baker et al., 2016).

In this paper, we focus on the monetary policy part of economic policy uncertainty. The existing literature uses predominantly market-based measures of uncertainty to measure MPU, in which volatility - as a proxy for uncertainty - is derived from federal fund rate options and other interest-based derivatives (Bauer et al., 2022; Swanson, 2006; De Pooter et al., 2021; Bernanke & Kuttner, 2005). Other measures of MPU include the volatility in short-term interest rates (Creal & Wu, 2017), disagreements on future interest rate expectations and forecasts (Tillmann, 2020; Istrefi & Mouabbi, 2018), and measures based on the money growth process (Jordà & Salyer, 2003).

However, Husted et al. (2020) and Baker et al. (2016) also provide two separate MPU indices and take another approach uncommon to the existing literature. Building on and leveraging the methodologies provided Baker et al. (2016), these authors construct a newspaper-based uncertainty index for monetary policy. They designate separate keywords relating to United States monetary policy (uncertainty) and construct the index measured as the total count of 'monetary uncertainty articles' over the total issued articles. These articles stem from major (US) newspapers and are evaluated on a daily basis. Husted et al. (2020) conclude that MPU has a unique and significant effect on aggregate output relative to the broader EPU. These news-based indices on MPU differ from other measures of MPU in three distinct ways. First, news-based indices capture the uncertainty perception of a broader sample of economic agents (as opposed to only uncertainty perceived by participants in the option or bond market). Secondly, the aforementioned measures may capture a portion of uncertainty related to the general aversion to risk, while news-based measures capture only the specific uncertainty related to the policy. Lastly, MPU incorporates per definition a broader scope of uncertainty than only uncertainty related to the federal fund rate (Husted et al., 2020). For a deeper discussion on the methodological approaches of the indices used, we refer to Section 3 of this paper.

[4] See Baker et al. (2016), in which this other/political uncertainty branch is subdivided into nine more categories

2.2 Venture Capitalism

To study the potential real consequences of MPU as a distinct and unique transmission channel of monetary policy, we embed our research in the context of venture capitalism. This has some advantages over other markets in corporate finance. First, Venture Capitalists (VCs) are a key driver behind economic growth (Gompers & Lerner, 2004). Identifying a new transmission channel in the VC context thus has a relevant economic interpretation. Second, due to the particular construction of this market, we can easily accommodate multiple analyses to uncover the scope of the effects of MPU on corporate activities. The structure of the remainder of this thesis thus follows the lifecycle of a VC in this market, where he first needs to raise funds from outside investors in order to secondly invest in potentially profitable (young) companies. Finally, he needs to exit his investment to monetize his returns and return the committed capital to his investors. The dynamics of this trilogy are presented in the following sections.

2.2.1 Fundraising Activities

In the first stage of a VC fund, VCs (also known as General Partners (Gompers & Lerner, 2001)) set up a fund in which investors (also known as Limited Partners) commit capital, which is provided at the discretion of General Partners or at predetermined dates (Metrick & Yasuda, 2021). When the total necessary funds are committed, the fund is closed and remains committed for a predetermined period, usually 10 years (the lifespan of a venture capital fund). Jeng and Wells (2000), therefore, note that VCs serve a financial intermediary role between investors and investees. Gompers and Lerner (1999) refer to this fundraising process as the supply of venture capital, which is determined by the willingness of investors to provide funds. In economic-textbook-fashion, Gompers and Lerner (1999) analyze this using a supply curve context in which the commitment of capital by Limited Partners is contingent on the expected rate of return of the fund and argue that this supply is relatively elastic. To empirically validate these theoretical expectations, the fundraising process by VCs is usually measured by the total dollar-amounts invested in the fund (Poterba, 1989; Gompers & Lerner, 1999, 2004; Cumming, Fleming & Suchard, 2005).

In the seminal paper by Gompers and Lerner (1999), the authors contribute significantly to the understanding of the determinants of venture capital funding. Using a Heckman two-stage model and data from US VCs, they estimate the probability of raising a fund and investigate possible determinants of the optimal size of a venture capital fund. In line with Black and Gilson (1998), the authors do not find evidence of the effects of capital gains taxes on the probability of fundraising. Gompers and Lerner (1999) do, however, present a significant negative relation between these taxes and the fund size; the lower the individual tax rate, the higher the fund size. Using a model that studies the decision to become an entrepreneur by Black and Gilson (1998) and returning to their supply and demand schedule, the authors explain this finding as an increased attractiveness (as an external stimulus) to become an entrepreneur, thereby raising the demand for funding and thus the equilibrium fund size. Furthermore, Gompers and Lerner (1999) further conclude a positive relation between past venture capital firm performance and reputation on the size of the fund, suggesting that older firms with a better track record can more easily attract the attention of Limited Partners. Finally, they suggest a possible positive relationship between the Treasury Bill returns and the likelihood of raising a fund.

The literature later suggested several other determinants of venture capital supply. Cumming et al. (2005) argued that the expertise of the General Partner is positively associated with the fund size. Kollmann, Kuckertz and Middelberg (2014) provide evidence that the trustworthiness of VCs in combination with perceived controllability over the fund by limited partners is associated with larger funds. Kuckertz, Kollmann, Röhm and Middelberg (2015) add to this finding that trust is not a perfect substitute for the track record of the performance of a venture capital fund. Instead, good past performance is associated with a higher value of funds committed.

2.2.2 Venture Capital Staging

After securing the necessary commitments, VCs can begin with prospecting for promising start-ups. After an extensive period of screening, providing a term sheet (a preliminary offer) to the venture, and performing the necessary due diligence, a final set of contracts is signed in the final closing with a limited number of ventures (typically referred to as portfolio companies). Usually, the agreed investment is not committed up front, rather, the VCs provide capital in stages (Staged Capital Commitment) with predetermined (financial) milestones as gatekeepers for the renegotiation table (Metrick & Yasuda, 2021; Sahlman, 1990). Hellmann (1994) provides a theoretical framework related to the model of Stiglitz and Weiss (1983) for this particular observation, arguing that when the risk of failure is too large and considerable information on the quality is obtained throughout the investment process, a VC is inclined to provide financing in stages. The duration between these financing rounds (series) is particularly valued as the real option to abandon the project or to further invest in (Sahlman, 1990) By delaying any investments, the investor can update his beliefs on the future state and, therefore, better assess the viability and profitability of the project. Empirically, this period is usually defined and analyzed as the number of days between two successful and successive funding rounds by VCs in a respective portfolio company (see e.g. Huang et al. (2022); Gompers (1995)).

In the seminal contribution to the literature of venture capital staged financing, Gompers (1995) analyzes the factors affecting the staging (and thus duration) decisions of General Partners into their portfolio companies. Referring to the vast literature based on the notion of asymmetric information, known as the agency theory, he provides a theoretical basis for his predictions. He argues that, given the natural incentives of VCs to add value by providing complementary and supporting services to the entrepreneur, VCs are inclined to invest in early-stage ventures. These young companies do not feature impressive track records and typically have asymmetrical information relations with an investor, and thus are in relatively large need of close guidance and monitoring, something VCs infer as particularly attractive for they can add the most value. Asymmetrical information, manifested by discrepancies between individual and shareholder interests and by the possession of private information on the performance, and the existence of monitoring costs affect the duration between financing rounds. The higher the agency costs, the shorter the duration between financing to better monitor the entrepreneur. However, the opportunity costs of monitoring imply an opposite effect on financing duration (Gompers, 1995). Employing a unique random sample of venture capital-backed companies, he concluded that asset specificity and asset intangibility are negatively associated with funding duration, for they imply less recoverability of the initial investment. Lower market-to-book ratios (as a proxy for the inclination of entrepreneurs to pursue personal benefits) and higher liquidity constraints are associated with longer duration until new financing series.

2.2.3 Exit Strategy

Conforming to their role as financial intermediaries, VCs have the obligation to the Limited Partners to return their committed capital after a predetermined period. Hence, a VC must plan the withdrawal of invested funds from their portfolio companies, which is usually referred to as an exit. The process of divesting can take many forms, of which the IPO is the most common and lucrative vehicle to monetize the returns on the investment (Metrick & Yasuda, 2021). Other exit strategies encompass a merger or acquisition by another corporation (trade sale), selling shares to investors (secondary purchase) or the entrepreneur (buy-back), or liquidation of the venture (Bascha & Walz, 2001). The latter usually implies a loss for the venture capital fund and buying back shares by the entrepreneurs often indicates a loss in confidence by the General Partner in the viability of the venture. Therefore, Gompers, Kovner, Lerner and Scharfstein (2008) refer to successful exists as exists using the secondary purchase, trade-sale, or the IPO vehicles.

Gompers et al. (2008) investigate possible determinants of the success rate of exits by VCs. Building on the earlier acquired knowledge that VCs might time the equity market to successfully exit the portfolio company (Gompers, 1996), the authors study the effect of the public equity market cycles on the decision to exit. Hypothesizing that VCs look at fundamental aspects of the portfolio company to decide exits, they empirically show that experienced General Partners are more sensitive to volatile public markets, for these fluctuations signal information on the fundamental aspects of the respective industries.

Giot and Schwienbacher (2007) add valuable insights into the dynamics of the exit decisions. This decision - as they argue - consists of the timing and vehicle of the exit. Employing models of competing risks, they construct hazard functions to analyze the time-to-exit effects for different exit vehicles. They find that time-to-exit has a non-monotonic effect on the successful exit via an IPO, where the likelihood of this exit strategy rises sharply at the beginning of the investment period, reaching a plateau later, after which other strategies become more feasible over time. They further add that value-adding activities by General Partners also affect exit decisions, showing that syndicate size (a collaboration of multiple venture capital funds in one portfolio company), geographic proximity, and experience (as proxies for these value-adding activities), all affect the exit timing and vehicle decisions (Giot & Schwienbacher, 2007).

2.3 Hypothesis Development

Combining the macroeconomic literature on monetary policy, its related uncertainty, and transmission to the real economy with the literature on venture capitalism as presented above, we develop several predictions on the relationship between MPU and three components in the VC lifecycle: fundraising, investing, and exiting.

2.3.1 Fundraising Activities under MPU

The earlier indicated literature on the fundraising activities by VCs has not yet considered the potential effects of MPU on the amount of funding committed by Limited Partners. Despite the apparent gap in the understanding of this fundraising process, Bellavitis et al. (forthcomming) might provide some guidance. The authors show that, in times of negative interest rates, fundraising activities by venture capital funds increase. By employing worldwide data on individual venture capital funds and exploiting the features of a panel regression analysis, they concluded that negative interest rates improve fundraising. With this, the authors provide evidence of the uncertainty-reducing role General Partners serve through excessive screening and monitoring activities, since negative interest rates may be associated with more uncertainty (Bellavitis et al., forthcomming; Baum & Silverman, 2004).

Leveraging these scarce indications in the existing literature of a possible relationship between MPU and venture capital fundraising, we expect a positive relationship between MPU and fundraising activities by VCs. Building on the findings of Kollmann et al. (2014), venture capital might provide Limited Partners a way out of an uncertainty-dominated market implied by monetary policy. Through extensive screening and monitoring, the effects of MPU might be canceled out by the reduced uncertainty of these activities. Bellavitis et al. (forthcomming) supports this argument. Negative interest rates might be interpreted as increased uncertainty of monetary policy since central banks reached the Zero Lower Bound and are thus forced to use unconventional instruments. The usages and consequences of these instruments are uncertain since they deviate from conventional and thus predictable monetary policy measures. Bauer et al. (2022) conclude that the transmission of monetary policy is especially sensitive to MPU when the Zero Lower Bound is reached. Based on these studies, we thus predict a positive relationship between MPU and fundraising.

To put this argument in contrast, there is also a theoretical basis for the opposite relationship. Uncertainty, in general, raises the cost of capital and thus the required rate of return. The more uncertain the project, the higher the risk premium, the lower the net present value. Limited Partners, in assessing the viability of their investment in a venture capital fund, may thus more easily reject the investment opportunity and thus reduce funding amounts by General Partners. When a positive relation is found empirically, this thus implies that the uncertainty-reducing effect of VCs may outweigh these negative effects. This study can, therefore, fill this apparent gap in the literature by directly analyzing MPU as a determinant of venture funding.

2.3.2 Venture Capital Staging under MPU

Investment staging decisions by VCs have been subjected to relatively more academic scrutiny, and recently also concerning the role of policy uncertainty in these decisions. Most closely related to the effects of MPU on venture capital staged commitments is the study by Huang et al. (2022). In this paper, the authors rely on the premise of the real options theory and conclude that uncertainty, specifically EPU, adds value to the real option to delay investments (option to abandon), promoting a wait-and-see strategy. In the context of venture capital staged financing, this investment into the portfolio company is (partly) irreversible. This is a key driver behind the value of the real option, for irreversibility implies a greater need for certainty and thus a greater need for time to update beliefs on the prevailing state (Bernanke, 1983). Therefore, Huang et al. (2022) hypothesize that economic policy uncertainty is positively related to the duration between funding rounds. The authors draw upon the EPU index developed by Baker et al. (2016). The authors confirm their hypothesis by using survival analysis techniques to address possible censoring concerns in the staging data, using data from Chinese venture capital-backed firms. They further show that this positive relationship between EPU and staging durations is weakened by the negative effects of the interaction between EPU and the growth in a market (Huang et al., 2022).

These findings relate and are in line with previous research, such as Gulen and Ion (2016). These authors also study the broader economic policy uncertainty in the context of all corporate investments in the United States. They find similar results as Huang et al. (2022), concluding that increased policy uncertainty negatively affects investments, also in the United States as opposed to China. Particularly, they add to their results the significant persistence of this uncertainty, indicating an average effect duration of up to eight quarters after the change in the uncertainty measure by Baker et al. (2016).

However, these results are in contrast to the findings by Adra et al. (2020). These authors - using the policy uncertainty index specifically of monetary policy - find that the effect of MPU is unique and 'not necessarily moderated by uncertainties associated with other policy categories' (Adra et al., 2020). They also frame these results in the context of real options, arguing that higher MPU adds value to the option to abandon, implying longer durations until new investments. These findings thus challenge the conclusions by Huang et al. (2022) that EPU adds value to the real option to abandon. A separate and unique uncertainty transmission as concluded by Adra et al. (2020) would imply that both the effect of MPU and other economic policy uncertainties should be evaluated separately.

Earlier studies by Bekaert et al. (2013) and Husted et al. (2020) show the unique effects of MPU on economic activity at the macroeconomic level. The first study concludes that this uncertainty accounts for a significant portion of risk aversion, while the latter study concludes the negative effects of MPU on investments after controlling for the general EPU. Bauer et al. (2022) confirm the uniqueness of MPU as an uncertainty transmission channel and also find negative relationships between MPU and the investments made in the stock market. We thus predict a negative relationship between MPU and investments made by VCs in their portfolio companies. This should manifest in a lengthened duration between two successive staged financing rounds.

In line with Adra et al. (2020) and Husted et al. (2020), we embed this prediction in a real-option framework. Particularly, we expect that MPU has a positive effect on the value of the real option to abandon. Higher MPU incentivizes investors to hold up their investments and to wait and update their beliefs on the future states of the world. First, increased uncertainty of monetary policy could lead to possibly limited access to external debt funding by the portfolio company, putting constraints on further growth. Second, increased uncertainty can negatively affect aggregate economic conditions, constraining the output market of the portfolio company. This induces a profitable wait-and-see strategy by the VCs, therefore holding further funding back for some time to update their beliefs on the viability of the project. Finally, increased uncertainty increases risk premia and thus increases the cost of capital, thereby moderating future benefits from investing. This can further incentivize General Partners to hold back their investments in the portfolio company, lengthening the duration between funding series.

We argue that this effect is unique and is not as dominant for other economic policies, since monetary policy has far-reaching implications for both financial and economic markets (Di Maggio & Kacperczyk, 2017). Furthermore, monetary policy-makers, as opposed to other economic policies, face limited constraints (Taylor, 2000). It is therefore that Adra et al. (2020) note that monetary policy and its uncertainty are 'highly consequential' for investors. Other economic policymakers do not face the same independence. We thus argue that the positive effects of EPU on the duration between investments found in Huang et al. (2022) can be further understood by controlling for MPU. The effect of EPU on staging durations might thus be moderated or even reversed by the uncertainty channel of MPU.

2.3.3 Exit Strategy under MPU

Also, contributions to the literature on exit strategies by General Partners were made by Huang et al. (2022). The authors indicate that EPU negatively affects the hazard of a successful exit by a VC from its portfolio company and thus lengthens the duration until an exit occurs. Using the same data on Chinese venture-backed companies and a Cox proportional hazard model to address right-censored data, they also suggest a heterogeneous effect of economic policy uncertainty on the likelihood of a successful exit. This negative relationship is more pronounced for portfolio companies having fewer options to grow further, relating to the findings on staged capital commitments. Giot and Schwienbacher (2007) earlier suggested that reducing uncertainty may enhance and accelerate exits by VCs. The study by Huang et al. (2022) thus further specifies that reduced EPU is a partial driver behind these observed accelerated exits.

However, also for the duration until a VC exits its investment, we refer to the findings by Adra et al. (2020); Bekaert et al. (2013), and Bauer et al. (2022) on the uniqueness and distinctive uncertainty transmission channel of MPU. Due to the far-reaching implications of monetary policy, its second moment can also have far-reaching consequences for real economic behavior. Specifically, VCs may, as a consequence, wait before they withdraw from their investments since it is unclear whether future profits may deteriorate or improve due to the taken policy measures. Also, the results of Kroencke et al. (2021) amongst others indicate that higher MPU negatively affects financial markets, markets on which VCs depend to successfully exit their investments (Metrick & Yasuda, 2021). We thus expect a heterogeneous effect of MPU on the exit strategy, encompassing both the time to exit and exit vehicles. Higher MPU may affect the profitability of both the IPO and trade sale exit, lengthening durations until such exits occur and thus implying fewer IPO and trade sale exits. Exits via liquidations or other unsuccessful exits[5] might be less affected by MPU due to their less pronounced links with the financial markets, but we still expect increased durations until such exits.

These predictions of increased durations find their grounds also in the real-option framework. Particularly, we expect that also for the exit strategies MPU as a transmission mechanism positively affects the real option to abandon, promoting a 'wait-and-see' strategy. The study by Huang et al. (2022) conclude this effect is present also for other economic policies but might have overlooked MPU as an important contributor to this effect. As made clear from the predictions on the staging duration, monetary policy is unique amongst others. We thus predict that EPU has a less pronounced effect on the exit choice and duration than presented in Huang et al. (2022).

[5] See Gompers et al. (2008)

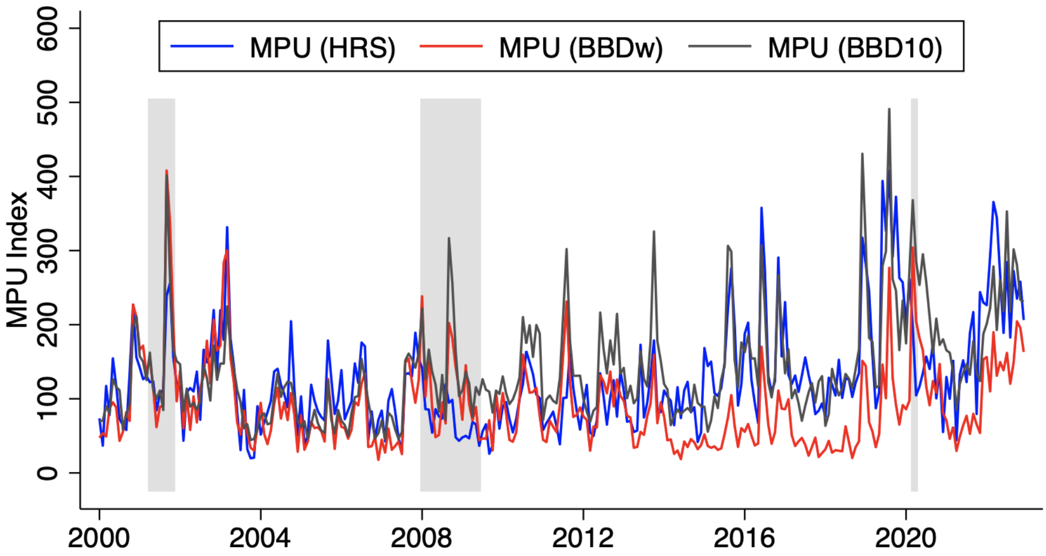

Figure 2: United States' Monetary Policy Uncertainty, monthly indices from 2000 to 2022
Source: From policyuncertainty.com, based on Baker et al. (2016) and Husted et al. (2020)

3 Data

3.1 Measuring Monetary Policy Uncertainty

To investigate the potential consequences of MPU as a separate uncertainty transmission channel for monetary policy, we consult the uncertainty index related to United States' monetary policy provided by Husted et al. (2020) (HRS). Using three major US newspapers (the Washington Post, Wall Street Journal, and New York Times) and text-analyzing techniques previously developed by Baker et al. (2016) (BBD), the authors construct an index based on the frequency of keywords relating to MPU per newspaper. Articles are flagged as MPU-indicating articles when certain keywords relating to uncertainty, monetary policy, and the Federal Reserve are mentioned in conjunction within one article. Furthermore, the authors control for the natural tendency of certain newspapers to cover more monetary policy-related news by scaling the identified 'MPU-related' news articles with the total number of articles relating to the Federal Reserve. After normalization and aggregation of the three indices, a monthly index (MPU-HRS) is created with an overall mean of 100 points (Husted et al., 2020).

Other indices relating to MPU are provided by Baker et al. (2016). These differ in the choice of newspapers, keywords, and scaling options in constructing the indices, but all relate to the general concept of uncertainty related to monetary policy executed by the Federal Reserve. BBD choose to construct two other types of MPU indices which mutually differ in the choice of newspapers. The first index (MPU-BBDw) is based on worldwide newspapers covering the monetary policy stance of the Federal Reserve, and the second (MPU-BBD10) only focuses on ten major US-located newspapers. These two indices use a larger set of keywords and different scaling techniques relative to HRS to construct the indices. BBD also construct a broader EPU index using different keywords but the same techniques and ten newspapers. The articles are then flagged as 'EPU-related' articles when they contain certain keywords relating to broader economic policies of the US, such as fiscal policy, regulation, and sovereign debt policies and uncertainty. Controlling for this broader concept of policy uncertainty results in a better estimation of the true data-generating process of the relationship between MPU specifically and Venture Capital activities.

Figure 2 shows the three different indices of MPU plotted together with indicators for recessions in the United States.[6] Notable are the joint sharp rises and drops in MPU during the outbreak and management of the Covid-19 recession of the three MPU-measures. However, the index by BBD based on worldwide newspapers deviates somewhat from the other two measures in certain periods, having a tendency to report on average lower index points than the other indices. This results in a correlation with HRS of 0.521 and with the index based on ten newspapers of 0.712. This uncovers some differences in the construction of these indices, particularly in the choice of newspapers and keywords. Husted et al. (2020) indicate that the indices provided by BBD might capture a larger global component of MPU, while theirs might be even more US-centric due to the fewer number of keywords used in constructing the MPU-HRS index relative to BBD. Given these relatively low correlations and different focal points of the indices, the choice of measurement is thus relevant for the analysis of the effect of MPU on Venture Capital Activity, and all three measures are thus considered in this study.

3.2 Venture Capital Sample Description and Data Collection

Data on venture capital activity, in particular its funding, investment staging, and exit strategies, are retrieved from the Preqin Database. This database covers the whole venture capital cycle, starting with its fundraising activities and ending with its exit decisions. The sample period is restricted from January 2000 to December 2022 and is analyzed in monthly time intervals. This allows for more recent evidence on the potential relationship between MPU and venture capital activity. The sample is further restricted to only venture capital limited partnerships located in the United States to focus on the effect of uncertainty related to the United States Federal Reserve monetary policy. These organizations can manage multiple funds at once and over time. This study is limited to the choices and actions of these US Venture Capital organizations to study the behavioral consequences of MPU in the United States. This sample restriction, therefore, does not exclude portfolio companies of these venture capital partnerships located outside the United States. We collect data on individual venture capital funds for the first analysis, and data on individual portfolio companies for the rest of this paper.

3.2.1 Fundraising Activities

To test the first prediction that MPU positively affects the dollar amounts committed to a venture capital fund, a sample of 6,234 venture capital funds raised by 3,193 individual venture capital limited partnerships is collected from the Preqin Database. The time of commitments to these funds (the final closing date) ranges from January 2000 until December 2022 and is expressed in monthly intervals. The unit of analysis is individual venture capital funds. Some venture capital organizations establish multiple funds within the same month (FundsPerMonth). In these cases, the committed million US dollar amounts to these funds are aggregated and the number of funds raised in that month is recorded. Subsequently, the dollar amounts of funds committed to VCs are log-transformed to account for the right-skewed distribution in these observations (LnFundsize). Data on the final closing date is collected to infer the number of days since the last fund was raised by one venture capital organization (DaysSinceLastFund) and the number of months since the last fund was raised (MonthsSinceLastFund). Related, data on the number of funds raised since the venture capital limited partnership was established is also gathered (Fundnumber). These variables relate to the activeness of a General Partner, which can be attractive to Limited Partners seeking a new investment opportunity and are thus controlled for. Funds can be managed and raised in conjunction with multiple other venture capital organizations. Data on these syndicated funds are also collected (Syndicate) to control for the increased attractiveness of the fund through more expertise and value-adding contributions by General Partners. These variables, thus, all

[6] Data from the Federal Reserve Bank of St. Louis, NBER based Recession Indicators for the United States from the Period following the Peak through the Trough

capture different aspects of expertise, trustworthiness, and track record of a General Partner, following the studies by Cumming et al. (2005); Kollmann et al. (2014); Kuckertz et al. (2015).

Furthermore, data on the dollar amounts of previous funds are collected over the past 10 years (ValuePastFunds) and of the previous fund raised (ValueLastFund). This is in line with Gompers and Lerner (1999), who include a similar measure to control for the total capital under management of a VC. The 10-year span is chosen in line with the typical lifespan of a venture capital fund. Higher capital under management might signal to potential investors that the fund has a good reputation and track record, therefore affecting the fundraising amounts of these funds. In line with Poterba (1989), who argue that the personal tax rate on capital gains might influence the decision by investors to commit funds to a VC, these tax rates are also included in the analysis. Data on this is collected from Wolters Kluwer. The final vector of covariates in the analysis of fundraising (X_{it}) thus encompasses the following variables: DaysSinceLastFund, Fundnumber, FundsPerMonth, ValuePastFunds, and Syndicate. The personal capital gains tax rate is also included as a time-varying control.

Table 1 describes the summary statistics of the total value of funds raised in a single month by one venture capital organization, as well as other relevant variables relating to fundraising by VCs. These summary statistics are further broken down by different states of MPU (based on HRS), where the Low and High MPU states are characterized by extreme values of the index. Notable is the large standard deviations, especially in the million US dollar amount of funds raised. To account for the right-skewed data in the dollar amounts of funds raised, a log transformation is applied to the value of the committed funds to put less weight on these extreme values. Interesting to see is that the days since the last fund was raised differ relative to the different states of MPU. When uncertainty related to monetary policy is high, the number of days between new funds decreases. This might indicate a safe haven effect for investors seeking alternative investments in times of uncertainty. A complete description of the variables and descriptive statistics are found in Tables A1 and A2 in the Appendix respectively.

Table 1: Key summary statistics for the fundraising and related activities by venture capital funds

Variable	No. Obs	DaysSinceLastFund	Syndicate	FundsPerMonth	ValuePastFunds	Fundsize
Full Sample	3557	793 (811)	0.9 (0.3)	1.1 (0.5)	603.6 (1656.5)	212.4 (486.9)
Panel A: Fundraising by stance of monetary policy uncertainty						
Low MPU	392	1076 (899)	0.9 (0.2)	1.1 (0.6)	554.6 (1259.4)	218.8 (347.7)
Medium MPU	2234	829 (807)	0.9 (0.2)	1.1 (0.3)	588.1 (1512.1)	214.0 (423.2)
High MPU	931	585 (729)	0.9 (0.3)	1.1 (0.8)	661.5 (2080.9)	205.9 (652.4)

Note: Means are reported per variable, standard deviations between brackets. For a full definition of the variables, we refer to Table A1.

3.2.2 Venture Capital Staging

Relating to the second hypothesis that MPU affects the duration between financing rounds into portfolio companies by a General Partner, the database of Preqin is also consulted. This database contains 115,516 unique venture capital financing deals over the period 2000 until 2022. These investments were committed to 57,025 individual portfolio companies of these VCs. The unit of analysis is the individual portfolio companies. For each of these deals, the time in days is calculated between the current deal date and the next date. If the next deal did not take place within the sample period, then the total days until the new financing round is truncated on December 31st, 2022 (StagingDuration). If this is the case, a dummy variable indicating if the staged financing round took place is created (Staged).

Various other portfolio company-related variables are collected, including the total number of previous investments in the portfolio company(InvestmentRound). The total million US dollar amounts of the investment in the portfolio company are also recorded while accounting for the right-skewed distributed data (LnDealsize). Huang et al. (2022) include similar measures to control for the possible activeness- and size-effects of the investment on the staging duration. Furthermore, we control for the stage of development of portfolio companies (DevStage). This includes companies in the early stage, expansion stage, later/other stages, and buyout stage of development (in line with the categorization by Giot and Schwienbacher (2007)). This classification follows the stages of the product or service development, for which investments by VCs are intended to enhance the development of the portfolio company. Including this in the analysis is in line with Huang et al. (2022) and Gompers (1995), who note that early-stage investments need shorter funding durations for tighter monitoring since they imply relatively high agency costs due to the lack of track record. This can also be seen in Table 2. Furthermore, the year of establishment of the portfolio company is included to control for the age of the portfolio company (Year) and the focal industry of the company to control for industry fixed effects (Industry). The vector P_{it} encompasses these portfolio company-specific variables.

Table 2: Key summary statistics related to the duration until a portfolio company receives new funding

Variable	No. Obs	DealSize	Syndicate	VC-comp(%)	Duration	Staged
Full Sample	91128	26.3 (140.1)	3.7 (2.8)	32.6 (21.1)	1308 (1672)	0.6
Panel A: Investment staging by industry						
Business Services	3513	17.7 (85.6)	3.2 (2.0)	5.3 (2.0)	1820 (2073)	0.5
Consumer Discretionary	8044	33.3 (178.1)	3.6 (3.1)	10.3 (2.3)	1159 (1415)	0.5
Energy & Utilities	1452	32.3 (114)	3.3 (2.6)	2.3 (1.4)	1616 (1877)	0.6
Financial & Insurance Services	6210	41.2 (211)	4.4 (3.4)	8.8 (3.2)	804 (1130)	0.5
Healthcare	16482	25.7 (93.1)	3.9 (2.9)	17.6 (3.1)	1399 (1704)	0.6
Industrials	2976	52.2 (224.4)	3.8 (3.0)	3.7 (0.9)	1115 (1488)	0.5
Information Technology	47637	22.2 (133.6)	3.6 (2.7)	52.3 (2.4)	1293 (1664)	0.6
Raw Materials & Natural Resources	1293	21.5 (70.0)	3.7 (3.0)	1.5 (0.3)	1254 (1595)	0.5
Real Estate	411	50.4 (136.7)	4.0 (3.0)	0.6 (0.2)	934 (1354)	0.5
Telecoms & Media	3094	26.1 (128.3)	3.6 (2.7)	5.3 (3.0)	1989 (2252)	0.5
Panel B: Investment staging by development stage						
Early Stage	58651	14.0 (45.9)	3.5 (2.5)	33.4 (21.1)	1132 (1462)	0.6
Expansion Stage	13592	45.7 (156.1)	4.5 (2.9)	31.8 (20.8)	1537 (1907)	0.6
Later/other Stages	18135	47.0 (258.2)	3.8 (3.5)	31.0 (21.5)	1681 (1980)	0.6
Buyout/Acquisition Stage	752	147.0 (371.0)	4.5 (4.2)	22.3 (16.8)	1900 (2214)	0.3
Panel C: Investment staging by the stance of monetary policy uncertainty						
Low MPU	15679	16.8 (78.7)	3.2 (2.4)	32.1 (21.1)	1858 (2064)	0.6
Medium MPU	61205	27.2 (153.9)	3.7 (2.8)	32.9 (21.2)	1334 (1658)	0.6
High MPU	14246	33.3 (132.7)	4.3 (3.2)	32.0 (21.1)	593 (741)	0.4

Note: Means are reported per variable, standard deviations between brackets. For a full definition of the variables, we refer to Table A1.

The number of syndicated partners is also collected (SyndicateSize) to control for the possible effects of a larger pool of investors on the staging duration for one portfolio company through enhanced efficiency (Huang et al., 2022). Also, in line with Huang et al. (2022), the competition in an industry in the venture capital market (VC-Comp) is also calculated as the total number of active VCs in a given industry over the total active VCs in all markets in a given year. A VC is active when he (or the syndicate) has completed a deal in a particular industry. These variables are collected in the vector V_i. See Tables A1 and A2 in the Appendix for a complete overview of the variables and summary statistics respectively.

Table 2 shows the duration in days until the new financing round, distinguished by the industry qualifications of the portfolio company, the development stage of the portfolio company, and the state of MPU (HRS). Also, other key variables relating to the investment staging are noted, such as the million US dollar amount invested in the company and the competition among VCs (expressed in percentage points). Notable is the relatively large deviations per industry segment in the duration between investments and amounts invested. Also, differences per stage of development are present in the data, showing an upwards trend in staging duration as a company progresses in the stage of development. It also shows that the amounts invested increase with the development stage. But most interesting is to see that the staging duration differs per state of MPU, where high MPU is characterized by a relatively short staging duration.

3.2.3 Exit Strategy

To analyze the effects of MPU on the duration until a VC exits its portfolio company, a sample of 67,692 unique portfolio companies is collected from the Preqin Database. These portfolio companies are all financially supported by VCs who have or have not yet exited from these portfolio companies. Of each of these companies, the type of exit vehicle is determined and classified as an Initial Public Offering (IPO), a Trade Sale or Merger (TS), a Liquidation (LIQ), as other vehicles (OTH), or as not having exited the company yet. An exit is considered as LIQ when the investment is written off, or when it is sold back to the entrepreneur since that typically implies a failed investment. Other exit vehicles encompass recapitalizations and restructuring and non-specified exit vehicles. For each of these exits, the duration in days (ExitDuration) between the date of the initial investment and the date of exit is determined. When a VC has not yet exited the portfolio company at the end of the sample period, the duration is truncated on December 31st, 2022.

Various portfolio company-specific characteristics are collected, such as the amount initially invested by the VC in the company (DealSize). In line with the findings of Giot and Schwienbacher (2007), we control for the size of the committed investment to the company since they appear to have a significant negative effect on exit times. We account for the right-skewed distribution in the data by applying a log transformation (LnDealSize). Also, the stage of development of the portfolio company is included in a similar fashion as in the staging duration analysis (ExitStage). This allows for an analysis of the portfolio company to see if it has improved on its development stage from the initial investment to the exit (Improvement). Also, the industry focus of the portfolio company is controlled for, in line with Giot and Schwienbacher (2007).

To control for other VC-related confounding factors, the size of the syndicate is included in the analysis (SyndicateSize), and the competition amongst VCs (VC-comp), similar to the analysis of the staging decisions, which is in line with (Huang et al., 2022). Also, the year of exit is included to control for general year effects. These portfolio company and VC-specific controls are captured in the vector W_i.

Table 3 describes the duration until the exit for various exit vehicles, as well as other relevant variables. These are presented by industry classification, stage of development, and the state of MPU. Notable is the increasing duration to exit when considering IPOs, Trade Sales, Liquidations, and others sequentially. This is in line with the 'pecking order' of preferred exit routes uncovered by Giot and Schwienbacher (2007). Interesting to see is the absolute number of days of the duration over the different exit vehicles is lower for extreme MPU conditions.

3.3 Macroeconomic Data Collection

To better estimate the true data-generating process of the effects of MPU on various behavioral aspects of venture capitalists, several other confounding factors on the macroeconomic level are included in every analysis. Uncertainty relating to monetary policy might be correlated with these variables, so including them results in a less biased parameter estimation of the true effect of MPU on the funding, staging, and exit actions of a VC. See Table A2 for related summary statistics.

First, the Economic Policy Uncertainty index by BBD is included (EPU-BBD) to control for the general uncertainty about macroeconomic policy. These include policies regarding fiscality, healthcare, national security, sovereign debt, and trade amongst others. This also influences corporate behavior, particularly the venture capital market (Huang et al., 2022; Baker et al., 2016). To further control for the more general uncertainty relating to the macroeconomic climate (MacroUncertainty), an uncertainty

Table 3: Key summary statistics related to the duration until a VC exits its investment

Variable	No. Obs	DealSize	Syndicate	ExitDuration			
				IPO	TS	LIQ	OTH
Full Sample	51605	20.5 (100.8)	2.1 (2.4)	825 (783)	1089 (909)	1632 (1552)	1980 (1645)
Panel A: Exits by industries							
Business Services	2236	13.4 (39.5)	1.7 (1.9)	967 (849)	1183 (922)	1745 (1588)	2423 (1683)
Consumer Discretionary	5100	23.1 (153.7)	2.0 (2.5)	926 (834)	1015 (834)	1312 (1192)	1659 (1473)
Energy & Utilities	916	22.4 (50.0)	1.6 (1.9)	902 (718)	1309 (1003)	1889 (1653)	2061 (1691)
Financial & Insurance Services	3288	28.1 (123.2)	3.2 (3.3)	864 (833)	951 (849)	1313 (1113)	1375 (1438)
Healthcare	9445	24.2 (57.8)	1.8 (2.2)	611 (658)	1133 (944)	1908 (1748)	1899 (1477)
Industrials	1903	42.9 (181.9)	2.1 (2.6)	1081 (819)	1090 (915)	1381 (1426)	1669 (1586)
Information Technology	25593	15.7 (90.6)	2.2 (2.3)	944 (843)	1069 (889)	1716 (1614)	2093 (1731)
Raw Materials & Natural Resources	894	12.8 (53.2)	1.9 (2.4)	1078 (821)	1397 (1117)	1600 (1545)	2360 (1694)
Real Estate	262	54.5 (185.0)	2.4 (2.5)	423 (427)	753 (743)	1680 (1662)	2185 (2140)
Telecoms & Media	1960	21.7 (75.9)	1.7 (2.1)	869 (708)	1166 (1022)	1755 (1819)	2567 (2025)
Panel B: Exits by development stage							
Early Stage	10348	14.1 (60.8)	0.9 (0.8)	939 (884)	1038 (845)	1545 (1435)	2157 (1659)
Expansion Stage	4426	40.6 (143.1)	0.8 (0.8)	738 (681)	1100 (918)	1686 (1659)	1883 (1569)
Later/other Stages	36123	18.2 (95.0)	2.6 (2.6)	870 (778)	1154 (983)	1840 (1741)	1985 (1685)
Buyout/Acquisition Stage	708	85.9 (252.0)	0.4 (0.7)	303 (409)	1203 (999)	877 (871)	1454 (1449)
Panel C: Exits by stance of monetary policy uncertainty							
Low MPU	4012	17.9 (50.2)	0.9 (0.8)	821 (743)	1055 (850)	979 (694)	1372 (952)
Medium MPU	44407	19.2 (98.8)	2.3 (2.5)	825 (788)	1090 (923)	1888 (1742)	2170 (1744)
High MPU	3186	37.5 (138.6)	0.9 (0.8)	835 (808)	1135 (915)	1161 (802)	1273 (1020)

Note: Means are reported per variable, standard deviations between brackets. For a full definition of the variables, we refer to Table A1.

index provided by Jurado, Ludvigson and Ng (2015) is included. These authors construct a model-free index to capture the uncertainty in various macroeconomic indicators 'at the same time, across firms, sectors, markets, and geographic regions' (Jurado et al., 2015). This measure is included since other common measures (for example GDP volatility in Huang et al. (2022)) as uncertainty-proxies might reflect fluctuations that are not related to the uncertainty of the macroeconomic climate. This index is robust for these biases. Furthermore, to control for other uncertainties, a real risk premium (RealRiskPremium) is included.[7] It measures the compensation investors require for holding inflation-protected securities, given that future short-term rates are uncertain. This measure thus captures the investor's perspective of the real risk related to real interest rates. Together with the yields on the 10-year maturity of a US treasury bill (TBILL), including these variables controls for the investor's perspective on investment choices, especially with respect to venture capital investments (both by Limited and General Partners) (Bellavitis et al., forthcomming).

To describe and control for the macroeconomic climate, the growth in the money stock is included, measured as the M2 money stock (M2growth). This is included in line with the results of Huang et al. (2022), who report significant effects of the growth in M2 on the venture capital market, especially its staging and exit actions. Also, the inflation rate, measured as changes in the total US Consumer Price Index compared with previous years, is controlled for (Inflation). Data on both variables are retrieved from the FRED database. To control for the general economic stance, an index is included that tracks the real US economy (RealGDP). A strong economy may imply relatively more VC activity, both by Limited and General Partners. This is in line with the findings of Gompers and Lerner (1999). This index is provided by S&P Global Market Intelligence and is consistent with the concept and calculation of the Gross Domestic Product. Dummy variables indicating US recessions by NBER are included to control for extreme economic conditions (Recession), in line with Huang et al. (2022), which are retrieved from FRED.

[7]Federal Reserve Bank of Cleveland, Real Risk Premium, retrieved from FRED, Federal Reserve Bank of St. Louis

Finally, to cover the activeness of the public equity market, a measure of the returns on the stock market is included (NASDAQ). This is in line with Black and Gilson (1998), who argue that a strong public market is associated with a strong venture capital market. The returns on the NASDAQ index are included since it contains relatively more innovative firms, akin to the portfolio companies VCs want to invest in. In line with Jeng and Wells (2000), the total number of IPOs by companies supported by venture capital funds is included (VC-IPO). They argue that increased VC-backed IPO exits might attract more activity since it signals a better exit option for investors. Data on this variable is collected from Ritter (2013). These ten, time-varying macroeconomic controls are captured in the vector M_t.

4 Methodology

The following section provides the methodological framework and boundaries of this analysis. We first define the groundwork for the study of the fundraising activities by General Partners. Subsequently, the methodologies for the staging and exit durations are presented. The unit of analysis shifts from the venture capital partnership that raises funds from outside investors to the individual portfolio companies of these venture capital partnerships that receive funding from their funds.

4.1 Fundraising Activities

To analyze the effects of MPU as a transmission mechanism in the decision to raise a venture capital fund, a panel regression analysis is employed. This method allows for the optimal exploitation of the nature of the dataset by controlling for individual effects relating to the specific venture capital organization. The following equation forms the basis of this analysis:

$$LnFundsize_{it} = \alpha + \beta MPU_t + \gamma_1 X_{it} + \gamma_2 M_t + u_{it}. \tag{1}$$

A Hausman test is used to select the best model specification, selecting either random or fixed effects errors. Robust standard errors are used in all specifications to address potential heteroskedasticity issues.

The dependent variable in the regression equation is the log-transformed value of committed funds to a venture capital limited partnership, expressed in million US dollars. The log transformation is used to address the right-skewed distribution of the dollar amounts of funds committed and is in line with Gompers and Lerner (1999). The variable of main interest is MPU. The index provided by Husted et al. (2020) is used as the base of this analysis. Additionally, other models are estimated using different operationalizations of MPU, relating to the two different MPU indices provided by Baker et al. (2016). The significance of the effect of MPU on the million US dollar amount committed to a fund is evaluated on the basis of the estimated coefficient β using a t-test and a five percent significance level. X_{it} is included to control for venture capital fund-specific factors and M_t is included to control for the macroeconomic stance, as defined in Section 3.2.1. M_t are variables observed on a monthly time basis, which are then matched to the unit of analysis (i.e. the individual VC funds) per observation based on the month of the final closing date of the fund, for every $t = ClosingDateMonth$.

To address potential sample selection bias concerns, an additional logit model is estimated to account for the probability of raising a fund in a given month. We only observe the funds that are successfully raised in a given month. However, a VC might decide to delay the final closing date of the fund or even decide not to raise the fund if MPU is high. Similar to Gompers and Lerner (1999), a Heckman two-stage procedure is implemented to this end. First, a logit model is estimated to predict the conditional probability of raising a fund, given the stance of MPU and other factors. Secondly, the predicted probabilities are used as an additional regressor in X_{it} from Equation 1. The first stage logit model is specified as follows:

$$FundRaised_{it} = \alpha + \beta MPU_t + \lambda_1 Z_{it} + \lambda_2 M_t + u_{it}. \quad (2)$$

The dependent variable, $FundRaised_{it}$ indicates whether a fund is raised in a particular month by a VC. MPU is also considered a predictor for the probability of raising a fund. Possible other determinants of the conditional probability of raising a fund are captured in Z_{it}. These include the value of the last fund that was raised and the number of months since the last fund was raised. Also, the same set of regressors relating to the macroeconomic conditions (M_t) is included in this specification.

4.2 Venture Capital Staging

In the analysis of venture capital staged investment, the observed durations until a VC refinances his portfolio company are likely to encompass censored data. Since we do not observe a successive financing round after the sample period ends or since a portfolio company might - unreportedly - cease to exist, the data is right-censored. We, therefore, resort to the literature on Survival Analysis and the accompanying duration models. Gompers (1995) first used these models in the context of Venture Capital staged financing, acknowledging the particular and inseparable combination of duration and success of staged financing. See also Huang et al. (2022) for their methodological outline.

Duration analysis aims to model the conditional probability that the spell (i.e. the observed duration between two events) ends given that it has not ended. In the context of staged financing by VCs, it models the conditional probability that a portfolio company receives a new funding round at time t contingent on the fact that the portfolio company has not yet received funding: $Pr[T_i = t \mid T_i \geq t]$. This conditional probability function is better known as a hazard function, modeling the 'hazard' of receiving funding within the sample period. Alternatively, the Survival Function can be estimated, giving the probability that a firm does not receive staged financing within the sample period, denoted by $S(t) = 1 - F(t) = Pr\ [T_i \geq t]$, where T_i is the duration of staying in a given state (i.e. waiting for refinancing), t is the observed time, and $F(t)$ the cumulative density function of the probability of receiving new funding. $f(t)$ denotes the probability density function of the (unconditional) probability that a portfolio company receives new funding. The hazard function $\lambda(t)$ can, therefore, be specified as follows:

$$\lambda(t) = \frac{Pr[staged\ financing\ at\ t\ ]}{Pr[no\ staged\ financing\ until\ t\ ]} = \frac{f(t)}{S(t)} = \frac{f(t)}{1 - F(t)}. \quad (3)$$

This equation thus models the instantaneous probability of receiving a new financing round given that it has not received funding yet. This hazard of receiving a staged financing round as a portfolio company can be contingent on multiple other factors besides time, such as uncertainty relating to monetary policy. MPU might delay the refinancing decision by a VC in its portfolio company. The vector X_i includes the following covariates: MPU_t, P_i, V_i, and M_t as defined in section 3.2.2. Observations of MPU and other macroeconomic controls are matched per portfolio company i using the month of the staged financing deal date, for every $t = DealDateMonth$. The hazard function can thus be more precisely described as:

$$\lambda(t_i \mid X_i) = \lim_{h \to 0} \frac{Pr[\ t\ \leq T_i < t + h \mid T_i\ \geq t\ ]}{h}. \quad (4)$$

There are two common approaches to including the explanatory variables in the hazard functions and estimating them; the Accelerated Failure Time models (AFT) and the Proportional Hazard Models (PHM) (Cox, 1975). The AFT scales the baseline failure time by the $exp(X_i'\beta)$ within the Survival Function $S(t)$ while the PHM scales the baseline hazard function $\lambda_0(t)$ (i.e. the hazard function without covariates) with that same scaling factor. Since the AFT estimates the direct effect of the covariates on the dependent variable StagingDuration (as opposed to the effect of X_i on the hazard by a PHM), this model specification is chosen. The methodological principles of the PHM are outlined in Appendix C and estimated as a robustness check.

Defining a random variable $u_i = -X_i'\beta + lnT_i$, the following regression-like equation is estimated:

$$lnT_i = X_i'\beta + u_i \;\Leftrightarrow\; T_i = exp(X_i'\beta)T_0, \tag{5}$$

where T_0 is the baseline failure time defined as $exp(u_i)$, and u_i is assumed to be a zero-mean error term and follows a predetermined distribution exogenous of X_i. In this analysis, the error term is assumed to follow a log-normal distribution, since it allows for the model to estimate a non-monotonic hazard function (i.e. the hazard may increase or decrease over time). Other error specification distributions are used as a robustness check in the Appendix.

From Equation 5 thus follows that w.l.o.g. $exp(X_i'\beta) = \alpha$ results in $1/\alpha$ as fast failure time for a given portfolio company waiting for refinancing relative to a portfolio company not affected by any of the covariates (the baseline failure time T_0). The covariates thus multiplicatively rescale (accelerate) the baseline failure time. In terms of the hazards, β can be interpreted as having an inverse relationship with the hazard, for the hazard function is specified in an AFT as $\lambda(t_i \mid X_i) = \lambda_0(exp(-X_i'\beta)t_i)exp(-X_i'\beta)$. A positive coefficient thus lowers the hazard of receiving funding, implying longer durations.

Furthermore, the time (or acceleration) ratios can be inferred by taking the exponential of the estimated coefficient. For a given individual portfolio company i with the same baseline failure time T_0 as company j, a unit change in covariate k implies $\frac{T_i}{T_j} = exp(\beta_k)$. The Maximum Likelihood estimator is adjusted to allow for censored observations using the hazard functions.

4.3 Exit Strategy

Finally, to analyze the effects of MPU as a transmission mechanism in the exit strategy (including the choice of exit vehicle and the timing), similar methodological approaches are taken. Particularly, this analysis depends on the competing risk models within the survival analysis class. The dependent variable, in this case, is the time in days from the initial investment in the portfolio company until the time of exit by the investing VC. Thereby, the VC has multiple optional mutually exclusive vehicles to exit the investment. In line with Giot and Schwienbacher (2007), we identify three possible classes of exit vehicles, each competing for the usage by the VC to liquidate the returns. These vehicles include the IPO, Trade Sale and Merger, and Liquidation. We define $\Omega = \{IPO, TS, LIQ\}$ Besides these exits, we also observe some investments not having exited the portfolio company at the end of the sample period, implying right-censored data observations. If $j \in \Omega$, T_i^j the observed exit duration for vehicle j, and c_i the censored exit duration, we thus observe $min\{T_i^j, c_i\}$ per portfolio company.

The competing risk models explicitly take into account the different modes of exits and the observations of portfolio companies that have not seen their investments being exited, which ordinary panel regressions do not take into account. These models rely on the same methodological foundations as the survival analysis models outlined in the previous subsection. Particularly, the AFT models also form the basis of this analysis. This allows us to study the particular combination of time to exit and chosen exit vehicle. The general regression equation, in line with Equation 5, thus equates:

$$lnT_i = \eta_i^j + u_i \;\Leftrightarrow\; T_i = exp(\eta_i^j)T_0, \tag{6}$$

where $j \in \Omega$, and η_i^j represents the linear predictor of covariates for exit mode j. T_0 is the baseline failure time, defined as $exp(u_i)$. u_i is assumed to be zero-mean error and to follow a log-normal distribution to allow for a non-monotonic hazard function estimation. This non-monotonic assumption is theoretically justified, for the hazard of e.g. an IPO exit may first rapidly increase and afterward decrease since longer durations to develop the company may imply a non-successful business. This is in line with the findings of Giot and Schwienbacher (2007).

The duration between the initial investment and the date of exit is captured by T_i and the hazard of exiting via vehicle j is given by Equation 4. This hazard is also contingent on other covariates (X_i), which include the portfolio company- and VC-specific controls W_i and the macroeconomic factors M_t, as defined in Section 3.2.3. Data on the MPU and other macroeconomic controls are matched per portfolio company i using the month of the staged financing deal date, for every $t = ExitDateMonth$. The main variable of interest is MPU_t. These enter Equation 6 in the following fashion:

$$\eta_i^j = MPU_t'\beta^j + W_i'\gamma_1^j + M_t'\gamma_2^j. \tag{7}$$

The estimation of these three resulting regression equations follows a Maximum-Likelihood procedure. The Likelihood function is adjusted to account for right-censored observations, which include the investments not exited yet (c_i) and all observations for which $k \in \Omega$, and $k \neq j$ (Giot & Schwienbacher, 2007). The estimated coefficient β^j is evaluated on a five percent significance level and can be interpreted as being positively related to the exit duration and inversely related to the hazard of exit j. The higher the coefficient, the lower the hazard, and thus the longer the exit duration.

For the interpretation of the estimated coefficients in the AFT model, we also resort to the concept of time ratios, where for a given individual portfolio company i with the same baseline failure time T_0 as company j, a unit change in covariate k implies $\frac{T_i}{T_j} = exp(\beta_k)$.

5 Results

5.1 Fundraising Activities

For the discussion on the fundraising regression results without the Heckman correction term and its consequential logit model estimation, we refer to Appendix B, Tables A3 and A4. The results of the estimation of Equation 1, which includes the conditional probability estimated using Equation 2, are presented in Table 4. The equations are estimates using a different set of regressors, where three different MPU measures are included. Six models are included in the Table, which differ in the MPU index employed, featuring either the MPU-HRS, MPU-BBDw or the MPU-BBD10 index. The variable Pr-FundRaised for Models 1 to 6 corresponds to the conditional probability estimates of raising a venture capital fund reported in the respective models 1 to 6 from Table A4.

The results show a weak significant effect of MPU on the amount raised in venture capital funds. Depending on the chosen operationalization of MPU, this effect is either significant or not. Only using the MPU-BBDw index we find positive and significant effects of MPU on the size of the venture capital fund raised, measured in log-transformed million US dollars. Model 4 reports a significant and positive coefficient of 0.0015. This results in an estimated effect of a 9.0 percent increase in fund size as a result of one standard deviation increase in MPU.[8] Based on these preliminary results, we conclude merely a positive effect of MPU on the value of a venture capital fund.

Leveraging these scare indications, we note that this positive relationship is in line with our earlier outlined expectations. Bellavitis et al. (forthcomming) already suggested that VCs play an uncertainty-reducing role. A positive relationship between MPU and the fund size thus further supports this argument. We find no evidence for the contrasting argument that high MPU might result in smaller venture capital funds due to the increased risk premium and thus increased cost of capital. The coefficients of TBILL show positive and significant relationships in all models, indicating that higher interest rates are associated with larger funds. This contradicts any remarks that the interest rate (here proxied as the yield on the treasury bill) has an opposite effect on the size of a VC fund than MPU.

Finally, we note based on the results in Table 4 that uncertainty related to the broader macroeconomic

[8] Coefficients are multiplied by 100. See Table A2 for relevant summary statistics

Table 4: Regression results on the size of a VC fund including the Heckman correction term

	Dependent Variable: LnFundsize					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.0005	0.0007				
	(0.0003)	(0.0005)				
MPU-BBDw			0.0001	0.0015**		
			(-0.0004)	(-0.0007)		
MPU-BBD10					-0.0002	0.0005
					(0.0004)	(0.0006)
ValuePastFunds		0.0000**		0.0000**		0.0000**
		(0.0000)		(0.0000)		(0.0000)
DaysSinceLastFund		-0.0000		-0.0000		-0.0000
		(0.0001)		(0.0001)		(0.0001)
NoFundsMonth		0.3989***		0.4004***		0.3995***
		(0.0985)		(0.0983)		(0.0979)
FundNumber		-0.0006		-0.0008		-0.0005
		(0.0040)		(0.0040)		(0.0040)
Syndicate		1.2220***		1.2245***		1.2218***
		(0.1455)		(0.1452)		(0.1447)
EPU-BBD		-0.0020***		-0.0025***		-0.0021**
		(0.0007)		(0.0008)		(0.0008)
Inflation		0.1739**		0.1765**		0.1786**
		(0.0744)		(0.0743)		(0.0746)
M2growth		0.0785		0.0734		0.0792
		(0.0519)		(0.0516)		(0.0518)
MacroUncertainty		2.5968***		2.3928***		2.5921***
		(0.6079)		(0.6041)		(0.6149)
NASDAQ		-0.0045		-0.0011		-0.0053
		(0.0061)		(0.0068)		(0.0062)
RealGDP		0.0001***		0.0001***		0.0001***
		(0.0000)		(0.0000)		(0.0000)
RealRiskPremium		-0.3191		-0.3742		-0.3999
		(0.4716)		(0.4724)		(0.4790)
Recession		0.0199		-0.0094		-0.0124
		(0.1224)		(0.1227)		(0.1232)
TBILL		0.1418***		0.1379***		0.1546***
		(0.0452)		(0.0436)		(0.0460)
VC-IPO		0.0417***		0.0419***		0.0401***
		(0.0102)		(0.0100)		(0.0101)
CGTR		0.0040		0.0082		0.0088
		(0.0136)		(0.0132)		(0.0134)
PrFundRaised	-0.3829	-27.3184***	-0.1131	-27.3812***	-0.1714	-27.7124***
	(3.4582)	(7.6017)	(3.4120)	(7.5300)	(3.3814)	(7.5216)
Constant	3.8105***	-1.7340*	3.8671***	-1.8037*	3.9142***	-1.8887**
	(0.0860)	(0.9443)	(0.0826)	(0.9334)	(0.0864)	(0.9300)
Panel B:						
Error Specification	FE	FE	FE	FE	FE	FE
Observations	3588	3557	3588	3557	3588	3557
Groups	1237	1232	1237	1232	1237	1232
R^2	0.00	0.10	0.00	0.10	0.00	0.10
Adjusted R^2	0.00	0.09	0.00	0.09	0.00	0.09
F statistic	0.93	9.97***	0.04	10.04***	0.19	9.91***
P-value Hausman	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Heckman corrected OLS panel regression estimates for Equation 1. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. In this case, the Hausman test advocated for a fixed effects specification in all models. PrFundRaised denotes the estimated probability of raising a fund for a given month, following the results of Table A4. PrFundRaised for column (1) corresponds to the estimates of column (1) in Table A4 etc. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics, including the number of observations, the number of unique groups (venture capital limited partnerships), the R^2, the Adjusted R^2, the significance of the total model (F-statistic with significance stars), and the p-value of the Hausman test.

climate significantly and positively affects the size of the venture capital fund. When evaluating the joint significance of MPU and the MacroUncertainty, the F-statistics for Models 2, 4, and 6 are respectively 9.7, 10.6, and 9.0, implying joint significance for these two variables. We suggest, due to the large scope of the consequences of monetary policy on the economy, that a possible mediating effect is present, where the effect of MPU on the size of the fund is partly captured by an altered macroeconomic climate.

Table 5: Interaction effects in the effect of MPU on the size of the VC fund under high MPU

	Dependent Variable: LnFundsize					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.0035			0.0352		
	(0.0029)			(0.0357)		
MPU-BBDw		0.0019			0.3059***	
		(0.0037)			(0.0814)	
MPU-BBD10			0.0038*			0.0629**
			(0.0023)			(0.0286)
MPUxMacroUncertainty				-0.0329	-0.3134***	-0.0627**
				(0.0375)	(0.0834)	(0.0306)
ValuePastFunds	0.0001	0.0001	0.0001	0.0001	0.0001*	0.0001
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
DaysSinceLastFund	0.0000	-0.0001	-0.0001	-0.0000	0.0000	-0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
NoFundsMonth	0.2810***	0.2820***	0.2762***	0.2828***	0.2510***	0.2801***
	(0.0855)	(0.0865)	(0.0880)	(0.0877)	(0.0774)	(0.0854)
FundNumber	0.0013	0.0020	0.0018	0.0016	0.0007	0.0025
	(0.0100)	(0.0098)	(0.0097)	(0.0103)	(0.0090)	(0.0091)
Syndicate	1.1135***	1.1116***	1.1205***	1.1398***	1.0803***	1.1003***
	(0.3704)	(0.3666)	(0.3668)	(0.3589)	(0.3791)	(0.3777)
EPU-BBD	-0.0056**	-0.0058	-0.0078**	-0.0062**	-0.0144***	-0.0086***
	(0.0027)	(0.0039)	(0.0032)	(0.0028)	(0.0043)	(0.0030)
Inflation	1.0413***	0.9096**	1.2119**	1.1907***	2.0903***	1.4026***
	(0.3806)	(0.3641)	(0.4733)	(0.3997)	(0.4550)	(0.4845)
M2growth	0.8516**	0.9610**	0.9206**	0.9115**	1.7779***	0.8508**
	(0.3819)	(0.4019)	(0.3928)	(0.3915)	(0.4324)	(0.3818)
MacroUncertainty	13.0981***	11.6692**	11.6182***	23.1659*	61.2133***	33.4448***
	(4.9921)	(4.6326)	(4.4687)	(11.9437)	(14.6649)	(11.6318)
NASDAQ	0.0257	0.0207	0.0472	0.0346	0.1127***	0.0637
	(0.0267)	(0.0254)	(0.0388)	(0.0262)	(0.0377)	(0.0395)
RealGDP	-0.0002	-0.0001	-0.0001	-0.0002	-0.0007*	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)
RealRiskPremium	-0.8139	-0.8771	0.4442	-0.7965	-4.4782*	-2.3400
	(2.2456)	(2.2953)	(2.4452)	(2.2446)	(2.4582)	(2.9258)
Recession	-3.4692	-3.1326	-2.4007	-3.6414	-12.1295***	-5.4891*
	(2.9614)	(3.2265)	(2.7509)	(2.9551)	(4.2814)	(3.0550)
TBILL	0.7487*	0.5914	0.5430	0.8022*	2.4794***	1.0083**
	(0.4385)	(0.3604)	(0.3486)	(0.4359)	(0.5900)	(0.4076)
VC-IPO	0.0733	0.0555	0.0529	0.0631	-0.0257	0.0413
	(0.0697)	(0.0709)	(0.0644)	(0.0708)	(0.0729)	(0.0639)
PrFundRaised	-67.2100**	-72.6770**	-71.5459**	-68.6593**	-71.6233**	-71.5912**
	(29.1175)	(29.1994)	(29.2204)	(29.0900)	(28.8639)	(28.7625)
Constant	-6.3958*	-6.0934	-7.5449**	-15.5278	-40.0704***	-18.6323***
	(3.7692)	(4.4974)	(3.7989)	(10.2362)	(9.6215)	(5.9043)
Panel B:						
Error Specification	FE	FE	FE	FE	FE	FE
Observations	703	703	703	703	703	703
Groups	463	463	463	463	463	463
R^2	0.21	0.21	0.21	0.21	0.24	0.22
Adjusted R^2	0.19	0.19	0.19	0.19	0.22	0.21
F statistic	8.59***	9.46***	9.38***	9.20***	12.22***	8.90***

Notes: Heckman corrected OLS panel regression estimates for Equation 1. The sample is restricted to periods of high MPU, which are characterized by the largest 15 percentile of the MPU-HRS distribution over the period 2000 to 2022. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. For Models 4 to 6, an interaction term between MPU and MacroUncertainty is added. PrFundRaised denotes the estimated probability of raising a fund for a given month, following the results in Table A4. PrFundRaised for column (1) corresponds to the estimates of column (2) in Table A4, (2) with (4), and (3) with (6), repeated also for the last three columns of this table. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics, including the number of observations used to estimate the models, the number of unique groups (venture capital limited partnerships), the R^2, the Adjusted R^2, and the significance of the total model (F-statistic with significance stars).

To further uncover the heterogeneous effects of MPU on the size of the VC fund, we additionally estimate Equation 1 for a different sample period. We restricted the sample of venture capital funds using the largest 10 percent of the MPU distribution over the sample period, effectively studying the relationship between MPU and FundSize in a high-MPU context. The alternative sample is selected based on the MPU index by HRS. The results are presented in Table 5, Models 1 to 3. These results do not imply different conclusions. We, however, do note that the coefficients of MacroUncertainty have increased in absolute size, indicating that the effect of the uncertainty related to the economic climate is more pronounced in times of high MPU.

Based on the observation that macroeconomic uncertainty may moderate the effect of MPU on the fund size and that macroeconomic uncertainty is more important in times of high MPU, we include an additional interaction term between MPU and MacroUncertainty. These results are presented in Models 4 to 6 of Table 5 and relate to the same altered sample period as Models 1 to 3. We note several interesting results for this restricted sample.

First, in line with the previous conclusion, the effect of MPU on the size of the venture capital fund is positive, resulting in larger funds if MPU increases in times of high monetary policy uncertainty. However, these effects are more pronounced and (highly) significant for Models 5 and 6. This further confirms our hypothesis that MPU increases the size of a venture capital fund. Based on Model 5, this effect is quantifiable as a 35.8 percent increase in the fund size as a result of one index point increase in the BBDw index.[9]

Second, the included interaction term between MPU and the uncertainty related to the macroeconomic climate is significant and negative for Models 5 and 6. This indicates a negative omitted variable bias in the previous estimations of the MPU effects without an interaction term for this restricted sample. By including this term, we, therefore, explicitly control for the multiplicative effect of MacroUncertainty and MPU on the size of the fund, which tends to be a negative contributor to the fund size. This confirms the previously raised concern that the effect of MPU is moderated by the effects of MacroUncertainty.

Third, we further confirm that EPU is negatively associated with the size of a venture capital fund. In line with Table 4, most models in Table 5 report significant and negative coefficients. This may further support the argument that a VC plays a unique save-heaven role in times of extreme MPU. Uncertainty relating to other policies has a negative effect, thus warding off potential investors, while MPU has a positive effect on the fund size.

5.2 Venture Capital Staging

Following the lifecycle of the venture capital market, we investigate the potential consequences of MPU as a transmission mechanism in the venture capital market as having an effect on the staging durations. To this end, Equation 5 is estimated. The results of the AFT models are presented in Table 6 and relate to the time in days until a VC refinances his portfolio company. The models differ in MPU measure employed as covariate, relating either to the MPU-HRS, MPU-BBDw, or the MPU-BBD10 index. Robustness checks for different error specifications and PHM models are performed and discussed in Appendix C.

Table 6 reports positive and highly significant estimates of the effect of MPU on the duration of days between successive VC-financing rounds. Even after controlling for EPU-BBD, MacroUncertainty, and RealRiskPremium (all direct measures of uncertainty), the estimated effect of MPU on the duration is still significant for all three operationalizations of MPU. The estimated direction of this relationship is positive, which provides evidence for the real options argument; MPU positively affects the duration between new financing rounds since it favors a wait-and-see strategy by the investor to wait and analyze its future potential profitability (Bernanke, 1983). This effect is quantifiable for e.g. Model 2 at $exp(0.0010)$, yielding a time-to-event ratio of 1.001. This implies that the survival time (i.e. the duration until a

[9]Effects of MPU on the fund size is $\%\Delta = (exp(\beta^{MPU-BBDw}) - 1) * 100\%$

Table 6: Survival analysis results of the effects of MPU on the duration between staging rounds

	Dependent Variable: LnDuration					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.0007***	0.0010***				
	(0.0001)	(0.0002)				
MPU-BBDw			0.0012***	0.0037***		
			(0.0002)	(0.0003)		
MPU-BBD10					-0.0005***	0.0007***
					(0.0001)	(0.0002)
EstYear		0.0249*		0.0415***		0.0114
		(0.0138)		(0.0138)		(0.0135)
InvestmentRound		-0.7899***		-0.7961***		-0.7920***
		(0.0106)		(0.0106)		(0.0106)
LnDealsize		0.0763***		0.0769***		0.0769***
		(0.0070)		(0.0070)		(0.0070)
SyndicateSize		0.0116***		0.0107**		0.0123***
		(0.0043)		(0.0044)		(0.0043)
VC-Comp		-1.6546***		-1.5412***		-1.5488***
		(0.4230)		(0.4231)		(0.4225)
EPU-BBD		-0.0016***		-0.0032***		-0.0017***
		(0.0003)		(0.0003)		(0.0003)
Inflation		-0.0311		-0.0331		-0.0300
		(0.0254)		(0.0255)		(0.0255)
M2growth		-0.0937***		-0.1068***		-0.0887***
		(0.0229)		(0.0230)		(0.0230)
MacroUncertainty		2.1009***		1.8135***		2.0892***
		(0.2307)		(0.2316)		(0.2314)
NASDAQ		-0.0148***		-0.0069***		-0.0150***
		(0.0024)		(0.0025)		(0.0024)
RealGDP		-0.0000		-0.0001		0.0000
		(0.0000)		(0.0000)		(0.0000)
RealRiskPremium		0.9390***		0.9819***		0.9776***
		(0.2165)		(0.2174)		(0.2169)
Recession		-0.1100*		-0.1521***		-0.1476**
		(0.0588)		(0.0585)		(0.0584)
TBILL		0.1118***		0.1050***		0.1128***
		(0.0227)		(0.0227)		(0.0228)
VC-IPO		-0.0125***		-0.0060**		-0.0141***
		(0.0028)		(0.0029)		(0.0029)
Constant	7.4027***	-44.9079*	7.4026***	-77.9624***	7.5782***	-18.6734
	(0.0220)	(27.1883)	(0.0205)	(27.2064)	(0.0245)	(26.5892)
DevStage Fixed Effects	No	Yes	No	Yes	No	Yes
Industry Fixed Effects	No	Yes	No	Yes	No	Yes
Panel B:						
Observation	62053	45721	62053	45721	62053	45721
LR Chi2	30.98***	6754.15***	37.87***	6850.88***	11.35***	6733.63***
AIC	158196.0	113634.6	158189.1	113537.8	158215.6	113655.1
BIC	158223.1	113905.2	158216.2	113808.5	158242.7	113925.7
Distribution	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal

Notes: Lognormal AFT regression results for Equation 5. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. DevStage Fixed Effects denote whether dummies of the current state of the portfolio company are included, and Industry Fixed Effects denote whether dummies relating to the focal industry of the portfolio company are included. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

new financing round) increases by 0.1 percent when the MPU-index increases by one index point, or equivalently by 6.9 percent if the index increased by one standard deviation (Table A2).

The Table indicates significant negative relationships between the duration between investment stage rounds and EPU. This implies that uncertainty related to other economic policies besides monetary policy

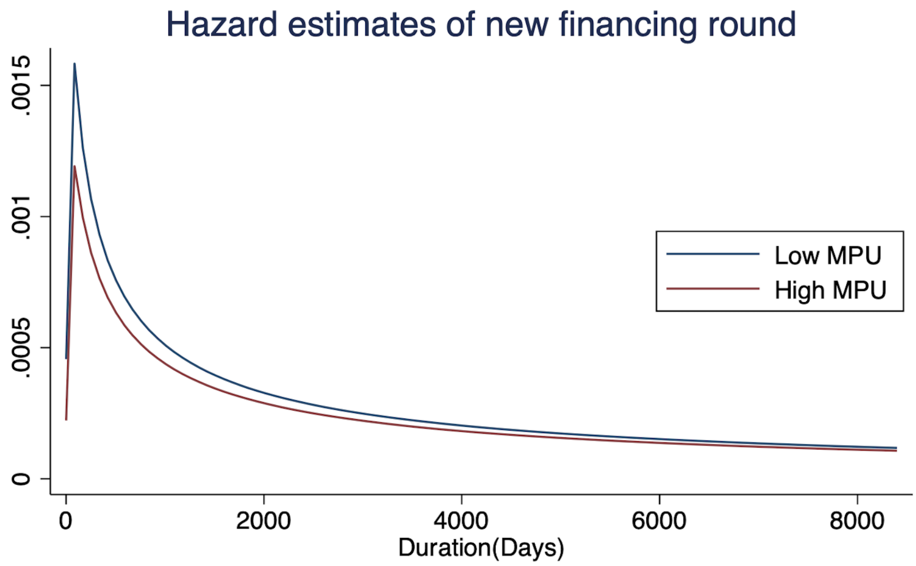

Figure 3: Hazard Function Estimates of hazard to receive staged funding under different MPU stances, using Model 2, Table 6 and log-normal errors.

has a negative effect on the duration, implying more investments by VCs. For Model 2 e.g. this coefficient is -0.0016, implying a time ratio of 0.998.

Figure 3 shows the estimated hazard function based on Model 2 of Table 6. These hazard functions are plotted based on high and low MPU values, relating to the extreme values of the MPU-HRS index. This visually confirms the above-stated conclusion that increased uncertainty related to US monetary policy increases the duration between VC-financing rounds. The hazard of receiving new financing is lower under high MPU. The Figure also indicates that - independent of the MPU stance - the hazard of receiving new funding sharply increases at the beginning of the waiting time and later trails off. This may indicate that several factors such as agency costs, which decrease duration times (Gompers, 1995; Li, 2008), are dominant in earlier phases of the staging, while later losing their power to increase the hazard.

Based on these findings we thus conclude that MPU has a unique and distinct effect as a separate monetary policy transmission mechanism on the duration of staging rounds by VCs in their portfolio companies. We embed these results in the framework of real options, arguing that MPU increases the value of the real option to abandon and thus promotes the VC to wait to invest. This contributes to the literature on the determinants of staging duration by VCs.

However, these results also put the findings by Huang et al. (2022) in contrast. The authors report a significant and positive effect of EPU on the duration between financing rounds by Chinese VCs, embedding this result also in a real-option framework. However, we report only a significant and positive effect of MPU on the duration. Uncertainty related to other economic policies - captured by the EPU-BBD coefficient while controlling for MPU - yields significant negative effects on this duration in our sample. We provide two suggestive arguments for this particular observation and provide some critical remarks on the conclusions drawn in Huang et al. (2022).

First, we stress as an implication of our results that MPU has a particular and unique effect on corporate actions. Our results thus confirm the findings by Adra et al. (2020) and Bauer et al. (2022). We note that MPU has a significantly different effect than other EPU aspects on investment behavior. We thus provide evidence on the effects of the uncertainty transmission channel of monetary policy in the VC market.

Secondly, we suggest that both EPU and MPU affect the value of the real option heterogeneously,

Table 7: Interaction dynamics in the effects of MPU on staging duration

	Dependent Variable: LnDuration					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.0015***			0.0010***		
	(0.0005)			(0.0002)		
MPU-BBDw		0.0052***			0.0040***	
		(0.0006)			(0.0003)	
MPU-BBD10			0.0024***			0.0007***
			(0.0004)			(0.0002)
EPUxVC-Comp	0.0002	0.0002	0.0002			
	(0.0007)	(0.0007)	(0.0007)			
MPUxEPU	-0.0000	-0.0000***	-0.0000***			
	(0.0000)	(0.0000)	(0.0000)			
MPUxRecession				-0.0004	-0.0021***	-0.0013**
				(0.0009)	(0.0006)	(0.0005)
EstYear	0.0246*	0.0498***	0.0161	0.0250*	0.0479***	0.0152
	(0.0138)	(0.0140)	(0.0136)	(0.0139)	(0.0140)	(0.0136)
InvestmentRound	-0.7898***	-0.7962***	-0.7924***	-0.7899***	-0.7966***	-0.7920***
	(0.0106)	(0.0106)	(0.0106)	(0.0106)	(0.0106)	(0.0106)
LnDealsize	0.0761***	0.0762***	0.0757***	0.0763***	0.0769***	0.0767***
	(0.0070)	(0.0070)	(0.0070)	(0.0069)	(0.0070)	(0.0070)
SyndicateSize	0.0115***	0.0104**	0.0118***	0.0116***	0.0107**	0.0123***
	(0.0043)	(0.0044)	(0.0043)	(0.0043)	(0.0044)	(0.0043)
VC-Comp	-1.6616***	-1.4968***	-1.5020***	-1.6482***	-1.5078***	-1.5373***
	(0.4240)	(0.4245)	(0.4238)	(0.4232)	(0.4232)	(0.4225)
EPU-BBD	-0.0012**	-0.0024***	-0.0000	-0.0016***	-0.0033***	-0.0016***
	(0.0005)	(0.0005)	(0.0005)	(0.0003)	(0.0003)	(0.0003)
Inflation	-0.0322	-0.0452*	-0.0441*	-0.0309	-0.0439*	-0.0386
	(0.0254)	(0.0257)	(0.0256)	(0.0254)	(0.0256)	(0.0257)
M2growth	-0.0953***	-0.0761***	-0.0568**	-0.0930***	-0.0938***	-0.0740***
	(0.0229)	(0.0246)	(0.0239)	(0.0230)	(0.0233)	(0.0238)
MacroUncertainty	2.0689***	1.7684***	2.1274***	2.0823***	1.6917***	2.0445***
	(0.2325)	(0.2323)	(0.2319)	(0.2345)	(0.2340)	(0.2321)
NASDAQ	-0.0149***	-0.0079***	-0.0154***	-0.0150***	-0.0088***	-0.0168***
	(0.0024)	(0.0025)	(0.0024)	(0.0024)	(0.0026)	(0.0026)
RealGDP	-0.0000	-0.0001**	-0.0000	-0.0000	-0.0001*	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RealRiskPremium	0.9092***	0.9095***	0.8682***	0.9283***	0.8905***	0.9246***
	(0.2177)	(0.2184)	(0.2182)	(0.2179)	(0.2190)	(0.2180)
Recession	-0.1045*	-0.1364**	-0.1550***	-0.0695	0.1330	0.0653
	(0.0590)	(0.0587)	(0.0585)	(0.1091)	(0.0993)	(0.1055)
TBILL	0.1158***	0.1195***	0.1351***	0.1130***	0.1135***	0.1199***
	(0.0229)	(0.0231)	(0.0233)	(0.0228)	(0.0229)	(0.0230)
VC-IPO	-0.0125***	-0.0061**	-0.0142***	-0.0124***	-0.0045	-0.0136***
	(0.0028)	(0.0029)	(0.0029)	(0.0029)	(0.0029)	(0.0029)
Constant	-44.4433	-94.3307***	-28.2573	-45.2072*	-90.3336***	-26.2057
	(27.1885)	(27.6045)	(26.6719)	(27.1964)	(27.4322)	(26.7676)
DevStage Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Panel B:						
Observation	43174	43174	43174	43174	43174	43174
LR Chi2	7209.43***	7340.95***	7275.76***	7238.47***	7353.34***	7248.31***
AIC	104478.3	104346.8	104412.0	104447.3	104332.4	104437.4
BIC	104764.5	104633.0	104698.2	104724.8	104609.9	104714.9
Distribution	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal

Notes: Lognormal AFT regression results for Equation 5. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. DevStage Fixed Effects denote whether dummies of the current state of the portfolio company are included, and Industry Fixed Effects denote whether dummies relating to the focal industry of the portfolio company are included. For the interaction terms, MPU refers to the MPU measure by the index used in that same model as the variable of main interest. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

which is previously unrecognized by the literature in the context of venture capital staging. More specifically, we suggest evidence embedded in a real-option framework that EPU has a positive effect on the value of the growth option, while MPU has a positive effect on the value of the option to abandon. EPU may positively affect the inclination to invest since waiting to update beliefs on future states may be too costly (Tajaddini & Gholipour, 2021). Horra et al. (2022) add to this that R&D investments are akin to purchasing a call-option, which increases in value as uncertainty/volatility increases. The authors report significant positive effects of EPU on the investment in R&D companies. We argue that venture capital investments in portfolio companies - typically innovative firms - are also akin to purchasing call options in an R&D company. This justifies the negative effect of EPU on staging durations reported. Contrarily, MPU might have a more pronounced effect on the real option to abandon, as a higher MPU might imply that it is more valuable to wait and update beliefs on future states. This can be attributed to the far-reaching scope and consequences of monetary policy for both financial and real markets (Di Maggio & Kacperczyk, 2017; Taylor, 2000). Its second moment can also exhibit these far-reaching consequences, resulting in the benefits of waiting to invest outweighing the costs of waiting. This may explain the results by Huang et al. (2022) since the MPU-component within EPU has an opposite effect than other policies that can outweigh the effects of those policies.

However, Huang et al. (2022) does address the potential effects of the growth option on the effects of EPU on VC staging. The authors argue that the existence of growth options may mitigate some positive effects of EPU on staging duration. They report significant negative coefficients of an interaction term between EPU and competition amongst VCs, which is used as a proxy for the existence of growth options in a market. In Table 7, Models 1 to 3, we also included a similar term with the respective MPU indices, yielding insignificant estimates for this interaction term for all three models. Models 1 to 3 do remain to be significant and positive with respect to the MPU coefficients and significant and negative to the EPU and VC-Comp coefficients. We, therefore, suggest that the growth option-effect may not only be present in a VC-competitive environment but may be the apparent nature of EPU, which Huang et al. (2022) have overlooked to address.

To further confirm the suggestive evidence that MPU is a unique transmission mechanism, an additional interaction term between MPU and EPU is estimated in Models 1 to 3 of Table 7. These yield significant negative coefficients. This implies that the effect of MPU is moderated when EPU is high. This thus confirms the positive effects of EPU on the value of the growth option, incentivizing a VC to invest earlier. We, therefore, stress the uniqueness of MPU as a separate transmission channel of monetary policy and argue that Huang et al. (2022) missed an important predictor of VC staging.

Besides, we do report moderating forces on the positive effect of MPU on the duration of bad economic business cycles. Particularly, we report in line with (Huang et al., 2022) that MPU increases the staging duration, which is less prominent in times of economic recession. See Table 7, Models 4 to 6 where an interaction term between MPU (corresponding to the chosen index per model) and the Recession indicators are included.

5.3 Exit Strategy

To complete the analysis of the scope of MPU as a transmission mechanism in the venture capital market, several competing risk models are estimated per exit strategy $j \in \Omega$ corresponding to Equation 6. Results without interaction terms are presented in Table A6 in the Appendix, as well as several robustness checks. In line with the conclusions drawn in the previous section that EPU has a moderating effect on the relationship between MPU and (staging) durations, we additionally control for an interaction effect between MPU and EPU. The estimated coefficients per exit vehicle are presented in Table 8. The models differ in MPU index employed, where the HRS and the two BBD indices are used.

Table 8: Regression results of the effect of MPU on the duration until exit

	IPO			TS			LIQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A:									
MPU-HRS	0.0032***			0.0036***			0.0001		
	(0.0010)			(0.0004)			(0.0009)		
MPU-BBDw		0.0090***			0.0104***			0.0036***	
		(0.0012)			(0.0005)			(0.0010)	
MPU-BBD10			0.0039***			0.0047***			0.0002
			(0.0009)			(0.0004)			(0.0008)
EPUxMPU	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000	-0.0000**	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnDealsize	-0.3289***	-0.3188***	-0.3267***	-0.0439***	-0.0405***	-0.0445***	0.0803***	0.0814***	0.0802***
	(0.0139)	(0.0138)	(0.0139)	(0.0054)	(0.0054)	(0.0054)	(0.0097)	(0.0097)	(0.0097)
SyndicateSize	3.1708***	3.1483***	3.1720***	-0.0791***	-0.0831***	-0.0774***	2.3812***	2.3696***	2.3846***
	(0.0682)	(0.0676)	(0.0682)	(0.0051)	(0.0051)	(0.0051)	(0.0592)	(0.0590)	(0.0593)
VC-Comp	0.7979***	0.9510***	0.8144***	1.7010***	1.7240***	1.7037***	0.1328	0.1584	0.1155
	(0.1609)	(0.1616)	(0.1611)	(0.0717)	(0.0716)	(0.0719)	(0.1139)	(0.1141)	(0.1140)
EstYear	0.0641**	0.1265***	0.0837***	0.0479***	0.1660***	0.1076***	0.0222	0.0744***	0.0457*
	(0.0291)	(0.0285)	(0.0281)	(0.0125)	(0.0125)	(0.0123)	(0.0255)	(0.0247)	(0.0246)
Improvement	-0.0617	-0.0661	-0.0628	0.1234***	0.1058***	0.1306***	-0.3282***	-0.3267***	-0.3275***
	(0.0549)	(0.0546)	(0.0549)	(0.0218)	(0.0219)	(0.0219)	(0.0516)	(0.0515)	(0.0517)
EPU-BBD	0.0013	-0.0026***	-0.0003	0.0031***	-0.0024***	0.0008*	-0.0008	-0.0019***	-0.0015*
	(0.0009)	(0.0008)	(0.0010)	(0.0004)	(0.0003)	(0.0004)	(0.0007)	(0.0006)	(0.0008)
Inflation	0.0000	-0.0001*	-0.0000	0.0003***	-0.0001***	0.0000	0.0001	-0.0001	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
M2growth	0.1860***	0.1514***	0.1766***	0.3739***	0.3434***	0.3795***	0.1435***	0.1495***	0.1483***
	(0.0456)	(0.0456)	(0.0463)	(0.0201)	(0.0202)	(0.0205)	(0.0378)	(0.0378)	(0.0382)
MacroUncertainty	0.0084	0.0231***	0.0136**	0.0179***	0.0312***	0.0242***	-0.0009	0.0033	0.0003
	(0.0054)	(0.0055)	(0.0054)	(0.0021)	(0.0022)	(0.0022)	(0.0046)	(0.0048)	(0.0046)
NASDAQ	0.2527*	0.2881*	0.2227	-0.5696***	-0.4726***	-0.5848***	-0.8937***	-0.8388***	-0.8938***
	(0.1519)	(0.1498)	(0.1511)	(0.0508)	(0.0503)	(0.0504)	(0.1031)	(0.1026)	(0.1021)
RealGDP	3.0991***	2.3662***	3.4881***	2.0752***	2.0482***	2.9315***	3.7923***	3.7891***	4.0807***
	(0.4461)	(0.4457)	(0.4394)	(0.1874)	(0.1850)	(0.1851)	(0.3652)	(0.3576)	(0.3541)
RealRiskPremium	1.9742***	1.7186***	2.0406***	1.1492***	0.9079***	1.1973***	1.2208***	1.0232***	1.2306***
	(0.4374)	(0.4327)	(0.4371)	(0.1882)	(0.1875)	(0.1892)	(0.3564)	(0.3542)	(0.3553)
Recession	-0.0468	-0.0111	0.0045	0.1282***	0.1990***	0.2082***	0.0468	0.0468	0.0418
	(0.0490)	(0.0528)	(0.0500)	(0.0214)	(0.0228)	(0.0220)	(0.0410)	(0.0427)	(0.0406)
TBILL	-0.5278***	-0.4690***	-0.5252***	-0.5860***	-0.5670***	-0.6101***	-0.3276***	-0.3061***	-0.3320***
	(0.0519)	(0.0527)	(0.0523)	(0.0207)	(0.0209)	(0.0209)	(0.0469)	(0.0475)	(0.0472)
VC-IPO	-0.0669***	-0.0499***	-0.0616***	-0.0573***	-0.0288***	-0.0449***	-0.0073	0.0054	-0.0042
	(0.0059)	(0.0060)	(0.0059)	(0.0028)	(0.0029)	(0.0028)	(0.0062)	(0.0065)	(0.0063)
Constant	-126.9343**	-248.5705***	-165.4793***	-98.1929***	-329.2336***	-215.5079***	-44.1363	-146.2429***	-90.2950*
	(57.0651)	(56.0289)	(55.2275)	(24.4777)	(24.5624)	(24.0575)	(50.1415)	(48.5754)	(48.2273)
DevStage Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B:									
Observation	49108	49108	49108	50215	50215	50215	50988	50988	50988
LR Chi2	16170.54***	16255.66***	16181.04***	28569.12***	28829.77***	28397.09***	10383.12***	10390.33***	10374.01***
AIC	13846.9	13761.74	13836.4	51667.3	51406.6	51839.3	9802.5	9795.3	9811.6
BIC	14128.5	14043.4	14118.0	51949.7	51689.0	52121.7	10085.3	10078.1	10094.4
Distribution	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal

Notes: Lognormal AFT regression in competing risk environment for Equation 6. The models presented correspond to three different exits; IPOs, trade sales, and liquidations. The first column of Panel A denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in the choice of MPU measurement. Stage and Industry fixed effects dummies are included in all models. The interaction term between EPU and MPU corresponds to the MPU measurement in that specific model. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

Table 8 reports highly significant and positive coefficients corresponding to the IPO exit and Trade Sale exit vehicles for all three measurements of MPU. For Model 1, corresponding to the time to an IPO exit and using the HRS index, the estimated time ratio is 1.0032, implying 0.32 percent longer survival times until a VC exits its investment via an IPO if MPU increases with one index point. Similar significant estimates of the MPU coefficients are found for the strategy to exit the investment in the portfolio company via a Trade Sale or Merger. This indicates that higher uncertainty levels regarding monetary policy will likely result in longer durations until a VC exits its investment in a portfolio company via either of these successful exit vehicles. However, we do not report such robust results of the choice of Liquidation as the exit vehicle, implying that MPU has a more pronounced effect as a transmission mechanism for typical successful exit vehicles. We only report weak but positive effects for the Liquidation mode, being only significant and positive for Model 8.

These results thus provide early evidence on the mechanisms of MPU via the uncertainty channel by Bauer et al. (2022) in the context of VC exits. These results add to the findings by Giot and Schwienbacher (2007), who suggested that reduced uncertainty may accelerate exits. Also, these findings are in line with e.g. Bauer et al. (2022) and Kroencke et al. (2021), who investigate the effects of MPU on the transmission of monetary policy on the financial (equity) markets. Both studies suggest negative relationships. As presented in Metrick and Yasuda (2021), the success of VC exits critically depend on the access and stance of the public equity markets. Our results of the negative relationship between MPU and the inclination to exit via either an IPO or TS are thus in line with these previous studies.

However, when comparing the results of Table 8 with those of Huang et al. (2022), we again note some important differences. The authors report a positive effect of EPU on the duration between the initial investment and the time of a successful exit, implying that higher uncertainty related to all economic policies increases the value of waiting to exit. However, based on the results presented in Table A6, our study presents negative coefficients for EPU, implying that uncertainty related to other economic policies besides monetary policy decreases the durations before a VC exits. Similar to the previous results in the VC market, EPU thus plays an opposite role than MPU in the duration until an exit occurs, particularly for the IPO and TS exit. We suggest similar arguments for these contrasting findings.

First, we again stress the uniqueness of MPU as a separate transmission channel, this time in the VC exit strategy context. Due to the particular scope of monetary policy, its second moment also has distinct effects on the economy. Second, we also suggest that EPU might have a more prominent effect on the value of the real growth option, implying that it is more profitable to act (i.e. exit) now. MPU might have a more pronounced effect on the value of the real option to abandon, implying that it is more valuable to wait before acting (i.e. exiting). This confirms the presence of a separate uncertainty transmission channel of monetary policy.

To further verify this suggestive evidence, an additional interaction term between EPU and MPU is estimated and presented in Table 8 for all models and exit vehicles. For both the IPO and TS exit vehicles the estimated coefficients for the interaction terms are highly significant and negative. This implies that the effect of MPU is moderated if EPU increases, resulting in shorter exit durations for the IPO and TS exit modes. We thus confirm the opposite powers of monetary policy and other economic policies in the exit strategy. The individual effects of EPU on the duration to exit remain ambiguous when controlling for this interaction effect for all exit vehicles. Based on these observations, we thus conclude that MPU has a positive and significant effect on the time-to-exit decisions by VCs, which is more prominent for the decision to monetize the returns via an IPO or Trade Sale/Merger compared to the liquidation of the investment.

To further uncover this apparent heterogeneous effect of MPU on the exit duration, we define - in line with Gompers et al. (2008) - a successful exit by a VC to be either an IPO or TS exit. The authors argue that VCs strive to exit their investments via these vehicles since they typically imply the highest returns. Equation 6 is thus estimated based on the following set of exit modes $\Psi = \{1, 2\}$, where 1

Table 9: Regression results of the effect of MPU on exit success

	Successful exit			Others		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.0038***			0.0008		
	(0.0004)			(0.0006)		
MPU-BBDw		0.0106***			0.0060***	
		(0.0005)			(0.0007)	
MPU-BBD10			0.0048***			0.0021***
			(0.0004)			(0.0006)
EPUxMPU	-0.0000***	-0.0000***	-0.0000***	-0.0000**	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
EPU-BBD	0.0029***	-0.0027***	0.0006	-0.0008	-0.0025***	-0.0009
	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0005)	(0.0006)
MacroUncertainty	2.3107***	2.1200***	3.0921***	2.9541***	2.6186***	3.2898***
	(0.1808)	(0.1788)	(0.1784)	(0.2737)	(0.2720)	(0.2666)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Panel B:						
Observation	48371	48371	48371	49683	49683	49683
LR Chi2	34076.77***	34452.73***	33941.46***	12758.52***	12828.68***	12753.1
AIC	58558.6	58182.62	58693.9	25503.7	25433.5	25509.1
BIC	58839.8	58463.8	58975.1	25785.7	25715.6	25791.1
Distribution	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal

Notes: Regression results for Lognormal AFT models for Equation 5. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. Controls and Fixed Effects refer to other (categorical) variables also included in Table 8. For the interaction term, MPU refers to the MPU measure by the index used in that same model as the variable of main interest. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

represents either the IPO or TS exit and 2 for any other exit (including LIQ and others), where $j \in \Psi$. The main results are presented in Table 9. Models 1 to 3 report all significant and positive coefficients for MPU and relate to the successful exit modes. Models 4 to 6, relating to other exit vehicles, also report significant and positive results for the BBD indices, but the coefficients are half the size of the coefficients for the successful exits. These results further confirm that the positive effect of MPU as a transmission mechanism on the choice of exit vehicle is present and heterogeneous, having a more prominent effect on vehicles used in successful exits than other vehicles. Also, the negative and significant interaction term confirms the contrary effects of EPU and MPU, advocating for the recognition of MPU as a separate and unique transmission channel amongst other policies.

These results can be best summarized using the implied hazard functions resulting from the estimates found in Table 9, Models 1 and 4. We present two distinct plots of the hazard curves per exit mode in Figure 4. In the left panel, the hazard of exiting successfully via either an IPO or TS is shown, indicating an initial rise in the hazard, which reaches a plateau around 5.5 years (2000 days) after the initial investment in the company. Afterward, it subsequently slowly declines over the remaining lifespan of the investment. The left panel further indicates that this hazard is substantially lower in times of high MPU and reaches a plateau slightly later than under low MPU, in line with the significance of the earlier presented results. The particular shape of the hazard function is in line with the results by Giot and Schwienbacher (2007). The right panel shows the hazard estimates for other exits. We note that this hazard is monotonically increasing and lower in times of high MPU. This indicates that it becomes increasingly more likely over time that the exit of the investment occurs via an alternative exit vehicle.

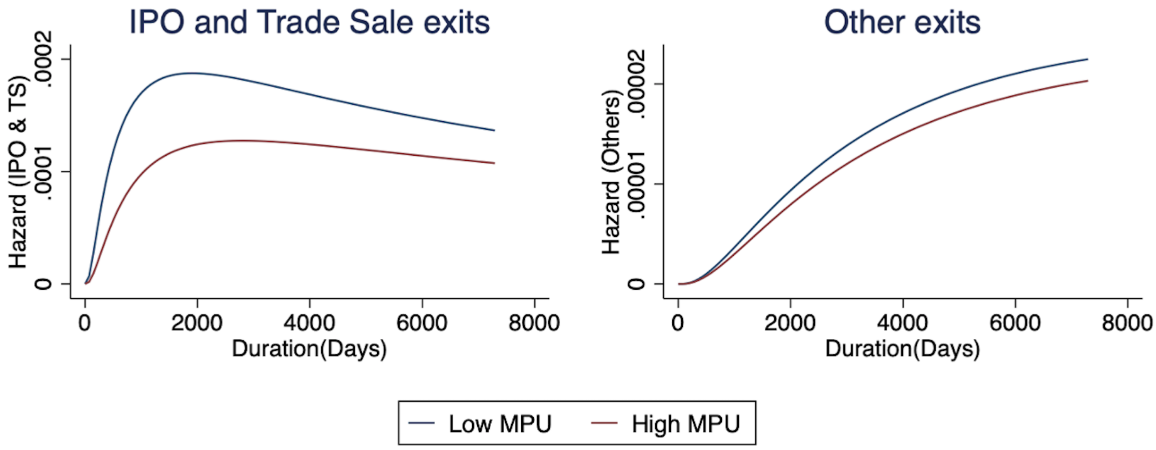

Figure 4: Hazard Function estimates of hazard to successfully exit using Models 1 (left) and 4 (right), Table 9 and log-normal errors.

5.4 Discussion

The results as presented in this Section on the different aspects of the venture capital market indicate the ubiquitous presence of MPU as a monetary policy transmission channel. We highlight some of the most prominent implications of these findings, contributing to the literature on both monetary policy and the venture capital market.

First, the above-presented results confirm the hypothesis that uncertainty related to monetary policy affects the venture capital market. We find that MPU positively affects the size of the venture capital fund, negatively affects investments made by VCs, and negatively affects the exit strategies from those investments. This implies the dynamic nature of MPU in the venture capital market. Particularly, higher MPU incentivizes Limited Partners to invest in venture capital funds, instead of other mutually exclusive investment options. However, this does not result in increased venture capital activity, spurring the (local) economy. On the contrary, as a result of high MPU, investments by VCs are delayed and strategies to monetize the returns are negatively affected, resulting in longer capital lock-ups in the venture capital funds and less investment exits via more profitable vehicles.

Second, the results from this Section also imply the important difference between monetary and other economic policies. In all three separate aspects of the venture capital market, we find contrary estimated effects of MPU and EPU, the latter negatively affecting the size of the venture capital fund, the staging, and exit durations. Based on this, we thus suggest that uncertainty related to other economic policies may favor the value of the option to grow, implying that it is more favorable to act now for it is too costly to wait. MPU may affect the option value to abandon, implying a wait-and-see strategy. This can be attributed to the particularly large scope and consequences of monetary policy itself on the economy.

We thus stress both the academic and social relevance of these findings. Firstly, scholars in monetary economics should consider MPU as a separate and unique transmission channel for monetary policy when evaluating monetary policy impacts on the real economy. Secondly, monetary policymakers should aim as a secondary policy objective to maintain and manage uncertainty resulting from their policy implications. Previous attempts by forward guidance actions have apparently failed in the past decades to mitigate the real effects of MPU. This study - by uncovering the real effects of MPU in the venture capital market - thus also helps to evaluate these policy measures and may contribute to the development of more sustainable and manageable instruments directly aimed at containing MPU

6 Conclusion

The goal of this paper is to uncover and analyze the potential effects of a new monetary transmission channel in the context of the US venture capital market. Recent developments in the literature on monetary policy have proposed a new measure of the uncertainty relating to the policy implementation and effectuation of monetary policy by central banks. Monetary Policy Uncertainty (MPU) relates to the uncertainty of a central bank's action and its consequences perceived by economic agents, which is contingent on both the chosen (set of) known monetary policy instruments and the unknown prevailing economic condition. MPU is measured using text-analyzing techniques in newspapers. The central question in this paper is how MPU affects the behavior and activities of economic agents in the venture capital market. Particularly, we study the fundraising activities, investment staging durations, and exit durations by venture capitalists (VCs), following the VC's lifecycle. We provide evidence on the mechanisms of MPU as a separate and unique transmission channel in the venture capital market

First, we investigate the potential effects of MPU on the size of the fund raised by VCs amongst Limited Partners. Employing a panel regression analysis with a Heckman correction term, we conclude that MPU has a limited but positive effect on the size of the venture capital fund. This effect is more pronounced in a high-MPU context and when controlling for an interaction effect between macroeconomic uncertainty and MPU, conforming to our hypothesis. Secondly, we analyze the relationship between MPU and the time between investment rounds by VCs in their portfolio companies. To address right-censoring in the observed data, we resort to the survival analysis literature, employing Accelerated Failure Time models and treating observations that did not receive new funding as truncated. We report highly significant and positive effects of MPU on the duration until a portfolio company receives new financing. The findings advocate for the argument that MPU has a positive effect on the value of the real option to abandon the investment. Higher MPU implies a wait-and-see strategy to update the beliefs on the profitability of the investment. This results in longer staging durations, in line with our hypothesis. Third and finally, we follow the lifecycle of a VC investment and uncover the relationship between MPU and the choice of exit vehicle and its accompanying time to exit. Identifying three exit vehicles of interest (IPO, Trade Sale (TS), and Liquidation), we also employ AFT models in a competing risk environment. We confirm our expectation that MPU has a positive effect on the duration until a VC exits the investment for the IPO and TS exit vehicle. This effect is less pronounced for the exit via liquidation. Also, when analyzing the exit strategies as either successful or not, the same conclusion holds. We thus conclude that MPU positively affects the value of the real option to abandon, promoting waiting longer and updating beliefs.

Generally, the results imply the unique presence of MPU as a transmission mechanism in the venture capital market. We infer from this the wide scope of the uncertainty effects of MPU in the venture capital market. This transmission mechanism is unique to monetary policy inter alia economic policies. MPU increases venture capital funds, but this does not result in more investments or more frequent and profitable exits. Other economic policies imply the opposite outcomes. We provide suggestive evidence - contrary to the current understanding in the literature - that MPU implies a profitable wait-and-see strategy, while other EPUs imply that it is more profitable to act now. We attribute this to the particularly large impact of monetary policy on the real and financial markets, while policymakers face limited boundaries. This adds value to the real option to abandon, for it is more profitable to wait and update beliefs on future states. This is in contrast to other economic policies. We find indications that other EPUs may favor the value of the real option to grow, implying that losses are limited and waiting is thus too costly to not forego any current profits.

We thus confirm the unique and ubiquitous presence of MPU as a predictor of corporate behavior. We stress the importance of this new predictor for monetary policymakers, as venture capitalism is a driving and thriving factor behind economic prosperity. Steering on reducing MPU via (new) monetary policy instruments may promote economic growth. We also stress the importance to economic agents active in the venture capital market, for these results may act as a warning for those acting in times of high MPU.

This study thus opens up a new field of research in the literature on both venture capitalism and corporate behavior, and the transmission of economic policy. More specifically, further research may investigate the scope of the effect of MPU on corporate behavior by extending this analysis to other markets. Also, further research into the uniqueness claims of MPU inter alia policy uncertainties made in this paper may enhance our understanding of this relatively new transmission channel and may confirm our suggestive evidence of the contrary effects of MPU and EPU on the value of real options. Doing so will result in a better academic groundwork for monetary policymakers to build on while improving or developing instruments aimed at reducing uncertainty. Finally, research aimed at better understanding the complex world of venture capitalism may benefit from this study in analyzing other aspects of this market in relation to policy uncertainty, in particular monetary policy uncertainty.

References

Adra, S., Barbopoulos, L. G. & Saunders, A. (2020). The impact of monetary policy on m&a outcomes. *Journal of Corporate Finance*, *62*, 101529.

Baker, S. R., Bloom, N. & Davis, S. J. (2016). Measuring economic policy uncertainty. *The quarterly journal of economics*, *131*(4), 1593–1636.

Barro, R. J. & Gordon, D. B. (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of monetary economics*, *12*(1), 101–121.

Bascha, A. & Walz, U. (2001). Convertible securities and optimal exit decisions in venture capital finance. *Journal of corporate finance*, *7*(3), 285–306.

Bauer, M. D., Lakdawala, A. & Mueller, P. (2022). Market-based monetary policy uncertainty. *The Economic Journal*, *132*(644), 1290–1308.

Baum, J. A. & Silverman, B. S. (2004). Picking winners or building them? alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of business venturing*, *19*(3), 411–436.

Bekaert, G., Hoerova, M. & Duca, M. L. (2013). Risk, uncertainty and monetary policy. *Journal of Monetary Economics*, *60*(7), 771–788.

Bellavitis, C., Fisch, C. & Vismara, S. (forthcomming). Monetary policy and venture capital markets. *Review of Corporate Finance*.

Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. *The quarterly journal of economics*, *98*(1), 85–106.

Bernanke, B. S. & Kuttner, K. N. (2005). What explains the stock market's reaction to federal reserve policy? *The Journal of finance*, *60*(3), 1221–1257.

Black, B. S. & Gilson, R. J. (1998). Venture capital and the structure of capital markets: banks versus stock markets. *Journal of financial economics*, *47*(3), 243–277.

Bloom, N. (2014). Fluctuations in uncertainty. *Journal of economic Perspectives*, *28*(2), 153–176.

Brainard, W. C. (1967). Uncertainty and the effectiveness of policy. *The American Economic Review*, *57*(2), 411–425.

Bundick, B., Herriford, T. & Smith, A. (2017). Forward guidance, monetary policy uncertainty, and the term premium. *Monetary Policy Uncertainty, and the Term Premium (July 2017)*.

Cieslak, A., Hansen, S., McMahon, M. & Xiao, S. (2021). Policymakers' uncertainty. *Available at SSRN 3936999*.

Cox, D. R. (1975). Partial likelihood. *Biometrika*, *62*(2), 269–276.

Creal, D. D. & Wu, J. C. (2017). Monetary policy uncertainty and economic fluctuations. *International Economic Review*, *58*(4), 1317–1354.

Cumming, D., Fleming, G. & Suchard, J.-A. (2005). Venture capitalist value-added activities, fundraising and drawdowns. *Journal of Banking & Finance*, *29*(2), 295–331.

De Pooter, M., Favara, G., Modugno, M. & Wu, J. (2021). Reprint: Monetary policy uncertainty and monetary policy surprises. *Journal of International Money and Finance*, *114*, 102401.

Di Maggio, M. & Kacperczyk, M. (2017). The unintended consequences of the zero lower bound policy. *Journal of Financial Economics*, *123*(1), 59–80.

Friedman, M. (1968). The role of monetary policy. *The American Economic Review*, *58*(1).

Geraats, P. M. (2001). Why adopt transparency? the publication of central bank forecasts. *The Publication of Central Bank Forecasts (January 2001).*

Giot, P. & Schwienbacher, A. (2007). Ipos, trade sales and liquidations: Modelling venture capital exits using survival analysis. *Journal of Banking & Finance*, *31*(3), 679–702.

Gompers, P. A. (1995). Optimal investment, monitoring, and the staging of venture capital. *The journal of finance*, *50*(5), 1461–1489.

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial economics*, *42*(1), 133–156.

Gompers, P. A., Kovner, A., Lerner, J. & Scharfstein, D. (2008). Venture capital investment cycles: The impact of public markets. *Journal of financial economics*, *87*(1), 1–23.

Gompers, P. A. & Lerner. (2004). *The venture capital cycle*. MIT press.

Gompers, P. A. & Lerner, J. (1999). What drives venture capital fundraising? *NBER Working Paper*(w6906).

Gompers, P. A. & Lerner, J. (2001). The venture capital revolution. *Journal of economic perspectives*, *15*(2), 145–168.

Greenspan, A. (2004). Risk and uncertainty in monetary policy. *American Economic Review*, *94*(2), 33–40.

Gulen, H. & Ion, M. (2016). Policy uncertainty and corporate investment. *The Review of Financial Studies*, *29*(3), 523–564.

Hellmann, T. (1994). Financial structure and control in venture capital.

Horra, L. P. d. l., Perote, J. & Fuente, G. d. l. (2022). The impact of economic policy uncertainty and monetary policy on r&d investment: An option pricing approach. *Economics Letters*, *214*, 110413.

Huang, Y. S., Wu, J. & Guo, F. (2022). Venture capital staging under economic policy uncertainty. *International Review of Economics & Finance*, *78*, 572–596.

Husted, L., Rogers, J. & Sun, B. (2020). Monetary policy uncertainty. *Journal of Monetary Economics*, *115*, 20–36.

Istrefi, K. & Mouabbi, S. (2018). Subjective interest rate uncertainty and the macroeconomy: A cross-country analysis. *Journal of International Money and Finance*, *88*, 296–313.

Jeng, L. A. & Wells, P. C. (2000). The determinants of venture capital funding: evidence across countries. *Journal of corporate Finance*, *6*(3), 241–289.

Jordà, Ò. & Salyer, K. D. (2003). The response of term rates to monetary policy uncertainty. *Review of Economic Dynamics*, *6*(4), 941–962.

Jurado, K., Ludvigson, S. C. & Ng, S. (2015). Measuring uncertainty. *American Economic Review*, *105*(3), 1177–1216.

Kollmann, T., Kuckertz, A. & Middelberg, N. (2014). Trust and controllability in venture capital fundraising. *Journal of business research*, *67*(11), 2411–2418.

Kroencke, T. A., Schmeling, M. & Schrimpf, A. (2021). The fomc risk shift. *Journal of Monetary Economics*, *120*, 21–39.

Kuckertz, A., Kollmann, T., Röhm, P. & Middelberg, N. (2015). The interplay of track record and trustworthiness in venture capital fundraising. *Journal of Business Venturing Insights*, *4*, 6–13.

Li, Y. (2008). Duration analysis of venture capital staging: A real options perspective. *Journal of Business Venturing*, *23*(5), 497–512.

Metrick, A. & Yasuda, A. (2021). *Venture capital and the finance of innovation.* John Wiley & Sons.

Poterba, J. M. (1989). Venture capital and capital gains taxation. *Tax policy and the economy*, *3*, 47–67.

Ritter, J. R. (2013). Initial public offerings: Vc-backed ipo statistics through 2012. *Avaialable at http://bear. warrington. ufl. edu/ritter/IPOs2012VC-backed*.

Rodrik, D. (1991). Policy uncertainty and private investment in developing countries. *Journal of Development Economics*, *36*(2), 229–242.

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of financial economics*, *27*(2), 473–521.

Stiglitz, J. E. & Weiss, A. (1983). Incentive effects of terminations: Applications to the credit and labor markets. *The American Economic Review*, *73*(5), 912–927.

Swanson, E. T. (2006). Have increases in federal reserve transparency improved private sector interest rate forecasts? *Journal of Money, Credit and Banking*, 791–819.

Tajaddini, R. & Gholipour, H. F. (2021). Economic policy uncertainty, r&d expenditures and innovation outputs. *Journal of Economic Studies*, *48*(2), 413–427.

Taylor, J. B. (2000). Reassessing discretionary fiscal policy. *Journal of economic Perspectives*, *14*(3), 21–36.

Tillmann, P. (2020). Monetary policy uncertainty and the response of the yield curve to policy shocks. *Journal of Money, Credit and Banking*, *52*(4), 803–833.

A Data Description

Table A1: Variable Description

Variable Name	Analysis	Variable Description	Unit	Source
CGTR	[1]	Percentage of personal capital gains tax based on historical US fiscal law	Percentage, monthly	Wolters Kluwer
DaysSinceLastFund	[1]	Total number of days since last fund was successfully raised	Days	Preqin
Dealsize	[2] [3]	US million dollar amounts of Investment by VC in portfolio company	US Dollars	Preqin
DevStage	[2] [3]	Stage of Development by portfolio company, divided into early, expansion, later, buyout, and other stages.	Categorical	Preqin
EPU-BBD	[1] [2] [3]	Economic Policy Uncertainty - Based on 10 major US newspaper	Index - Meam normalized to 100 over 1985 until 2009, monthly	Baker et al. (2016)
EstYear	[2]	Year of establishment of a portfolio company	Number	Preqin
ExitDuration	[3]	Duration in days until a VC exits its portfolio company after an investment	Days	Preqin
ExitYear	[3]	Year in which the VC exits its portfolio company	Number	Preqin
Fundnumber	[1]	Total lifetime funds raised by a VC	Number	Preqin
FundRaised	[1]	Takes value one if a fund was closed in the respective month, 0 otherwise	Binary	Preqin
FundsPerMonth	[1]	Number of funds raised in a particular month by a particular VC	Number	Preqin
Improvement	[3]	Takes value one if the stage of development between investment and exit changed, zero otherwise	Binary	Preqin
Industry	[2] [3]	Includes 11 dummies relating to the main focal industry of the portfolio company	Categorical	Preqin
Inflation	[1] [2] [3]	Change in total Consumer Price Index relative to the previous year for the US	Percent point, monthly	FRED
InvestmentRound	[2] [3]	Number of funding rounds by a VC into its portfolio company	Number	Preqin
LnDealsize	[2] [3]	Natural logarithm of the US dollar amounts invested by a Syndicate into a portfolio company	Log-transformed US million dollar amounts	Preqin
LnFundsize	[1]	Natural Logarithm of total US million dollar funds committed to a VC fund	Log-transformed US dollar amounts	Preqin
M2growth	[1] [2] [3]	Growth of the money stock measured as M2	Percentage, monthly	FRED

Table A1: Variable Description (Cont.)

MacroUncertainty	[1] [2] [3]	Time-varying uncertainty about macroeconomic climate	Index, monthly	Jurado et al. (2015)
MonthsSinceLastFund	[1]	Total number of months since last fund was successfully raised	Months	Preqin
MPU-BBD10	[1] [2] [3]	Monetary Policy Uncertainty - Based on 10 major US newspaper	Index - Mean normalized to 100 over 1985 until 2009, monthly	Baker et al. (2016)
MPU-BBDw	[1] [2] [3]	Monetary Policy Uncertainty - Based on newspapers available worldwide	Index - Mean normalized to 100 over 1985 until 2009, monthly	Baker et al. (2016)
MPU-HRS	[1] [2] [3]	Monetary Policy Uncertainty - Based on three different US newspapers	Index - Mean normalized to 100 over 1985 until 2018, monthly	Husted et al. (2020)
NASDAQ	[1] [2] [3]	Yields on securities traded on NASDAQ exchange	Percentage, monthly	FRED
RealGDP	[1] [2] [3]	Measure total output generated by the US economy. Index consistent with US real GDP	Index, monthly	S&P Global
RealRiskPremium	[1] [2] [3]	Measure of the compensation investors require for holding real (inflation-protected) bonds over some period	Percentage, monthly	FRED
Recession	[1] [2] [3]	NBER-based recession indicators for the US (Peak through Trough)	Binary	FRED
StagingDuration	[2]	Time in days between two successful financing rounds, where the intervals were calculated as days until the next investment round	Days	Preqin
Syndicate	[1]	Takes value one if the fund was raised in collaboration with other VCs, and 0 otherwise	Binary	Preqin
SyndicateSize	[2] [3]	Number of VCs partnering in the same deal in a portfolio company	Number	Preqin
TBILL	[1] [2] [3]	Yields on 10-year maturity US Treasury securities	Percentage, monthly	FRED
ValueLastFund	[1]	Value in US dollars of previous fund raised	US Dollars	Preqin
VC-Comp	[2] [3]	Proportion of total VCs active in the portfolio company's industry to the total active VCs in a given year	Fraction	Preqin
VC-IPO	[1] [2] [3]	Total number successful IPOs by VC-backed portfolio companies in the US averaged per month	Number	Ritter (2013)

Notes: The analysis column denotes for which analysis the variable is used, where [1] indicates the fundraising activities, [2] the investment staging decisions, and [3] the exit strategies by VCs.

Table A2: Summary Statistics

Variable	No.Obs	Mean	Stnd. Dev.	Min.	Max.
Panel A: Summary Statistics for Fundraising-related variables					
DaysSinceLastFund	3557	789.1	811.4	0	7946
FundRaised	3557	1.0	0.0	1	1
Fundsize	3557	212.4	486.9	0	12700
FundsPerMonth	3557	1.1	0.5	1	15
LnFundsize	3557	3.9	2.0	-2	9
MonthsSinceLastFund	3557	26.4	26.3	1	260
Syndicate	3557	0.9	0.3	0	1
ValueLastFund	3557	181.5	375.6	0	6655
ValuePastFund	3557	603.1	1646.6	0	24639
Panel B: Summary Statistics for Staging Duration-related variables					
Dealsize	91130	26.4	140.5	0	19560
EstYear	91130	2014.9	5.8	2000	2022
InvestmentRound	91130	1.3	1.7	0	22
LnDealsize	91130	1.9	1.7	-5	10
StagingDuration	91130	1308.2	1672.4	1	8400
StagingDuration	91130	0.6	0.5	0	1
SyndicateSize	91130	3.7	2.8	1	63
VC-Comp	91130	0.3	0.2	0	1
Panel C: Summary Statistics for Exit Duration-related variables					
ExitDuration	51603	1641.5	1527.1	1	7292
ExitYear	51603	2019.0	4.9	2000	2022
Improvement	51603	0.5	0.5	0	1
InvestmentRound	51603	1.1	0.6	1	18
LnDealsize	51603	1.5	1.7	-5	9
SyndicateSize	51603	2.1	2.4	0	59
VC-Comp	51603	0.3	0.2	0	1
Panel D: Summary Statistics for time-varying macro controls					
CGTR	275	17.8	2.5	15	20
EPU-BBD	275	139.1	66.0	45	504
Inflation	275	0.0	0.4	-3	2
M2growth	275	0.6	0.6	-1	6
MacroUncertainty	275	0.9	0.1	1	1
MPU-BBD10	275	140.1	72.4	44	491
MPU-BBDw	275	89.5	58.6	18	408
MPU-HRS	275	127.1	72.4	20	407
NASDAQ	275	0.5	5.3	-22	15
RealGDP	275	16294.0	1998.5	12870	20222
RealRiskPremium	275	1.2	0.1	1	1
Recession	275	0.1	0.3	0	1
TBILL	275	3.2	1.3	1	7
VC-IPO	275	5.9	4.5	1	21

Notes: Panels A to C contain summary statistics for the variables used in the regressions of the three analyses. Panel D contains summary statistics for the time-varying macroeconomic variables, measured on a monthly interval ranging from 2000 to 2022.

B Fundraising Activities

Table A3: Regression results of the effects of MPU on the size of the VC fund raised

	Dependent Variable: LnFundsize					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.00090***	0.00066				
	(0.000)	(0.000)				
MPU-BBDw			0.00089**	0.00125*		
			(0.000)	(0.001)		
MPU-BBD10					0.00044	0.00028
					(0.000)	(0.001)
ValuePastFunds		0.00003*		0.00004*		0.00003*
		(0.000)		(0.000)		(0.000)
DaysSinceLastFund		0.00015***		0.00015***		0.00015***
		(0.000)		(0.000)		(0.000)
NoFundsMonth		0.42366***		0.42509***		0.42329***
		(0.109)		(0.109)		(0.109)
FundNumber		-0.00165		-0.00188		-0.00162
		(0.004)		(0.004)		(0.004)
Syndicate		1.25452***		1.25373***		1.25263***
		(0.147)		(0.147)		(0.147)
EPU-BBD		-0.00168***		-0.00208***		-0.00166**
		(0.001)		(0.001)		(0.001)
Inflation		0.04478		0.04587		0.04489
		(0.065)		(0.065)		(0.065)
M2growth		0.10483**		0.10008*		0.10284*
		(0.053)		(0.053)		(0.053)
MacroUncertainty		2.03300***		1.83822***		2.01137***
		(0.536)		(0.545)		(0.541)
NASDAQ		-0.00052		0.00237		-0.00147
		(0.006)		(0.006)		(0.006)
RealGDP		0.00005		0.00007**		0.00006*
		(0.000)		(0.000)		(0.000)
RealRiskPremium		-0.41192		-0.47645		-0.50516
		(0.451)		(0.448)		(0.456)
Recession		-0.04841		-0.07361		-0.07795
		(0.120)		(0.121)		(0.120)
TBILL		0.14220***		0.14104***		0.15461***
		(0.045)		(0.043)		(0.045)
VC-IPO		0.00753		0.00726		0.00535
		(0.007)		(0.007)		(0.007)
CGTR		0.01292		0.01676		0.01708
		(0.014)		(0.013)		(0.013)
Constant	3.53074***	-0.68584	3.58884***	-0.70025	3.59740***	-0.76668
	(0.041)	(0.832)	(0.033)	(0.823)	(0.046)	(0.824)
Panel B:						
Error Specification	FE	FE	FE	FE	FE	FE
Observations	6234	4084	6234	4084	6234	4084
Groups (individual VC firms)	2526	1419	2526	1419	2526	1419
R-squared	0.00	0.09	0.00	0.09	0.00	0.09
Adjusted R-squared	0.00	0.09	0.00	0.09	0.00	0.09
F statistic	11.09***	9.25***	5.89**	9.06***	2.43	8.88***
P-value Hausman	0.000	0.000	0.000	0.000	0.000	0.000

Notes: OLS panel regression results for Equation 1. For Panel A, the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. In this case, the Hausman test advocated for a fixed effects specification in all models. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics, including the number of observations used to estimate the models, the number of unique groups (venture capital limited partnerships), the R^2, the Adjusted R^2, the significance of the total model (F-statistic with significance stars), and the p-value of the Hausman test.

In this Appendix, we first lay out some methodological groundwork for the interpretation of the estimated logit models. Then, we discuss the results of our first analysis of the fundraising activities by

Table A4: Regression results on the conditional probability to raise a fund

	Dependent Variable: LnFundRaised					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:						
MPU-HRS	0.00409***	0.00027				
	(0.0001)	(0.0003)				
MPU-BBDw			0.00023	0.00054		
			(0.0002)	(0.0005)		
MPU-BBD10					0.00361***	0.00070*
					(0.0001)	(0.0004)
MonthsSinceLastFund		-0.01744***		-0.01745***		-0.01746***
		(0.0004)		(0.0004)		(0.0004)
ValueLastFund		-0.00000***		-0.00000***		-0.00000***
		(0.0000)		(0.0000)		(0.0000)
EPU-BBD		-0.00020		-0.00039		-0.00065
		(0.0004)		(0.0005)		(0.0005)
Inflation		0.12868***		0.12889***		0.13487***
		(0.0425)		(0.0425)		(0.0428)
M2growth		0.01727		0.01535		0.02217
		(0.0316)		(0.0314)		(0.0317)
MacroUncertainty		1.00967***		0.93614***		1.02488***
		(0.3531)		(0.3579)		(0.3501)
NASDAQ		-0.00420		-0.00329		-0.00293
		(0.0036)		(0.0037)		(0.0036)
RealGDP		0.00012***		0.00013***		0.00012***
		(0.0000)		(0.0000)		(0.0000)
RealRiskPremium		0.11439		0.09514		0.15755
		(0.3110)		(0.3065)		(0.3113)
Recession		0.13903		0.12499		0.13110
		(0.0943)		(0.0935)		(0.0939)
TBILL		0.03741		0.03543		0.03056
		(0.0307)		(0.0310)		(0.0303)
VC-IPO		0.04778***		0.04801***		0.04908***
		(0.0047)		(0.0048)		(0.0048)
CGTR		0.02151*		0.02316**		0.02114*
		(0.0120)		(0.0116)		(0.0117)
Constant	-5.49275***	-7.70179***	-4.94355***	-7.71483***	-5.46900***	-7.70002***
	(0.0243)	(0.4007)	(0.0225)	(0.3971)	(0.0244)	(0.3961)
Panel B:						
McFadden's R^2	0.01	0.07	0.00	0.07	0.01	0.07
Wald Chi2	905.59***	2083.54***	1.22	2085.00***	794.83***	2083.83***
AIC	74750.3	35893.3	75472.3	35893.1	74904.6	35890.6
BIC	74773.6	36051.8	75495.7	36051.5	74928.0	36049.1
AUC	0.733	0.733	0.733	0.597	0.505	0.599

Notes: Logit regression results for Equation 2. For Panel A , the first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in their variable of interest, employing different measurements of US MPU. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics, including the number of observations used to estimate the models, McFadden's R^2, the significance of the total model denoted by the Chi-squared Likelihood Ration and significance stars, the Akaike and Bayesian Information Criteria, and the Area Under the Curve statistic.

VCs. We then present the estimated logit models for the conditional probability of raising a fund.

To analyze the effectiveness of the predictive performance of the logit models specified by Equation 2, several additional statistics are included in the analysis. Besides the information criteria, the Likelihood Ratio statistic, and McFadden's R-squared which capture the model fit, the receiver operating characteristics (ROC) per model are considered. The latter can be best summarized in a figure plotting the true positive rate against the true negative rate contingent on a changing cutoff rate. The true positive rate is the rate of correct predicted successes over the total success predictions. The opposite holds for the true negative rate. A prediction is considered successful depending on the chosen cutoff rate. For example, when the model specified by Equation 2 predicts a probability of raising a fund in a given year for a given venture capital organization of 0.05, with a cutoff value of 0.01 this prediction is considered accurate. The ROC plane can be summarized using the Area Under the Curve (AUC) statistic, measuring how well the model can distinguish between the different success rates for differing cut-off values. The higher the AUC statistic, the more accurate the model can predict. The AUC statistic can be, therefore, interpreted as the probability of a successful prediction.

Table A3 shows the preliminary results of the estimation of Equation 1 without a Heckman correction term. We conclude, based on these results, that MPU only has a moderate effect on the size of the fund, being only significant for the model employing the index by BBD based on worldwide newspapers. Table A4 reports the estimations of the logit regression, modeling the probability of closing a VC fund in a given month conditional on various VC-related and macroeconomic factors. MPU does not appear to have a particular effect on this choice, showing only a significant positive effect on the 10 percent significance level for the model based on MPU-BBD10. The predictive performance of the full models lies between 60 and 73 percent, beating the randomness threshold of 50 percent by a considerable margin. The predicted probabilities resulting from these full models are used as an additional regression in the main analysis to control for the probability of raising a fund.

We further note from the results in Table A3 that these are in line with other literature, especially with respect to the findings on the positive effects of the Syndicate and Real GDP by Gompers and Lerner (1999) and the positive effects of a strong public market (VC-IPO) by Black and Gilson (1998). Furthermore, when comparing the results from Tables A3 and Table 4, the estimated probabilities of raising a fund in a given month from Table A4 appear to have a significant negative effect on the fund size, thus advocating for and justifying the Heckman two-stage approach.

C Staged Financing

In this Appendix, we present robustness checks on the estimates and conclusions drawn in the main text of this paper. To this end, we first specify the methodological basis for the PHM, used as a robustness check. Then, we estimate multiple models using different error and model specifications.

To validate the results of the analysis of the staging duration between two successive VC-financing rounds, several other model specifications are estimated as a robustness check. In the context of AFT models, the error term, defined in Equation 5, can follow other distributions besides the log-normal distributions. The choice of distribution results in an implied distribution for the survival time T and, therefore, implies a certain shape for the hazard function. Several other common distributions for the AFT models include the log-normal distribution, the log-logistic distribution, and the generalized gamma distribution. The log-normal distribution is chosen for the flexible function form of the hazard function since it allows for a non-monotonic form of the hazard. Also, the log-logistic and the generalized gamma distribution (the latter being a generalized form of the exponential, Weibull, and Gamma distribution) allow for a hazard function to be non-monotonic. Especially in the context of venture capital staged financing, this characteristic can be of meaningful value. As Gompers (1995) pointed out in his seminal contribution, various factors affecting the duration between staging rounds are present, each having its own particular (and sometimes opposite) effects. Allowing for a non-monotonic hazard function thus gives rise to his notions, where one can expect an initial sharp rise in the hazard of new funding, for close monitoring might be preferred by the VC. Afterward, this hazard may gradually decline, since it becomes less likely that a VC will invest new funding after a longer period. See also the findings by Li (2008). Other distributions do not account for a flexible specification of the hazard function. The exponential distribution implies a constant hazard and the Weibull distribution implies a monotonic shape of the hazard function. Based on theoretical grounds, we prefer the first class of distributions. These error specifications are estimated in Table A5.

Table A5: Robustness checks on duration models of the effect of MPU-HRS on StagingDuration

	Dependent Variable: LnDuration								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	AFT	AFT	AFT	AFT	AFT	PHM	PHM	PHM	PHM
Panel A:									
MPU-HRS	0.0010***	0.0009***	0.0010***	0.0006***	0.0010***	-0.0006***	-0.0007***	-0.0007***	-0.0006***
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
EstYear	0.0249*	0.0360***	0.0220	-0.0106	0.0075	0.0106	-0.0051	-0.0276***	-0.0173*
	(0.0138)	(0.0138)	(0.0140)	(0.0093)	(0.0135)	(0.0093)	(0.0092)	(0.0092)	(0.0092)
InvRound	-0.7899***	-0.7981***	-0.7741***	-0.5612***	-0.6684***	0.5612***	0.4565***	0.4692***	0.5447***
	(0.0106)	(0.0109)	(0.0119)	(0.0040)	(0.0064)	(0.0040)	(0.0044)	(0.0046)	(0.0050)
LnDealsize	0.0763***	0.0779***	0.0946***	0.0141***	0.0222***	-0.0141***	-0.0152***	-0.0207***	-0.0266***
	(0.0070)	(0.0071)	(0.0070)	(0.0045)	(0.0066)	(0.0045)	(0.0045)	(0.0046)	(0.0046)
SyndicateSize	0.0116***	0.0095**	0.0155***	-0.0053*	0.0008	0.0053*	-0.0006	-0.0036	-0.0024
	(0.0043)	(0.0043)	(0.0043)	(0.0028)	(0.0041)	(0.0028)	(0.0028)	(0.0029)	(0.0029)
VC-Comp	-1.6546***	-1.6714***	-1.5492***	-0.9269***	-1.3962***	0.9269***	0.9536***	0.9258***	0.9441***
	(0.4230)	(0.4260)	(0.4313)	(0.2779)	(0.4077)	(0.2779)	(0.2784)	(0.2788)	(0.2789)
EPU-BBD	-0.0016***	-0.0016***	-0.0013***	-0.0014***	-0.0020***	0.0014***	0.0013***	0.0012***	0.0010***
	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Inflation	-0.0311	-0.0442*	-0.0187	-0.0200	-0.0270	0.0200	0.0184	0.0056	-0.0086
	(0.0254)	(0.0258)	(0.0254)	(0.0173)	(0.0253)	(0.0173)	(0.0173)	(0.0173)	(0.0173)
M2growth	-0.0937***	-0.0972***	-0.0734***	-0.0706***	-0.1030***	0.0706***	0.0703***	0.0560***	0.0429***
	(0.0229)	(0.0225)	(0.0236)	(0.0146)	(0.0213)	(0.0146)	(0.0145)	(0.0145)	(0.0145)
MU	2.1009***	2.0780***	1.8770***	1.0561***	2.5514***	-1.0561***	-1.7425***	-1.5895***	-1.3885***
	(0.2307)	(0.2293)	(0.2299)	(0.1571)	(0.2316)	(0.1571)	(0.1573)	(0.1567)	(0.1572)
NASDAQ	-0.0148***	-0.0154***	-0.0118***	-0.0137***	-0.0192***	0.0137***	0.0131***	0.0109***	0.0097***
	(0.0024)	(0.0024)	(0.0024)	(0.0016)	(0.0023)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
RealGDP	-0.0000	-0.0001*	-0.0000	-0.0001***	-0.0001**	0.0001***	0.0001**	0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RRP	0.9390***	1.0083***	0.7476***	0.7052***	1.3245***	-0.7052***	-0.9046***	-0.8068***	-0.5646***
	(0.2165)	(0.2156)	(0.2170)	(0.1470)	(0.2146)	(0.1470)	(0.1463)	(0.1456)	(0.1456)
Recession	-0.1100*	-0.0878	-0.1505**	0.0050	-0.0942*	-0.0050	0.0643*	0.0618	0.0300
	(0.0588)	(0.0601)	(0.0602)	(0.0381)	(0.0559)	(0.0381)	(0.0381)	(0.0383)	(0.0383)
TBILL	0.1118***	0.1198***	0.1045***	0.0738***	0.1113***	-0.0738***	-0.0760***	-0.0602***	-0.0455***
	(0.0227)	(0.0225)	(0.0231)	(0.0150)	(0.0219)	(0.0150)	(0.0149)	(0.0149)	(0.0149)
VC-IPO	-0.0125***	-0.0157***	-0.0099***	-0.0100***	-0.0152***	0.0100***	0.0104***	0.0082***	0.0027
	(0.0028)	(0.0029)	(0.0029)	(0.0018)	(0.0027)	(0.0018)	(0.0018)	(0.0018)	(0.0019)
Constant	-44.9079*	-67.0270**	-39.8848	29.5836	-9.3503	-29.5836	6.3860	50.7420***	
	(27.1883)	(27.1203)	(27.5491)	(18.2309)	(26.4937)	(18.2309)	(18.0935)	(18.0026)	
Panel B:									
Observation	45721	45721	45721	45721	45721	45721	45721	45721	45721
LR Chi2	6754.15***	7007.49***	5954.17***	15420.15***	7930.86***	15420.15***	7930.86***	6469.65***	7384.53***
AIC	113634.6	114279.3	112903.6	123049.0	118122.3	123049.0	118122.3	107080.7	433656.7
BIC	113905.2	114550.0	113183.0	123311.0	118393.0	123311.0	118393.0	107351.3	433909.9
Distribution	Lognormal	LogLogistic	GGamma	Exponential	Weibull	Exponential	Weibull	Gompertz	Cox

Notes: Robustness check for alternative specifications of Equation 5 and 8. The first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in the choice of distribution and in the specification: AFT or PHM. Stage and Industry fixed effects are included in all models. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

Besides these alternative specifications of the errors in AFT models, the other class of duration models, proportional hazard models (PHM) are also commonly used in survival analysis. In contrast to AFTs, these models directly estimate the hazard function. The following equation presents the general form of the regression equation:

$$\begin{aligned} ln\lambda_i(t \mid X_i) &= \beta_0 + X_i'\beta \\ \lambda_i(t \mid X_i) &= \lambda_0(t)exp(X_i'\beta) \end{aligned} \tag{8}$$

where λ_0 is the baseline hazard function, defined as $exp(\beta_0)$ and represents the hazard for $X_i' = 0$. This λ_0 is assumed to follow a certain distribution. In Table A5 the exponential, Weibull, and Gompertz distributions are estimated. For PHM, the coefficients are interpreted differently than in AFTS, since PHM model the hazard function directly. The interpretation of coefficient β_j corresponding to covariate j can be interpreted as the hazard ratio in the following fashion:

$$\frac{\lambda_i(t \mid X_{ij} = x + 1)}{\lambda_i(t \mid X_{ij} = x)} = exp(\beta_j) \tag{9}$$

In the case of a positive coefficient, an increase in the value of the covariate thus implies an increase in the hazard and thus a shorter survival time T_i and vice versa.

Additionally, a Cox Proportional Hazard model is also estimated. This is a semi-parametric model which does not make any explicit assumptions bout the distribution of the baseline hazard function λ_0. Instead, it assumes constant hazard over small intervals of the baseline hazard function, which allows for a flexible form. Results of all these models are presented in Table A5. From this, we can conclude that all specifications lead to the same conclusions as presented in the paper. The AFT models al report significant and positive coefficients for MPU based on the HRS index. All PHM report significant and negative coefficients. All models thus imply a longer duration until new financing as a result of higher MPU.

D Exit Strategy

In this Appendix, we present some base results for the analysis of the exit strategies by VCs and perform some robustness checks to validate the conclusions drawn in the main text of this paper.

The baseline survival model for the time to exit is presented in Table A6. These estimates yield mixed results on the effect of MPU on the duration until a VC exits its investment via one of the specified exit routes Ω. The effect is either positive or negative significantly different from zero, depending on the chosen measurement of MPU. This holds for the three exit vehicles IPO, TS, and LIQ. We further note that the estimates of EPU all yield significant negative coefficients. This provides some suggestive evidence of the impact of EPU and MPU on the value of real options, as discussed in section 5.2. EPU might have a more pronounced positive effect on the value of the 'growth option', which indicates that it may be more valuable to exit the investment earlier in this context. MPU, on the other hand, might have a different effect, promoting the value of the 'option-to-abandon'. This would imply in the context of exit durations that is may be more profitable to wait and update beliefs on the true value of exiting. To uncover these suggestions even further, Section 5.3 will provide a more detailed discussion.

In line with the discussion on the duration until a new VC-financing round, we also perform some robustness checks on the results of the exit duration. Particularly, we fit several other distributions for the error term of the AFT models specified by Equation 6 (the lognormal and generalized Gamma) and we fit a Weibull PHM following Equation 8. The dependent variable is the time to a successful exit, defined as either an IPO or TS. Other exits are treated as censored. Results are presented in Table A7 and are based on the HRS-index. For the different assumptions of distributions in Models 1 to 9, we first with the data with only VC-related control variables. Secondly, we add the macroeconomic controls, and third the interaction term. Notable is the fact that MPU is positive and significant when only controlling for VC-related variables. When adding the macroeconomics controls in Models 2, 5, and 8, these estimates become significantly negative. However, in line with the discussion above, we note the fact that EPU and MPU may interact with each other in the effects on the exit duration. So, to account for this potential bias, we also include an interaction term. This yields significant and positive results for the MPU coefficients and significantly negative coefficients for the interaction term. These results are robust for the chosen distributions and model estimations (AFT, PHM, or Cox PHM). Table A7 only presents the estimated coefficients for the time until a successful exit analysis, but the same observations and conclusions hold for both the analysis on the individual exit routes $j \in \Omega$ as well as the combined exit routes $j \in \Psi$. This thus confirms our conclusion that MPU positively affects the duration until a VC exits a portfolio company.

Table A6: Regression results of the effect of MPU on the duration until exit

	IPO			TS			LIQ		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A:									
MPU-HRS	-0.0001			-0.0018***			-0.0008***		
	(0.0004)			(0.0002)			(0.0003)		
MPU-BBDw		0.0064***			0.0058***			0.0018***	
		(0.0007)			(0.0003)			(0.0005)	
MPU-BBD10			0.0018***			0.0011***			-0.0001
			(0.0005)			(0.0002)			(0.0004)
LnDealsize	-0.3285***	-0.3185***	-0.3262***	-0.0451***	-0.0409***	-0.0452***	0.0802***	0.0811***	0.0802***
	(0.0139)	(0.0138)	(0.0139)	(0.0054)	(0.0054)	(0.0054)	(0.0097)	(0.0097)	(0.0097)
SyndicateSize	3.1731***	3.1507***	3.1741***	-0.0772***	-0.0818***	-0.0759***	2.3826***	2.3741***	2.3853***
	(0.0681)	(0.0677)	(0.0682)	(0.0051)	(0.0051)	(0.0052)	(0.0592)	(0.0591)	(0.0593)
VC-Comp	0.7853***	0.9573***	0.8072***	1.7070***	1.7365***	1.7074***	0.1320	0.1540	0.1142
	(0.1608)	(0.1617)	(0.1611)	(0.0718)	(0.0717)	(0.0720)	(0.1139)	(0.1142)	(0.1140)
EstYear	0.0628**	0.1132***	0.0765***	0.0425***	0.1372***	0.0920***	0.0208	0.0648***	0.0445*
	(0.0291)	(0.0281)	(0.0280)	(0.0125)	(0.0123)	(0.0122)	(0.0255)	(0.0244)	(0.0244)
Improvement	-0.0662	-0.0697	-0.0676	0.1310***	0.1159***	0.1398***	-0.3290***	-0.3280***	-0.3279***
	(0.0548)	(0.0546)	(0.0548)	(0.0219)	(0.0219)	(0.0219)	(0.0516)	(0.0515)	(0.0517)
EPU-BBD	-0.0012**	-0.0042***	-0.0026***	-0.0009***	-0.0050***	-0.0028***	-0.0015***	-0.0028***	-0.0018***
	(0.0005)	(0.0006)	(0.0006)	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0005)
Inflation	0.0001	-0.0001	-0.0000	0.0003***	-0.0000	0.0001**	0.0001	-0.0001	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
M2growth	0.1692***	0.1306***	0.1521***	0.3370***	0.3001***	0.3317***	0.1375***	0.1380***	0.1449***
	(0.0453)	(0.0450)	(0.0454)	(0.0199)	(0.0199)	(0.0200)	(0.0375)	(0.0374)	(0.0375)
MacroUncertainty	0.0089	0.0239***	0.0132**	0.0188***	0.0350***	0.0254***	-0.0004	0.0051	0.0004
	(0.0054)	(0.0055)	(0.0054)	(0.0021)	(0.0022)	(0.0022)	(0.0045)	(0.0047)	(0.0046)
NASDAQ	0.2156	0.2522*	0.2163	-0.6477***	-0.5206***	-0.5807***	-0.9114***	-0.8625***	-0.8954***
	(0.1517)	(0.1492)	(0.1510)	(0.0507)	(0.0502)	(0.0505)	(0.1021)	(0.1021)	(0.1020)
RealGDP	3.3120***	2.4015***	3.4508***	2.4863***	2.2531***	2.9469***	3.8759***	3.8632***	4.0825***
	(0.4428)	(0.4463)	(0.4397)	(0.1857)	(0.1846)	(0.1856)	(0.3586)	(0.3563)	(0.3540)
RealRiskPremium	2.1773***	1.8376***	2.2128***	1.5123***	1.2154***	1.5418***	1.2972***	1.1318***	1.2567***
	(0.4333)	(0.4304)	(0.4325)	(0.1868)	(0.1860)	(0.1870)	(0.3505)	(0.3509)	(0.3504)
Recession	-0.0336	-0.0716	-0.0284	0.1532***	0.1065***	0.1512***	0.0556	0.0157	0.0389
	(0.0488)	(0.0484)	(0.0487)	(0.0214)	(0.0214)	(0.0215)	(0.0404)	(0.0403)	(0.0401)
TBILL	-0.5306***	-0.4500***	-0.5132***	-0.5959***	-0.5456***	-0.5958***	-0.3278***	-0.3012***	-0.3313***
	(0.0520)	(0.0522)	(0.0521)	(0.0208)	(0.0209)	(0.0209)	(0.0470)	(0.0475)	(0.0471)
VC-IPO	-0.0680***	-0.0491***	-0.0622***	-0.0608***	-0.0302***	-0.0480***	-0.0083	0.0042	-0.0046
	(0.0058)	(0.0061)	(0.0059)	(0.0027)	(0.0029)	(0.0028)	(0.0061)	(0.0065)	(0.0062)
Constant	-124.4372**	-222.3748***	-151.1972***	-87.6419***	-272.5107***	-184.5693***	-41.2654	-127.4546***	-87.7984*
	(57.0689)	(55.2552)	(55.0178)	(24.5183)	(24.1138)	(23.9404)	(50.1307)	(47.9211)	(47.9189)
DevStage Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B:									
Observation	49108	49108	49108	50215	50215	50215	50988	50988	50988
LR Chi2	16158.01***	16247.76***	16172.85***	28381.11***	28690.49***	28269.92***	10381.70***	10385.58***	10373.81***
AIC	13857.4	13767.6	13842.6	51853.3	51543.9	51964.5	9801.9	9798.0	9809.8
BIC	14130.3	14040.5	14115.4	52126.9	51817.5	52238	10075.9	10072.0	10083.8
Distribution	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal	Lognormal

Notes: Lognormal AFT regression estimates for Equation 6 The models presented correspond to three different exits; IPOs, trade sales, and liquidations. The first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in the choice of MPU measurement. Stage and Industry fixed effects are included in all models. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.

Table A7: Robustness check on effect of MPU of the duration until a successful exit (IPO or TS)

	Dependent Variable: LnDuration until successful exit									
	(1) AFT	(2) AFT	(3) AFT	(4) AFT	(5) AFT	(6) AFT	(7) PHM	(8) PHM	(9) PHM	(10) PHM
Panel A:										
MPU-HRS	0.0018***	-0.0016***	0.0038***	0.0019***	-0.0013***	0.0027***	-0.0022***	0.0013***	-0.0028***	-0.0026***
	(0.0001)	(0.0001)	(0.0004)	(0.0001)	(0.0001)	(0.0004)	(0.0002)	(0.0001)	(0.0004)	(0.0004)
LnDealsize	-0.2066***	-0.1254***	-0.1246***	-0.1899***	-0.1036***	-0.1029***	0.1737***	0.1047***	0.1031***	0.1040***
	(0.0054)	(0.0052)	(0.0052)	(0.0055)	(0.0050)	(0.0050)	(0.0057)	(0.0058)	(0.0058)	(0.0058)
SyndicateSize	0.2905***	0.1032***	0.1004***	0.2424***	0.0781***	0.0764***	-0.2098***	-0.0834***	-0.0810***	-0.0869***
	(0.0089)	(0.0085)	(0.0085)	(0.0085)	(0.0079)	(0.0079)	(0.0082)	(0.0092)	(0.0092)	(0.0092)
VC-Comp	1.2905***	1.3714***	1.3624***	1.0646***	1.2192***	1.2228***	-0.8609***	-1.2953***	-1.3039***	-1.3720***
	(0.0739)	(0.0679)	(0.0678)	(0.0714)	(0.0648)	(0.0647)	(0.0726)	(0.0761)	(0.0759)	(0.0760)
EstYear	0.0995***	0.0211*	0.0260**	0.0937***	0.0482***	0.0531***	-0.0940***	-0.0824***	-0.0897***	-0.0822***
	(0.0020)	(0.0121)	(0.0121)	(0.0018)	(0.0107)	(0.0107)	(0.0017)	(0.0118)	(0.0118)	(0.0118)
Improvement	0.5992***	0.1551***	0.1478***	0.5527***	0.0668***	0.0640***	-0.5408***	-0.0228	-0.0195	-0.0365
	(0.0220)	(0.0214)	(0.0214)	(0.0214)	(0.0202)	(0.0202)	(0.0223)	(0.0233)	(0.0233)	(0.0233)
EPU-BBD		-0.0012***	0.0029***		-0.0006***	0.0024***		0.0004**	-0.0027***	-0.0025***
		(0.0002)	(0.0004)		(0.0002)	(0.0003)		(0.0002)	(0.0003)	(0.0003)
Inflation		0.0003***	0.0003***		0.0002***	0.0002***		-0.0001***	-0.0001***	-0.0001***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)	(0.0000)
M2growth		0.2957***	0.3313***		0.2750***	0.3001***		-0.3219***	-0.3471***	-0.3333***
		(0.0192)	(0.0193)		(0.0171)	(0.0173)		(0.0192)	(0.0195)	(0.0194)
MacroUncertainty		0.0167***	0.0158***		0.0101***	0.0091***		-0.0058***	-0.0044**	-0.0044**
		(0.0021)	(0.0021)		(0.0019)	(0.0019)		(0.0021)	(0.0021)	(0.0021)
NASDAQ		-0.5540***	-0.4806***		-0.5987***	-0.5264***		0.7535***	0.6648***	0.6474***
		(0.0501)	(0.0502)		(0.0433)	(0.0438)		(0.0476)	(0.0484)	(0.0484)
RealGDP		2.7052***	2.3107***		3.0404***	2.6960***		-3.8601***	-3.4816***	-3.3619***
		(0.1792)	(0.1808)		(0.1658)	(0.1679)		(0.1924)	(0.1953)	(0.1947)
RealRiskPremium		1.8051***	1.4512***		2.1451***	1.8578***		-2.7855***	-2.4979***	-2.3850***
		(0.1810)	(0.1824)		(0.1654)	(0.1677)		(0.1890)	(0.1920)	(0.1906)
Recession		0.1543***	0.1294***		0.0662***	0.0524***		-0.0130	0.0009	-0.0114
		(0.0206)	(0.0206)		(0.0183)	(0.0185)		(0.0201)	(0.0205)	(0.0205)
TBILL		-0.6042***	-0.5946***		-0.5423***	-0.5367***		0.6113***	0.6064***	0.5807***
		(0.0203)	(0.0202)		(0.0183)	(0.0182)		(0.0202)	(0.0200)	(0.0200)
VC-IPO		-0.0695***	-0.0662***		-0.0669***	-0.0647***		0.0786***	0.0764***	0.0748***
		(0.0026)	(0.0026)		(0.0022)	(0.0022)		(0.0023)	(0.0023)	(0.0024)
EPUxMPU			-0.0000***			-0.0000***			0.0000***	0.0000***
			(0.0000)			(0.0000)			(0.0000)	(0.0000)
Constant	-193.8425***	-45.6482*	-55.1022**	-181.9086***	-98.6070***	-108.0841***	181.7293***	166.5109***	180.8508***	
	(3.9571)	(23.7478)	(23.7094)	(3.6092)	(20.9396)	(20.9666)	(3.4783)	(23.1968)	(23.2182)	
Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B:										
Observation	48748	48371	48371	48748	48371	48371	48748	48371	48371	48371
LR Chi2	24015.67***	33881.46***	34076.77***	24618.73***	35231.91***	35375.71***	25813.36***	36693.17***	36822.30***	33501.09***
AIC	69990.8	58751.9	58558.6	69346.1	57351.7	57210.0	70291.0	58020.2	57893.1	293568.3
BIC	70175.5	59024.3	58839.8	69539.6	57632.9	57499.9	70475.7	58292.6	58174.3	293831.9
Distribution	Lognormal	Lognormal	Lognormal	GGamma	GGamma	GGamma	Weibull	Weibull	Weibull	Cox

Notes: Robustness check for alternative specifications of Equation 6 and 8 for the IPO & TS exit vehicles. The first column denotes the regressors, the following columns are the estimated coefficients with the standard errors in brackets for each independent variable per model. The models differ in the choice of distribution and in the specification: AFT or PHM. Stage and Industry fixed effects are included in all models. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level. Panel B shows the regression statistics and the goodness-of-fit measures, including the number of observations used to estimate the models, the Likelihood Ratio statistic including significance stars, the Akaike Information Criterion, and the Bayesian Information Criterion.