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Macroeconomic and Institutional Determinants of Venture Capital Investments

Bachelor's thesis

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Declaration of Authorship

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Prague, July 25, 2024

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Abstract

Venture capitalists (VCs) play one of the most crucial roles in identifying high-potential and innovative firms. Thus, the main research question studied in this thesis is how macroeconomics and institutional indicators influence the volume and number of venture capital investments into fast-growing technological companies (startups). The study is primarily based on panel data focusing on Central and Eastern Europe (CEE). Data consist of volume and number of VC investments as dependent variables, and multiple major macroeconomic and institutional determinants as independent variables. All collected from 2002 to 2022. The fixed effects model and random effects generalized least squares model are employed to test the hypotheses. The aim of this study is to analyze if there is an association between the aforementioned factors and compare it among the researched countries. The thesis answers questions such as how individual countries differ in their approach to investing in technological startups and how it is connected to their macroeconomic well-being. The results may be used in practice, as during the investment process in venture capital funds, the mentioned conditions must be considered to respond to variable valuations of startups and lower willingness of Limited Partners (LPs) to put money into these high-risk portfolio funds.

JEL Classification	E27, G11, G24, G32, G34, M13, L26
Keywords	venture capital, institutions, private capital, macroeconomy

Title	Macroeconomic and Institutional Determinants of Venture Capital Investments

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Abstrakt

Investoři rizikového kapitálu (VCs) hrají jednu z nejdůležitějších rolí při identifikaci inovativních firem v počátcích růstu, proto hlavní výzkumnou otázkou této práce je, jak makroekonomické a institucionální ukazatele ovlivňují objem a počet investic rizikového kapitálu do rychle rostoucích technologických společností (startupů). Studie vychází z panelových dat zaměřených na region střední a východní Evropy (CEE). Data se skládají ze závislých proměnných, jako jsou objem a počet investic na jedné straně, a hlavních makroekonomických a institucionálních determinantů na straně druhé. Vše shromážděno mezi lety 2002 a 2022. K testování hypotéz se používá model fixních efektů a model zobecněných nejmenších čtverců s náhodnými efekty. Cílem této studie je analyzovat, zda existuje souvislost mezi výše uvedenými faktory, a porovnat je mezi zkoumanými státy. Práce odpovídá na otázky, jak se jednotlivé země liší v přístupu k investicím do startupů a jak to souvisí s jejich makroekonomickou prosperitou. Výsledky lze využít v praxi, neboť při investičním procesu ve fondech venture kapitálu je třeba zohlednit uvedené podmínky a reagovat tak na proměnlivé ocenění startupů a nižší ochotu investorů (LPs) vkládat peníze do těchto rizikových portfoliových fondů.

Klasifikace JEL	E27, G11, G24, G32, G34, M13, L26
Klíčová slova	rizikový kapitál, instituce, soukromý kapitál, makroekonomie
Název práce	Makroekonomické a institucionální determinanty venture kapitálu
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Acronyms

AI Artificial Intelligence

BLUE Best Linear Unbiased Estimator

CEE Central and Eastern Europe

DD Due Diligence

FGLS Feasible Generalized Least Squares

FoF Fund of Funds

GDP Gross Domestic Product

GLS Generalized Least Squares

GPs General Partners

HNWI High Net Worth Individuals

IMF International Monetary Fund

IPO Initial Public Offering

IRR Internal Rate of Return

IC Investment Committee

LLC Limited Liability Company

LPs Limited Partners

M A Mergers and Acquisitions

MICE Multiple Imputation by Chained Equations

MOC Multiple of Capital Contributed

MVP Minimum Viable Product

OECD Organisation for Economic Co-operation and Development

Chapter 1

Introduction

Venture capital (VC) represents an industry whose scope is to support young, rapidly growing companies by providing capital and guidance to grow even faster. In return, VC funds expect to receive high returns on their investments, oftentimes surpassing other asset classes. For startups, receiving financing from VCs may accelerate their initial growth and also help them obtain a partner with a valuable source of consultation and connections. On the other hand, founders lose a minority stake in the company. Nowadays, venture capital plays an important role in the economy. In 2023 alone, close to $315 billion was invested in tech companies globally (Dealroom (2024b)). However, these investments pose high levels of risk to investors, and in most cases, they fail.

The background of this thesis is focused on the world of startup investments. The field of research then deals primarily with the macroeconomic and institutional environment that influences the venture capital industry. The general problem discussed in this thesis lies in the hypothesis that macroeconomic and institutional conditions influence not only the conditions under which investors enter startups but also the volume and number of investments made. This is observed especially in the less developed regions in the industry, such as Central and Eastern Europe (CEE), compared to the United States of America (USA), where the development of this asset class took place 20 to 30 years ago, in the 1990s.

This study builds on academic papers by Jeng and Wells (2000) and Felix et al. (2013), who analyzed the determinants of venture capital activity. Jeng and Wells (2000) uniquely examined the European VC market, focusing on entrepreneurial activity and unemployment rates. While a few studies, like Li and Zahra (2010), link VC funding to institutional characteristics, none

have combined institutional and macroeconomic determinants, especially for Central and Eastern Europe (CEE). This thesis addresses this gap, contributing to research on the VC industry by analyzing how much macroeconomic and institutional determinants influence investments in startups and comparing it among the researched countries. We develop a panel data analysis consisting of data on (1) the volume and number of VC investments, and (2) various macroeconomics and institutional determinants, all in the period from 2002 to 2022 across 20 countries in the CEE region.

The thesis is structured as follows: Chapter 2 introduces what basic terms used in this study mean. The chapter continues with stages of startup financing - where they should look for its financing, describing the brief history and how the number of startups developed over the years across the regions and industries. Chapter 3 focuses exclusively on venture capital, its history and how VC funds may differ from the other types of investment funds. The chapter also dives into how these types of funds work, their structure, and how they choose the startups they invest in in the first place and, therefore, manage to return money to their investors. Chapter 4 looks into the specifics of Central and Eastern Europe from a geographical, economic, and historical perspective. Chapter 5 is a literature review of papers and studies focused on VC investment criteria, followed by how VC creates value, and how various factors determine the number and amount of venture deals done. These studies were the basis on which I then followed up. The chapter also includes a description of how this thesis fits into the literature. Chapter 6 summarize the hypotheses that determined the direction of this bachelor's thesis, followed by Chapter 7 which is about the methodology, data, variables and econometrics tests used in the thesis. Chapter 8 presents its results from the tests and how to correctly interpret them. Chapter 9 summarizes findings, presents implications for practice, and topics for further research.

Chapter 2

Defining startups and their history

2.1 Definition

Startup is an often-used word these days. However, not everybody knows the meaning behind it. Startups are mostly associated with the USA, where they originated; however, they have since extended globally. To be able to continue writing this thesis, let's first define it. According to Paul Graham, an influential English entrepreneur and investor, a startup is "a company designed to grow fast". "Being newly founded does not in itself make a company a startup. Nor is it necessary for a startup to work on technology, or take venture funding, or have some sort of "exit." The only essential thing is growth. Everything else we associate with startups follows from growth.", he continues (Graham (2012)). This is only a figurative term. However, there is no specific definition nor data on how fast the company should grow to be able to name itself a "startup".

Generally, the name is often connected to young, significantly growing, and recently founded companies that are often looking for external capital to accelerate their growth. They are based on innovative ideas and are mostly connected to the technology industry. However, in practice, startups are not limited to this area. They are established from the desire to solve an issue that no one has solved previously, or that has been solved insufficiently well (Doston (2023)).

2.2 Startup investment cycles

The investment cycles of startups exactly copy the firm's development phases as Kiska (2014) described in his paper, which mapped the Central European VC

scene. In the beginning, there is a mere idea. Then, the concept is developed into a working prototype in order to evaluate market demand. The product is improved by the founders based on the first beta users' comments, and this is the first version that is made available to the general public. If there is a noticeable increase in demand, in order to help bring the product in front of as many people as possible, the founders hire additional employees. Particular stages of the cycle begin to recur as competition emerges, forcing the firm to innovate again and, therefore, raise even more capital to support this innovation and buy out competition.

The investment phases of startups shown in the picture can then be further divided into individual phases depending on how much capital the startup needs for subsequent growth and primarily at what stage the startup is. This is mostly determined by past investment rounds, team size, product stage, and revenue.

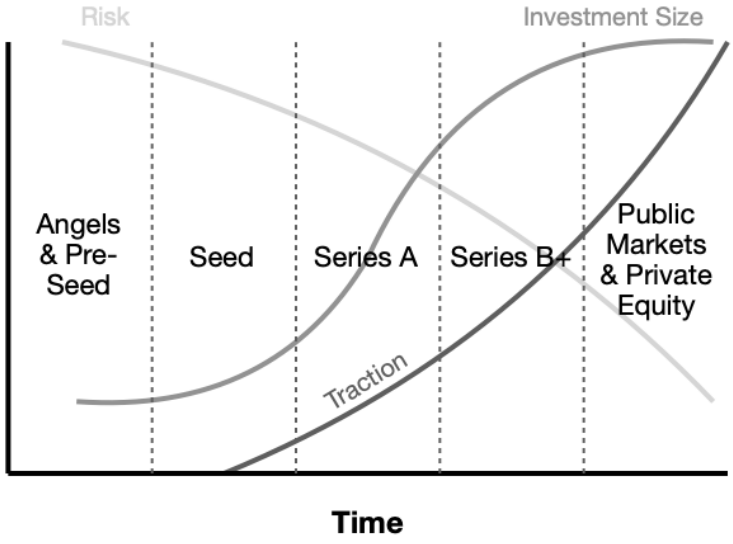

Figure 2.1: Startup investment cycles
Source: Author's elaboration, based on Kiska (2014)

As the graph shows, there are at least five fundraising stages for startups to raise capital. It needs to be said that this is a very generalized path, and most startups fail before reaching the seed phase. Every phase is characterized by hurdles that startups should meet. In the beginning, it is the product-market fit - verified thesis that there is a genuine market demand for the product and customers are willing to pay for it. At later stages, it may be a strong team of experts or a significant amount of revenue flowing to the startup. Also,

mistakes that startups deal with are characteristic of certain stages and are often repeated.

However, we can go beyond the five stages described above, and studies show that there can be more of them. Friends, family & fools (FFF), and angel rounds preceeding the Pre-Seed round, or Series D up to Series H, which managed to raise less than 20 startups worldwide. I will describe every stage in more detail. The description is, however, based on the practical experience from the VC fund in CEE and does not represent established definitions as experience varies across different regions.

FFF It is the first stage when searching for capital as a startup founder. The name speaks for itself. It is a stage of startup with an initial idea, without clients and revenue. The capital is needed for further development of the product and reaching the stage of minimum viable product (MVP). This stage is too risky for investment funds; therefore, none other than friends, family and fools will provide the capital at this stage. The investment is usually under EUR 50,000.

Angel round Still considered as the initial stage when startups decide to raise their first capital to accelerate growth. Angel investors are usually High Net Worth Individuals (HNWI) or syndicates of a larger number of smaller investors. It is considered a very niche form of investment with a high risk-reward ratio. Therefore, so-called "Angels" are mostly people from the industry - exited startup founders or VC fund executives. Same as in the FFF phase, capital is used to further develop a product, followed by launching the product on the market and subsequent iteration based on the feedback of the first customers. The investment is usually between EUR 100,000 to EUR 200,000.

Pre-Seed This is a stage when VC funds come into play. Investment funds focused on the Pre-Seed may be quite common, especially in the CEE. Investors do not need a high volume of capital to invest in this phase and diversify as investment tickets are quite low compared to later stages and vary between EUR 200,000 to EUR 500,000. The Pre-Seed phase overlaps with the Angel one; therefore startups often choose to raise one or another, and not both. Capital from this round is mostly used to bring the product to the market and gain some initial traction.

Seed Stage, which is very important in the initial formation of the startup. Founders have a broader overview of what their product does and which problem it solves on the market. They have mainly confirmed hypotheses that customers want the product and will pay for it. They create a pitch deck and detailed business plan to present to the investors. The investment tickets are around EUR 500,000 to EUR 3,000,000. They are used for paying all current employee expenses, hiring more people with expertise in the field, R&D, and initial marketing and sales expenses.

Series A, B and growth stages These are all separate funding events, named gradually by letters in alphabetical order from A up to H. Series A is considered one of the most important stages of startup funding as it transitions from the initial stage to the mature firm, which, however, still need capital for growth. A lot of startups fail to raise in this stage. Those who do no fail are called scaleups, as they are mature companies that try to scale their businesses to an even larger scale, past the development stage, and expand to further markets. Companies that have gone through Seed and Series A investment rounds have already grown significant user bases and demonstrated to investors that they have the capacity for success on a broader scale (Reif (2023)). The investment tickets vary between EUR 3,000,000 to EUR 10,000,000 in the Series A stage and go over EUR 10,000,000 in Series B and later stages.

Public Markets & Private Equity If the startups grow enough, they may come to the stage when VCs do not see enough opportunity for significant growth and, therefore, are no longer eligible for their funding. At this time, Public Markets & Private Equity begin to be applicable. For a lot of startups, IPO is an ultimate goal when shareholders are able to liquidate their shares in the startup and collect their profit from shares. However, it is a less common way of startup exit. The most common way is either acquisition from a big player in the same market or a private equity (PE) fund. At this point, the company is no longer called a startup or a scaleup. Investors also focus more on the profit from the company in terms of generating remarkable revenue, not on a potential upside of accelerating growth and later exiting the company as VCs do. There is no specific amount for how much companies are bought at this stage, which differs significantly. However, whereas VC investors take between 0-20% share in the company, PE funds take the majority, and M&A is a 100% takeover of the company.

2.3 Overview of history

The term "startup" was supposedly first used in Forbes in 1973. However, companies of similar character may be traced even to the USA in the 18th and 19th centuries (FasterCapital (2023)). In English, startup refers to the beginning of a process - to launch, to begin. First, startups had to manufacture their own products. This meant that product prototyping was needed, such as factory construction. Therefore, launching a startup required significant investment and risk before developing a working product. Nowadays, startups are mostly referred to as companies developing software, requiring much less capital for the initial MVP - the first product with the minimum capabilities required to be a viable customer solution.

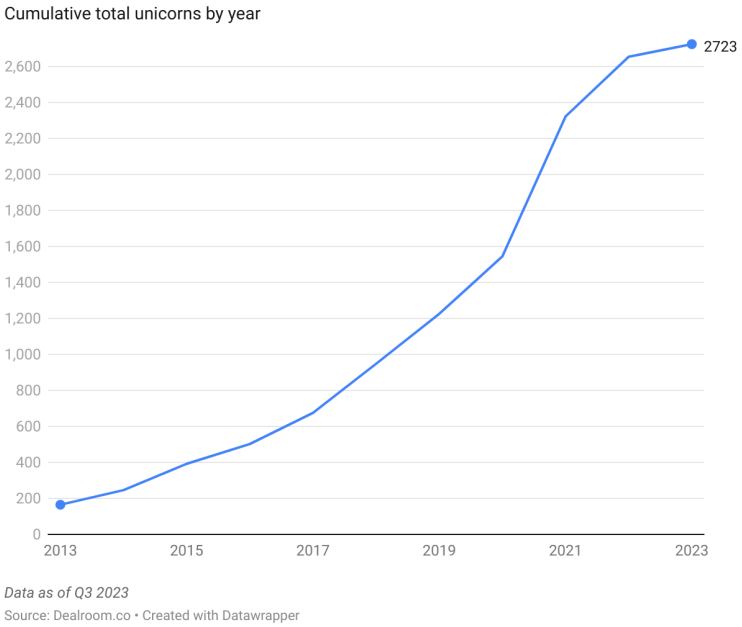

Figure 2.2: Cumulative number of companies valued at USD 1B+
Source: Dealroom (2023)

This graph shows how drastically the startup funding industry has developed over the last decade. By the beginning of 2013, there were exactly 165 unicorns (a privately held startup company with a value of over USD 1 billion) on the market. Since then, the number has increased more than 16 times over the last 10 years.

2.4 Startups across regions and industries

According to Dyvik (2023), historically, the most VC-backed industry has been financial technologies, with 7.1% of all startups in this industry by 2023. Followed by biotechnologies and healthcare at 6.8%, and artificial intelligence coming third. However, the venture ecosystem has substantially shifted throughout the last few years. Across all venture phases globally, fintech's funding share has decreased to 6.2% from 12.1% over the last two years. We could also see a drop in healthtech and consumer sectors and growth in the hardware, energy and biotech fields (Dowd (2023)). Nevertheless, the private market and the public market are driven by sentiment and expectations. Thus, the quantity of investments in various segments differs year by year, and it is natural that these statistics show a spillover of percentage points from one segment to another. Recently, for instance, there has been a huge amount of investment in AI as expectations around startups changing the world from this industry are larger than those of others. The same phenomenon happened with cryptocurrencies and blockchain startups in 2020 and the so-called "dot-com" bubble during the late 1990s associated with the broad adoption of the Internet and the World Wide Web (WWW).

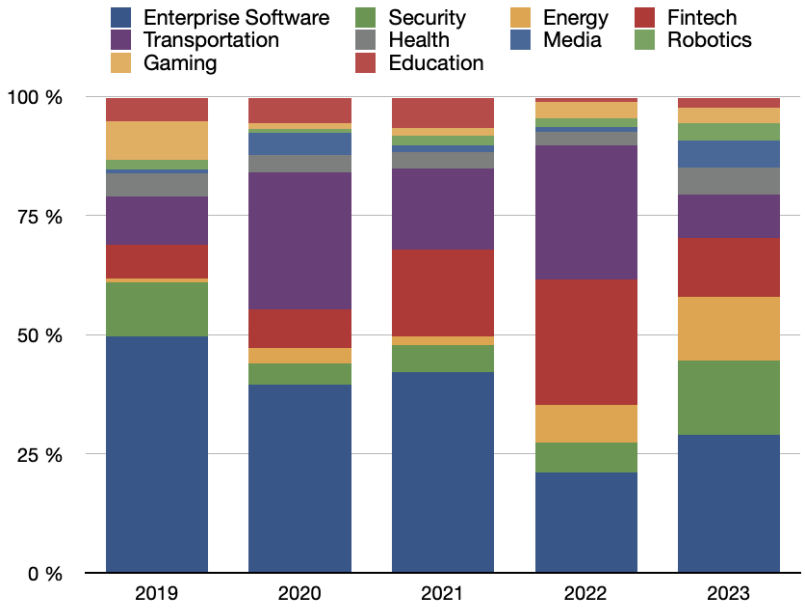

Figure 2.3: Most VC-funded startups in CEE across sectors
Source: Author's elaboration, based on Dealroom (2024a)

The same approach can be used in looking at a number of startups across

regions. These statistics may show us which countries and regions support the development of startups and where they do best, even from a macroeconomic perspective. I will focus on this in detail in the analysis section of this study. Term startup is often associated with VC-backed startups because there is no other reliable way how to navigate the number of startups in statistics as there is no precise definition. Thus, more on the distribution of startups in countries can be found in the next chapter, with a focus on VC investments in startups across regions.

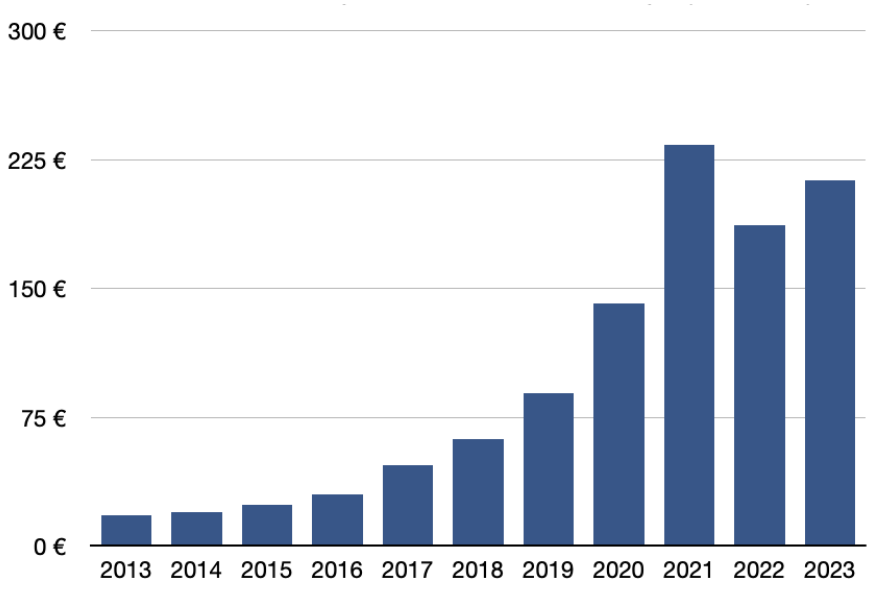

Figure 2.4: Combined enterprise value of CEE startups (in billions)
Source: Author's elaboration, based on Dealroom (2024a)

Chapter 3

Defining venture capital and its characteristics

3.1 Definition

Venture capital is an important factor for emerging innovative companies as it positively impacts the likelihood of success for startups (Jeong et al. (2020)). This type of financing serves as a financial intermediary with the primary goal of meeting the unique financial needs of startups. This focus on startups is largely due to their association with substantial growth potential and, therefore, the possibility of high investment returns on capital.

Despite this wide recognition of venture funds as key players underlying a country's entrepreneurial performances, there are huge differences across industrialized countries in the relative amounts invested in VC. For instance, VC intensity is relatively high in the USA and Canada, whereas it is very low in Japan. The diversity of national financial systems is undoubtedly one important factor underlying these international differences (Romain and van Pottelsberghe (2004)).

The statistics play a major role in the field. It is a business where exceptional payoffs from a few investments that the funds make in a large portfolio of startups return the money for most investments that yield mediocre or no returns at all (Nicholas (2019)).

3.2 Origins of venture capital

VC investing first appeared in the US before the end of World War II and thus is considered an invention of the United States. However, this type of investment was not completely established until the end of the 20th century. In the US at the end of the 20th century, investments were made mainly in the initial phase, i.e. the establishment of a company and its further development. This indicated that venture capital accounted for almost 70% of private equity investments.

The origins are traced back to the founding of the Boston-based American Research and Development Corporation (ARD) just after World War II in 1946. However, some say that the first high-tech VC investment was made in 1957 - the Digital Equipment Corporation (DEC). Generally, there is no broad consensus on when exactly the first VC investment occurred. The 1970s and 1980s were important years of VC development when we saw the emergence of iconic VC firms like Sequoia Capital, Kleiner Perkins, and Accel Partners, which funded early-stage tech giants like Apple, Cisco, and Google. Then, the 2010s brought new types of VC investors to the mix, such as micro VC firms, which transformed early-stage investing. The VC industry has continued to evolve, with the 2020s seeing an influx of corporate venture capital groups and more participation from non-traditional investors, impacting later-stage capital.

Since then, VC has grown in financial services to be a significant middleman, giving new, high-tech companies funding that they may not have otherwise received. It has helped to birth some well-known and world-renowned companies, such as Facebook, Tesla, Uber, and many more.

3.3 Characteristics of venture capital funds

VC funds have unique skills to manage elevated levels of uncertainty, asymmetric knowledge, and provide access to a valuable network. Compared to banks, venture capitalists are known for their more accurate project evaluations, and their financing is typically linked to high growth, high risk, high profitability, and very little collateral (Ueda (2004)). Usually, funds are set up as limited partnerships with limited partners (LPs) and general partners (GPs). They show a variety of characteristics, which affect their impact on portfolio companies, investment processes and decisions. These attributes include a low level

of involvement in management, as well as differences in investment preferences based on the type of fund provider (Andrieu (2013), Schertler (2005)).

3.4 Structure of venture capital funds

VC funds often focus on a certain sector or investment stage. Several aspects confirm that venture capitalists will not exploit limited partners. Included are the firm's finite duration (on average 7-10 years), the venture capitalists' compensation package structure, and the mandatory distribution policy (Sahlman (1990)). The compensation structure consists of a management fee and profit share called "carry". The standard case worldwide is the 2/20 - 2% management fee and 20% carry distribution. Carry is usually distributed to GPs only when investments are successful and funds manage to hit some milestone in terms of internal rate of return (IRR). This is called a "hurdle", and a common example is 12%, but it may vary across funds.

The management style and investment preferences of VCs can be influenced by the source of their money (Osnabrugge and Robinson (2001)). Public money in funds may cause tighter restrictions compared to VC funds, which are made up of money solely from private investors, such as pension funds, HNWI, and fund of funds (FoF). A closer look at the governance structure helps investors differentiate between reputable and incompetent venture funds.

Compared to market-traded products, VC investments are long-term and somewhat illiquid, unlike stocks or bonds. Investors are prepared to wait many years for a return on their investment since they have a lengthy investment horizon. This characteristic may potentially lead to higher rewards, offsetting the higher-than-average risk.

3.4.1 Roles in venture capital funds

VC funds, like other companies, divide their employees into certain roles according to their responsibilities. While the roles' names vary across funds, these are the established standards from the most renowned global funds.

(i) Limited Partner

(ii) General Partner

(iii) Principal

(iv) Associate

(v) Analyst

Limited Partners, as described above, are often private investors (HNWI or ex-startup founders), institutional investors (pension funds or FoF) and public investors (government organisations). They put money into funds and become investors, with which comes certain rights. General Partners are the most experienced senior members of the fund. Mostly, the owners and founders of the VC fund, in terms of legal entity. GPs usually have previous business experience and offer their expertise to startups. Also, mostly invest a small portion of their own money in the fund to show their faith in potential good returns that the fund may bring. Principals are medior employees, serving as a bridge between becoming partners and having much to learn as associates. They have a large portion of responsibilities in the fund. On one side, being an active part of the investment team that decides which startups to invest in, and on the other side helping portfolio companies to grow substantially. Both Associates and Analysts are the junior team members. They are mostly focused on sourcing deals and helping to decide if the fund should invest in the startup or not. This is done by conducting market and product research, and talking to founders of the companies. Additionally, they prepare all the investment documentation.

3.5 Returns of venture capital funds

VC funds exhibit a wide range of returns, with a few top-performing funds generating the majority of them (Supervisor and Wiklund (2006)). These returns follow a power-law distribution, where a small number of investments generate the majority of profits (Prencipe (2017)). In the industry, this generally accepted notion influences the construction of portfolios and the decisions made about investments. Factors influencing the performance of these funds include industry specialization, large fund sizes, strong deal flow, and syndication of investments (Supervisor and Wiklund (2006)). The terms of investment, influenced by fund size, also play a role in fund performance (Bowden (1994)). Despite the potential for high returns, the industry is highly opaque, making it difficult to predict fund performance (Prencipe (2017)).

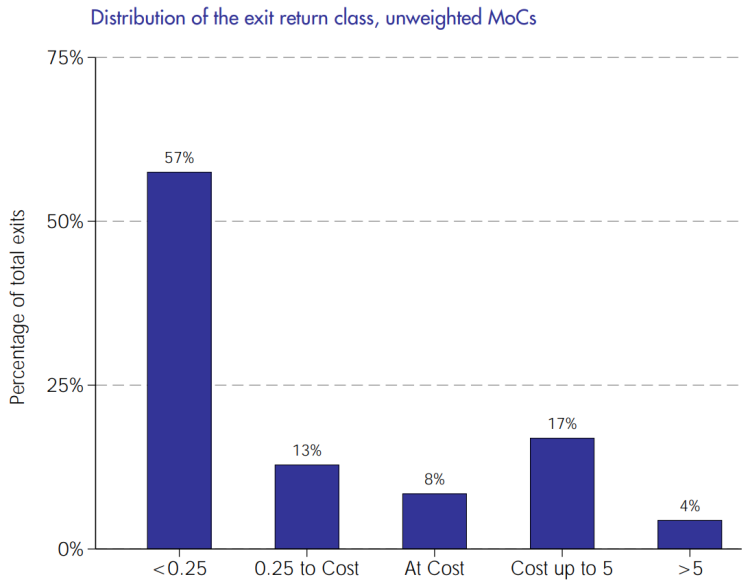

Figure 3.1: Distribution of the exit return class in Europe
Source: Prencipe (2017)

3.6 Description of investment process

The investment process of VC funds is rather different to other asset classes. To properly understand the complexity of the basis on which VCs work, how they choose the companies they invest in, and how they are able to return multiples of the invested money, it is crucial to know the structure behind it. This section introduces several stages of the aforementioned procedure in a structured but generalized way, based on the practice of VC funds in CEE.

Deal sourcing is the first stage of the VC investment process, which involves finding potential investment opportunities. The most common sources of deal flow are referrals from other investors, entrepreneurs, and industry contacts. Deals can also be manually sourced on the internet, the process may be automatized by some software, or usually, even startups are coming to funds themselves as they actively seek financing. Investors also attend events and conferences to meet with potential deal sources.

Screening is the next step in the process. Nowadays, screening is held as an online call to save time for both investors and founders. It consists of the founder presenting the company with a pitch deck, and the investor asking

additional questions to learn as much as possible about the team, product and market to be able to present it to the colleagues at the fund.

Due Diligence involves researching and analyzing the opportunity to assess its potential for success and, thus, deciding if the fund wants to proceed with the investment or not. This is usually done by analysts and associates who evaluate the technical side of the product, business model, market potential, competition, financials, and the team.

Investment Committee consists of senior members of the fund, usually GPs and industry advisors, who ultimately decide if the startup will get the investment or not. The startup is presented on the IC by an analyst or associate who conducted the DD and is working on the case. Voting mechanisms may vary across VC funds.

Term Sheet is a formal, legally non-binding document establishing the specific conditions and investment agreements between the startup and the fund. The startup receives a term sheet usually after the IC takes place if there is a decision to proceed further with the investment.

Acquisition phase includes back-and-forth communication between lawyers and both sides of the transaction to structure the deal, including determining the amount of funding, the valuation of the company, and the terms of the investment. If both parties agree on the terms, the process will result in the fund buying part of the stake in the startup.

Portfolio Support occurs when the fund has already acquired a share in the startup. The support is continuous, and investors help them accelerate growth, which means helping with sales, hiring, additional fundraising or any other value that the VC may add to the table.

Chapter 4

Venture capital in Central and Eastern Europe

4.1 Overview and definition

For the purpose of this thesis, I define Central and Eastern Europe (CEE) as a geographical region consisting of the countries in Northeast Europe (primarily the Baltics), Central Europe, Eastern Europe, and Southeast Europe (primarily the Balkans), historically former communist states from the Eastern Bloc and Warsaw Pact in Europe, as well as from former Yugoslavia. Until recent years, considered by some as still a developing region; however, according to the World Bank 2008 analysis, the transition to advanced market economies is over for all 10 countries that joined the EU in 2004 and 2007 (Bank (2013)). In this paper, for statistical reasons, CEE includes countries listed in the table below.

Table 4.1: List of countries in Central and Eastern Europe

Albania	Belarus	Bosnia and Herzegovina	Bulgaria
Croatia	Czech Republic	Estonia	Hungary
Kosovo	Latvia	Lithuania	Moldova
Montenegro	North Macedonia	Poland	Romania
Serbia	Slovakia	Slovenia	Ukraine

4.2 Characteristics of the region

For almost half of the 20th century, Central and Eastern Europe was ruled by the Soviet Union, and its economies were mostly state-owned and state-controlled with basically zero role of private capital. From 1945 to 1989, the centrally-planned social and economic policy caused it to be a commercial "black hole" for Western businesses. At the beginning of the 1990s, as the economies of CEE adopted free-market democracy and shifted to capitalism, important new markets with promising long-term development prospects for the West opened up. However, the initial excitement faded after a few years, and the move to open markets was more difficult than expected. Inflation and unemployment skyrocketed, while the living standards plummeted (Healey (1994)).

Initially, investment activity was fueled by privatization procedures and foreign government aid initiatives to revitalise entrepreneurship in these nations. Examples of such developments include actions adopted by the American Congress. These endeavours resulted in the establishment of the Hungarian-American Enterprise Fund ($70 million), the Polish-American Enterprise Fund ($240 million), and the Czech-Slovak American Enterprise Fund ($15 million) in 1990 and 1991, respectively. Following the success of the early entrants, international private venture capital companies began to enter the industry (Dariusz (2005)).

Almost 30 years have now passed since the 1990s which has changed the economic and political direction of the whole region. Nevertheless, we can still see how the development in the last century influenced technological progress and investments in them compared to the USA or Western Europe. This difference is largely seen also in the approach to innovations, startups, and their support from the public and private sector as we will see in the research part below. Although there has been extensive creation of new businesses since then, considerable progress still needs to be made in the development of entrepreneurial skills (Dariusz (2005)).

Table 4.2: Venture funding per capita by selected nations with USD 1+ billion in startup investment (2020)

Country Name	Total Funding (USD, in billions)	Population (in millions)	Funding Per Capita (USD)
Singapore	8.25	5.9	1,398
Israel	8.44	8.8	959
Estonia	1.19	1.3	915
US	269	333	808
Sweden	7.15	10.2	700
UK	32.1	68	472
The Netherlands	6.15	17.2	358
Denmark	1.97	5.8	340
Switzerland	2.75	8.7	316
Finland	1.7	5.6	303
Canada	10.3	38	271
Ireland	1.12	5	224
Germany	17	84	202
France	11.6	65	178
Australia	3.76	25.9	145
Austria	1.23	9.1	135
South Korea	3.95	51.3	77
Belgium	0.77	11.6	66
Spain	2.77	46.7	59
Brazil	10.64	214	50
China	60.6	1,445	42
Mexico	3.82	131	29
Colombia	1.2	51	24
India	28.2	1,400	20

Source: Author's elaboration, based on Dealroom (2024a)

As the figure shows, according to an analysis by Glasner (2021), Europe is doing well compared to other regions, with 13 countries on the list. However, those are mostly states from Western Europe. Among the top 24 countries worldwide that have USD 1 billion or more in startup investments, only one is from the CEE region. Estonia presents a unique case regarding the rest of the region, where it managed from the early 1990s to focus more on technology and educate its younger generation in tech entrepreneurship. The creation of Skype in 2003 was Estonia's first major technological accomplishment which helped to further develop the region. Since then, local companies and technological innovations have grown exponentially. The public sector, led by the govern-

ment, is currently providing more opportunities for business owners to launch new small firms and develop new technology, as well as making it relatively simple for startups to employ fresh talent from other countries.

Below, this graph shows specifically the amount of VC investments per capita in CEE countries measured last year. As in the figure above, Estonia stands out with EUR 310 per capita funding, followed by Lithuania with almost 3x less per capita funding and others to come. This confirms the trend in the region that the smaller countries are more innovation-driven and adaptable to use new funding sources to support their emerging companies.

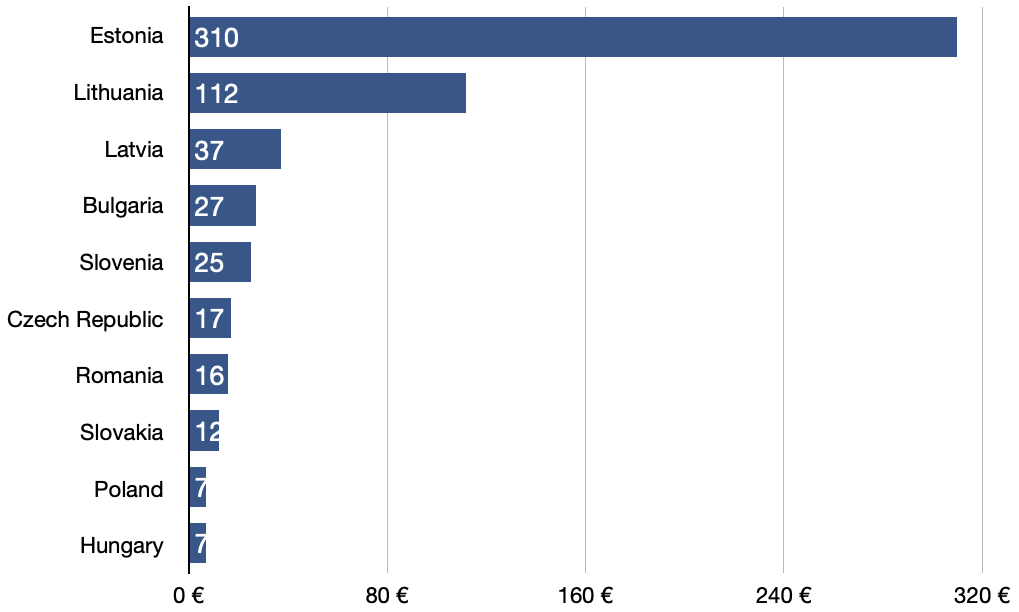

Figure 4.1: VC investment per capita in CEE countries (2023)
Source: Author's elaboration, based on Dealroom (2024a)

There is still a lot of potential in CEE. That is also what we could see in the last 5 years when the startup ecosystem here is expanding with new startups emerging and investors' hunger to founding new VC funds. This can also be seen in the statistics from the region. Companies Google & Atomico, in their CEE Startups 2022 report, presented that CEE is one of the fastest-growing regions for VC funding in Europe, growing 7.6x from since 2017. Thus outpacing more developed regions, such as Nordics or DACH region.

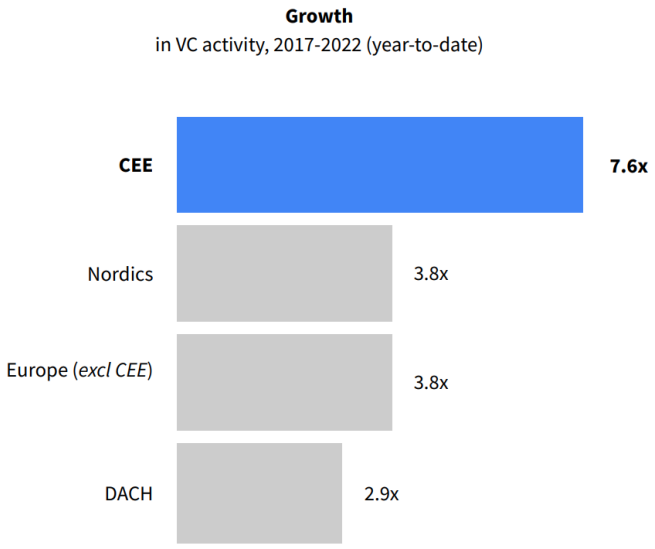

Figure 4.2: Comparison of growth in VC activity in Europe
Source: Atomico and Google (2022)

4.3 Historical development of venture capital in Central and Eastern Europe

Venture financing has a lengthy and difficult history in Europe. Though the sector did not fully take off until the late 1970s, the first VC firm was established in London in the early 1950s. Since then, VC has played a significant role in the European startup scene, helping to finance some of the most prosperous businesses in the region. In the Czech Republic, venture capital investment appeared only in 1990. The Czech Venture Capital Association (CVCA) played an important role in the country, and its members made over 100 investments totalling EUR 2.4 billion between 1990 and 2009. The majority of these investments were in information technology, telecommunications and the Internet.

The evolution of the VC industry in CEE countries with an emphasis on countries of the Visegrad Group between 1998 and 2003 was closely examined by Klonowski (2005). In the study, he focused on three statistics (fundraising, investing, and exits) indicating every startup ecosystem's strength. The paper has two major conclusions. Contrary to suggestions from earlier studies, Poland, and not Hungary, represents the most developed VC market in the region. Secondly, venture capitalists cannot treat the CEE region as a homogenous bloc. However, as the VC industry undergoes long-term cycles and

shifts in trends in fundraising, investing, and exiting activities, this can only be observed by analyzing longer data series.

Founding year	Pre-Seed	Seed	Series A	Series B	Series C	$100-250M	$250M+	Total
2013	285	57	25	12	5	3	0	**387**
2014	281	76	29	17	10	2	1	**416**
2015	340	92	41	15	10	4	0	**502**
2016	325	98	45	13	7	2	0	**490**
2017	422	141	48	18	8	1	0	**638**
2018	398	121	42	13	5	0	0	**579**
2019	389	96	37	12	5	3	1	**543**
2020	404	92	19	3	0	0	0	**518**
2021	318	94	24	8	4	2	0	**450**
2022	136	25	7	2	0	0	0	**170**
2023	37	6	1	0	0	0	0	**44**
Total	**3335**	**898**	**318**	**113**	**54**	**17**	**2**	**4737**

Figure 4.3: Number of VC investments in CEE across stages
Source: Author's elaboration, based on Dealroom (2024a)

4.4 Positive effect of startups in the region

Central and Eastern Europe, even though is not the most developed region in terms of VC investments and startups, has managed to produce some of the world's most famous and successful companies over the last twenty years. This includes Czech cybersecurity company AVG, which went public through an IPO in 2012.

Every successful startup, including those mentioned above, has extensive positive effects not just on the startup ecosystem in the given country but also boosts the whole economic environment. This effect happened also in Estonia after Skype became a multi-billion dollar company. It is informally called "Startup Mafia," and it means that dozens of first-time employees receive money from the company's exit, which allows them to build new startups in the region with already gained experience from building previously successful ones. That, among other things, brings foreign capital and investors to the country. Startup exit events may generate significant tax revenue for the government that can be subsequently used to develop entrepreneurship in the country. Last but not least, exits lead to growth and the creation of more job opportunities.

Chapter 5

Literature review

5.1 Venture capital investment criteria

Since the early 2000s, venture capitalists have become increasingly important in supporting early-stage companies across the world. The criteria according to which VCs choose the startups they invest in are often shrouded in fog and vary across funds. One of the first-ever detailed comparisons of investment criteria and procedures was made by Osnabrugge (2000). They investigated two investor types - business angels and venture capitalists - specifically in Great Britain and found that business angels and VCs use different approaches to reduce agency risks in their investments. Business angels focus more on post-investment risk reduction, and VCs emphasise pre-investment risk reduction. This is in line with the agency theory, which suggests that differences in investment decision policies can be explained by examining agency costs, market risks, information asymmetry, and control mechanisms (Hsu et al. (2013)).

Zinecker and Bolf (2015) conducted a survey among CEE countries and Russia intending to explore the issue of an essential role in selecting businesses by VC funds. They relied on primary data that were collected using a semi-structured questionnaire, and the results supported the idea that when examining business proposals, above-average attention has been paid to factors relating to the product's competitive edge and potential for significant profits. The poll also supported previous findings that the market's size and growth rate are also among the most important factors to consider. Management's familiarity with the target market is important; however, investors prioritize product and market features above this criterion.

On the other hand, Sharma (2015) highlighted that investment criteria vary

a lot across different stages, regions and industries, and thus cannot be generalized on larger data scales. They emphasised that not all venture capitalists are able to follow the same investment decision process for evaluating new ventures. Some investors emphasise the entrepreneur's characteristics, while others are more intrigued with financial and marketing perspectives. Therefore, findings reveal that VCs follow a multi-criteria perspective of decision-making.

5.2 Value creation of venture capital

The role of VC funds goes beyond the roles of debt providers such as banks, i.e., screening the project and providing loans. VC funds contribute with skills, expertise and industry-specific knowledge. This also explains why VC funding is largely fragmented and involves complex search and matching processes. Megginson and Weiss (1991) as one of the first studies compared VC-backed and non-VC-backed companies that went public through IPO. The paper indicates that VC-backed IPOs are associated with higher underwriter prestige, higher institutional holdings, and lower levels of underpricing than non-VC-backed IPOs. The presence of VC in the issuing firm lowers the total costs of going public and maximises the net proceeds to the issuing firm. These results were additionally confirmed by Jain and Kini (1995), who found that VC-backed firms show superior post-IPO operating performance than non-VC-backed ones. Brav and Gompers (1997) found that VC-backed firms have higher long-term returns, regardless of whether they went public or not. Chemmanur et al. (2011) indicated that VC-backed startups have higher sales results compared to non-VC-backed startups before VC funding and showed a steeper growth in sales after funding. The total production costs of VC-backed firms are higher than non-VC-backed ones before funding, and the growth in these costs after financing is also greater for VC-backed firms. They also found that while growth in the level of employment remains comparable across the two kinds of firms, salaries and wages grew more in VC-backed firms after receiving financing.

Hellmann and Puri (2002) provided a view where they examined the relationship between venture financing and the time it takes a company to bring its product to market. The results were that the presence of a VC fund as an investor in the startup is associated with being more forthcoming in introducing new products to the market. They pursue more aggressive market strategies than non-VC-backed firms and also aim at more radical innovations. This effect was strong for innovators but statistically insignificant for imitators. Also, an-

other study published by Kortum and Lerner (2000) pointed out that startups funded by VC are more innovative and associated with more valuable patents. In comparison, research by Michelacci and Suarez (2004) showed that venture funding has less potential to make a difference when received by companies at a later stage of their growth or in companies operating in technologically mature industries.

5.3 Determinants of venture capital investments

The number and volume of venture capital investments vary significantly worldwide. For instance, VC intensity is relatively high in the USA and Canada, whereas it is very low in Japan, as was presented in the study by Romain and van Pottelsberghe (2004). Therefore, scholars across countries study the main determinants of VC investments. Still, prior studies examining this question were mostly done in the microeconomic field, and research from a macroeconomic perspective remains relatively rare.

Studies by Conti et al. (2019), Gompers et al. (1998) and Jeng and Wells (2000) have shown that the development of startup markets is connected to macroeconomic factors, such as GDP per capita, labour market development or stock market performance. According to Black and Gilson (1998), there is a correlation between a state's financial system and its VC market. However, monetary policy, namely interest rate setting by central banks, is an often-overlooked macroeconomic indicator in entrepreneurial finance studies. A recent paper focusing on this matter was conducted by Bellavitis et al. (2024). They assessed the impact of negative central bank interest rates, using data from 32 countries from 2004 to 2019, making it one of the most comprehensive studies in this field. They claimed that interest rates significantly impact the activity of venture capital markets. Higher interest rates are linked to increased demand for capital from entrepreneurs and increased fundraising activity by VC companies. However, when lending rates fall, entrepreneurs' demand drops, while VC companies' fundraising activity rises. They confirmed the economic theory, suggesting that if interest rates rise, the level of investment should fall.

Other academic papers researching relations between entrepreneurship and economic growth were King and Levine (1993) and Shane (1996). In 1911, Joseph Schumpeter argued that financial intermediaries' services - which include controlling risk, enabling transactions, mobilizing funds, assessing projects, keeping an eye on managers, and facilitating transactions - stimulate technolog-

ical innovation and economic development. King and Levine (1993) used data from 80 countries from 1960 to 1989 and showed cross-country evidence in support of Schumpeter's theory that financial intermediaries stimulate long-run growth. The results were that several measures, such as financial development, including financial depth, are strongly associated with real per capita GDP growth, investment rates, and the rate of physical capital accumulation. Each measure had shortcomings, but all tell the same story: finance matters. For example, financial depth in 1960 (the ratio of broad money to GDP) is positively and significantly related to real per capita GDP growth over the next 30 years, even after controlling for various country-specific characteristics and policy indicators.

Governments worldwide seek to mimic the success of venture capital in the US (Megginson (2004)). These endeavours use significant amounts of public money flowing to the industry in certain countries, such as Poland. Poland is a specific case which we refer to as the "Polish paradox". Poland's economy has grown at one of the quickest rates in the EU during the last 20 years, but it has performed the worst when it comes to innovation. Thus, the Polish government established several programs aiming to expand Poland's innovation capacity, for instance, by placing promising local startups in the world-class ecosystem of the San Francisco Bay Area. One of the programs - Polish Silicon Bridge - is the subject of Bartlett and Mroczkowski (2019) paper. They analysed the experiences of early-stage Polish companies in Silicon Valley and found that international bridge organizations provide considerable benefits to emerging market startups looking to access the global market, including knowledge acquisition, mentorship, and networking with possible investors and strategic partners.

To this day, there is a limited understanding of the policies that might promote active venture capital markets. That is where Da Rin et al. (2006) contributed to fill the gap. This particular study focused on assessing various public policy instruments as potential determinants for creating active VC markets. They used "innovation ratios", defined by the shares of high-tech and early-stage investments as variables. The study was done on panel data from 14 European countries between 1988 and 2001. They had multiple findings, such as no proof of a lack of venture capital funds in Europe, calling into question the efficiency of the most commonly utilized policy to promote active VC markets. They are convinced that opening stock markets for entrepreneurial enterprises boosts creativity significantly, and lowering corporate capital gains

tax rates boosts investments in technological startups. Reducing labour regulations also leads to a bigger percentage of high-tech investments. They found no evidence that higher public R&D investments affect innovation ratios.

Deutsche Bundesbank commissioned a study following the Romain and van Pottelsberghe (2004) to identify the main determinants of VC. They quantitatively examined a theoretical model where macroeconomic conditions, technological opportunity and the entrepreneurial environment affect the demand and supply of venture funding. The results based on a panel dataset of 16 OECD countries from 1990 to 2000, showed that venture capital intensity is pro-cyclical. Interest rates mostly impact the demand side (startups) rather than the supply side (Limited Partners). Technological indicators, such as knowledge and patents, have a favourable and considerable impact on the volume of venture capital investments. A rise in the corporate income tax rate has a negative impact on VC intensity. These findings suggest a significant policy implication. Public decision-makers may promote VC by giving knowledge and strengthening the entrepreneurial climate rather than offering financial incentives.

Given the potential for VC funds to exit through an IPO, Black and Gilson (1998) asserted that a thriving venture market depends on an active stock market. IPOs are thought to have a big impact on venture funding. Jeng and Wells (2000) found no significant correlation between GDP and market capitalization. On the other hand, they proved that the most important factor influencing VC is the potential return on investment. However, that was not a surprise as a strong local stock and M&A market is vital for venture capitalists as it allows investors to exit at reasonable multiples per investment. Using a panel dataset of 21 countries, they demonstrated that labour market rigidities, the number of IPOs, government entrepreneurship policies, and bankruptcy processes account for considerable cross-country variability in VC intensity. Lastly, they showed how these variables affect various forms of VC investments differently. Rigid labour market conditions have a detrimental effect on VC investments in the early stages but not in the later stages. IPOs considerably influence later-stage VC investments globally, but they have little effect on early-stage ones. Using these forenamed key factors, I will follow up on this study in the analysis.

Employing it as a proxy for fund performance and using GDP growth, R&D investment and interest rates as explanatory factors for VC funding, Gompers et al. (1998) found no significant effect in their multivariate model. According

to Schertler (2000), early-stage VC investments are substantially positively impacted by stock market liquidity. Nonetheless, same as Jeng and Wells (2000), discovered that stock market capitalization growth rates have little effect on early-stage VC investments. Moreover, Gompers et al. (1998) model shows a strong correlation between R&D spending and state-level VC activity. Additionally, Schertler (2000) estimated the human capital endowment by comparing the number of workers in R&D and patents. He discovered that there is a benefit to having more R&D employees.

Felix et al. (2013) contributed to the research by analysing the determinants of European VC activity and investigating whether the size of the M&A is an important variable in explaining the drivers of the VC market. Also, they were the first ones to analyze the influence of macro-level information asymmetry, entrepreneurial activity levels, and unemployment rates on venture capital activity. By using data from 23 European countries for the period from 1998 to 2003, the results revealed that VC activity is positively influenced by the M&A market size and market-to-book ratio, whereas the unemployment rate has a negative impact. It highlighted the significance of exit strategies and asymmetric knowledge in the industry.

Despite sharing the same basic framework, mentioned available studies vary significantly regarding the specific variables included. This shows that while the fundamental structure is widely recognized, there is still no consensus on which criteria should be included in the demand and supply of venture capital.

5.4 Contribution of this thesis

The aim of this study is to analyze if there is an association between the above-mentioned macroeconomic and institutional factors and the volume of VC investments and compare it among the researched countries. The contribution is in connecting a microeconomic phenomenon, which the venture capital is, to macroeconomic and institutional conditions in CEE. The study answers questions such as how individual countries differ in their approach to investments in technological startups and how it is connected to their macroeconomic well-being. The results could be theoretically used in practice, as during the investment process in venture capital funds, also mentioned conditions must be taken into consideration to respond to variable valuations of technological startups and lower willingness of Limited Partners to put money into these high-risk portfolio funds.

The thesis framework is most similar to studies of Jeng and Wells (2000) and Felix et al. (2013), who analysed the determinants of venture capital activity. Many academics have examined the connection between macroeconomic factors and startup funding. However, the main novelty of Jeng and Wells (2000) was in accounting for the idiosyncrasies of the European venture capital market, with them being the first to study the direct impact of the level of entrepreneurial activity and the impact of the unemployment rate on venture capital activity. On the other hand, only a few studies, such as Li and Zahra (2010), have shown a connection between VC funding and countries' institutional characteristics, and none studied the connection of both institutional and macroeconomic determinants to VC activity. Moreover, no study with the most up-to-date data focused on Central and Eastern Europe. Instead, the Western markets are mostly examined. The story of CEE has not yet been covered because the local ecosystem is not as appealing to VC financing as other, more mature regions. That is, however, gradually shifting. I will follow up on these studies, using 6 macroeconomic variables and 6 institutional variables, some overlapping with determinants from their studies, and examine these determinants on countries of the CEE region between the years of 2002 and 2022.

Chapter 6

Hypotheses

This study aims to answer the questions, based on the literature review conducted, of how much individual determinants ceteris paribus influence the amount and number of venture capital investments in countries of Central and Eastern Europe. This chapter states the hypotheses as follows:

Higher interest rate (**H1**) and unemployment rate (**H2**) are linked to decreased venture capital activity.

Increased GDP per capita (**H3**), GDP growth rate (**H4**), inflation (**H5**) and market capitalization (**H6**) are positively associated with boosting the volume and number of VC investments.

Regulatory quality (**H7**), tax rate (**H8**) and political stability (**H9**) have an insignificant effect on VC intensity.

Government effectiveness (**H10**), new business density rate (**H11**) and technological indicators, such as patent applications per capita (**H12**), have a favourable impact on VC investments.

Chapter 7

Methodology and data

7.1 Methodology

As Felix et al. (2013) have already pointed out, most prior publications employ a reduced-form equilibrium framework. They attempt to identify the variables influencing venture capital demand and supply and, using the equilibrium condition, predict the impact of each element on equilibrium venture capital activity. Thus, the reduced-form equilibrium model is used in this study. In other words, we believe that variations in venture capital levels may be attributed to changes in either demand or supply. In short, venture capital is demanded by entrepreneurs seeking capital to fund their startups. The supply of venture capital matches the risk capital provided by individual investors, investment funds, and banks.

7.1.1 Panel Data Analysis

Given the nature of the data acquired, we opted to employ the panel data approach to investigate both sectional and time correlations. The fundamental structure of a panel data model with k explanatory variables and unobserved effects is as follows:

$$y_{it} = \beta_0 + \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + a_i + u_{it} \tag{7.1}$$

where $i = 1, \ldots, N$ refers to the country and $t = 1, \ldots, T$ refers to the time period (year). The term $v_{it} = a_i + u_{it}$ is the composite error for country i and period t. The component a_i is called the *country fixed effect* and captures all unobserved, time constant factors that affect y_{it}. In this example, the

component a_i might contain cultural and institutional elements that drive VC activity, which vary by country but are rather constant over time.

Considering the unbalanced panel dataset with varying technological opportunities, institutional and economic development, and other unobservable characteristics, the most appropriate estimation method is determined by whether or not the term a_i correlates with the explanatory factors. When a_i is not correlated with the explanatory variables, the random effect estimator is the best option since it is more consistent and efficient than the fixed effect estimate. However, if the unobserved effect is correlated with the explanatory factors, random effect estimators are biased and inconsistent, making the fixed effect estimator more appropriate.

The random effect estimator is the feasible generalized least squares (FGLS) estimator of 7.1 (GLS is used as the error terms $v_{it} = a_i + u_{it}$ are correlated) whereas the fixed effect estimator is the OLS estimator of the regression using time-demeaned data:

$$y_{it} - \bar{y}_i = \beta_1(x_{it1} - \bar{x}_{i1}) + \beta_2(x_{it2} - \bar{x}_{i2}) + \cdots + \beta_k(x_{itk} - \bar{x}_{ik}) + u_{it} - \bar{u}_i \quad (7.2)$$

Where $\bar{y}_i = \frac{\sum_{t=1}^{T} y_{it}}{T}$, and so on.

We estimate the reduced form coefficients using both the GLS and OLS estimators. To pick between the two estimators, we use the Hausman test to determine if the unobserved components were connected with the explanatory variables.

7.2 Regression analysis and models used

To measure the relationship between VC activity and macroeconomic and institutional determinants, the study estimates the following model on all paths described in the methodology in accordance with the literature previously reviewed, mostly Jeng and Wells (2000). We assume a linear specification of venture capital demand and supply. The equation describing VC supply is as follows:

$$\begin{aligned} VCSupply_{it} = \alpha_0 + \alpha_1 GDPperCapita_{it} + \alpha_2 Inflation_{it} + \\ \alpha_3 InterestRates_{it} + \alpha_4 UnemploymentRate_{it} + \\ \alpha_5 MarketCapitalization_{it} + \alpha_6 RealGDPGrowth_{it} + \\ \alpha_7 GovernmentEffectiveness_{it} + \alpha_8 PatentsperCapita_{it} + \\ \alpha_9 PoliticalStability_{it} + \alpha_{10} RegulatoryQuality_{it} + \\ \alpha_{11} TaxEnvironment_{it} + \alpha_{12} NewLLCperCapita_{it} \end{aligned} \tag{7.3}$$

The equation describing VC demand is as follows:

$$\begin{aligned} VCDemand_{it} = \beta_0 + \beta_1 GDPperCapita_{it} + \beta_2 Inflation_{it} + \\ \beta_3 InterestRates_{it} + \beta_4 UnemploymentRate_{it} + \\ \beta_5 MarketCapitalization_{it} + \beta_6 RealGDPGrowth_{it} + \\ \beta_7 GovernmentEffectiveness_{it} + \beta_8 PatentsperCapita_{it} + \\ \beta_9 PoliticalStability_{it} + \beta_{10} RegulatoryQuality_{it} + \\ \beta_{11} TaxEnvironment_{it} + \beta_{12} NewLLCperCapita_{it} \end{aligned} \tag{7.4}$$

To create the equilibrium equation, we solve the supply equation with regard to the return variable and substituted it into the demand equation for both response variables - (1) the amount of VC investments per capita and (2) the number of VC investments per capita. Considering the equality of the quantity of funds supplied and demanded, we calculate the equilibrium amount of venture capital funds as a function of the explanatory factors:

$$\begin{aligned} VCInvestmentsAmount_{it} = \gamma_0 + \gamma_1 GDPperCapita_{it} + \gamma_2 Inflation_{it} + \\ \gamma_3 InterestRates_{it} + \gamma_4 UnemploymentRate_{it} + \\ \gamma_5 MarketCap_{it} + \gamma_6 GDPGrowth_{it} + \\ \gamma_7 GovernmentEffectiveness_{it} + \\ \gamma_8 PatentsperCapita_{it} + \\ \gamma_9 PoliticalStability_{it} + \gamma_{10} RegulatoryQuality_{it} + \\ \gamma_{11} Taxes_{it} + \gamma_{12} NewBusinessDensityRate_{it} \end{aligned} \tag{7.5}$$

$$\begin{aligned} VCInvestmentsNumber_{it} = \delta_0 + \delta_1 GDPperCapita_{it} + \delta_2 Inflation_{it} + \\ \delta_3 InterestRates_{it} + \delta_4 UnemploymentRate_{it} + \\ \delta_5 MarketCap_{it} + \delta_6 GDPGrowth_{it} + \\ \delta_7 GovernmentEffectiveness_{it} + \\ \delta_8 PatentsperCapita_{it} + \\ \delta_9 PoliticalStability_{it} + \delta_{10} RegulatoryQuality_{it} + \\ \delta_{11} Taxes_{it} + \delta_{12} NewBusinessDensityRate_{it} \end{aligned} \tag{7.6}$$

7.3 Dataset

We constructed a panel dataset based on two data types for 20 countries of the CEE region from 2002 to 2022. It is important to note that it involves the entire post-communist region west of Russia, i.e. including Belarus and Ukraine. Firstly, we exploited microeconomic data from the database where users can access all venture capital investments into companies worldwide with a value of at least EUR 1 million, but sometimes even less. The database allows for filtering according to many variables, such as the volume of investments, number of investments, industries, geography, etc. Then, we matched these data with datasets of global macroeconomic and institutional data from publicly accessible sources. The data series presented within these subjects have been chosen as the most relevant in evaluation determinants of VC investments across recognized papers in the past, and for which comparable data across countries are available. This allowed us to examine different levels of VC activity observed across countries by considering the variations in economic and institutional environments. The final dataset has 420 observations of 14 variables, equivalent to 5880 observations with 594 NAs.

The model in the thesis incorporates most of the theory's proposed elements. We use GDP per capita and GDP growth as a proxy for economic expectations. Real interest rates, inflation and the unemployment rate are used as a proxy for expectations and labour market rigidities. Market capitalization is used as a proxy for the exit environment. All of the institutional determinants are used as proxies for the ability of countries' governments to support early-stage companies and how much they regulate the environment. Specifically, patents

per capita and new business density rate are used as a proxy for technological progress and innovation potential. The study examines each variable of the venture capital market included in our analysis, briefly describing its projected theoretical influence and summarizing the findings of prior empirical investigations. This analysis will be useful for evaluating our findings and comparing them to earlier research.

To handle the NAs, specifically in the macroeconomic and institutional datasets, we used the MICE method. The MICE (Multiple Imputation by Chained Equations) method is a statistical technique used to handle missing data in datasets. Instead of simply removing or ignoring the missing values, MICE creates multiple imputed datasets by replacing them with a set of plausible values based on other available information in the dataset. This allows for more accurate statistical analyses and predictions.

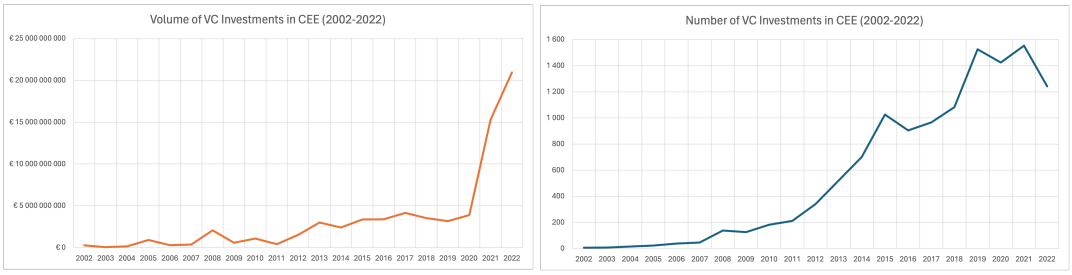

Figure 7.1: Amount and number of VC Investments in CEE
Source: Author's elaboration

7.3.1 Data collection

Data collection is quite challenging in the venture capital industry due to the restricted availability of data. To perform an analysis, we needed to collect data on the number and amount of venture capital investments in 20 chosen countries of the CEE region. For that, we downloaded data from Dealroom.co, followed by filtering the countries based on the chosen specifics. Two measures are used to assess the level of VC activity within a country. The first involves taking the total amount of VC investments scaled by the country's population (per capita). The second measure is the total number of VC investments per capita. The first measure serves as a robustness check since the information on the number of investments is missing for certain deals in the Dealroom.co database.

On the other hand, macroeconomic and institutional data were collected from various sources, including the World Bank database, Eurostat, OECD,

and International Monetary Fund (IMF). Ultimately, we chose 12 determinants overall - 6 macroeconomic ones and 6 institutional ones. Macroeconomic variables include (1) GDP per capita, (2) inflation, (3) interest rates, (4) market capitalization, (5) unemployment rate, and (6) GDP growth. Institutional variables include (1) government effectiveness, (2) patents per capita, (3) political stability, (4) regulatory quality, (5) tax environment, and (6) new business density rate. For some indefinite variables, predefined indexes by the World Bank were chosen and used as proxies. This applies to government effectiveness, political stability, regulatory quality and tax environment. Also, the amount and number of VC invested, GDP and patents were weighted per capita.

As different sources include various countries as a part of the CEE region, the specification is needed. As described earlier in the Chapter 6, I chose and collected data for Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia, and Ukraine. However, it is important to note that data in this region have limited availability and are difficult to obtain.

Table 7.1: Variable descriptions

Variable	Type of Data	Description	Source
Amount of VC Invested (per capita, USD)	VC	Amount of venture capital deals invested in Central and Eastern Europe between 2002-2022.	Dealroom.co
Number of VC Invested (per capita, USD)	VC	Number of venture capital deals invested in Central and Eastern Europe between 2002-2022.	Dealroom.co
GDP per Capita (USD)	Macroeconomic	GDP per capita is gross domestic product divided by midyear population.	World Bank national accounts data, OECD National Accounts data files
Inflation (annual %)	Macroeconomic	Inflation as measured by the consumer price index reflect the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services.	International Monetary Fund, International Financial Statistics and data files
Real Interest Rate (%)	Macroeconomic	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	International Monetary Fund, International Financial Statistics and data files
Unemployment Rate (% of the total labour force)	Macroeconomic	Unemployment refers to the share of the labour force that is without work but available for and seeking employment.	International Labour Organization
Market Capitalization (% of GDP, USD)	Macroeconomic	Market capitalization is the share price times the number of shares outstanding for listed domestic companies.	World Federation of Exchanges database
GDP Growth (annual %, USD)	Macroeconomic	Annual percentage growth rate of GDP at market prices based on constant local currency.	World Bank national accounts data, OECD National Accounts data files
Government Effectiveness	Institutional	Government Effectiveness captures perceptions of the quality of public and civil services and the degree of its independence from political pressures.	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010). World Bank Policy Research Working Paper No. 5430
Patent Applications (per capita)	Institutional	Patent applications are worldwide patent applications for exclusive rights for an invention.	World Intellectual Property Organization (WIPO)
Political Stability	Institutional	Political Stability measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010). World Bank Policy Research Working Paper No. 5430
Regulatory Quality	Institutional	Regulatory Quality captures ability of the government to formulate and implement policies and regulations that permit and promote private sector development.	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010). World Bank Policy Research Working Paper No. 5430
Total Tax and Contribution Rate (%)	Institutional	Total tax rate measures the amount of taxes and mandatory contributions payable by businesses as a share of commercial profits.	World Bank, Doing Business Project
New Business Density Rate (%)	Institutional	The number of newly registered firms with limited liability per 1,000 working-age people (ages 15-64) per calendar year.	The 7th edition of the Entrepreneurship Database by World Bank

Chapter 8

Empirical results

This section explains the estimating and testing strategies we employed and highlights primary findings. To determine the characteristics that drive venture capital investment in CEE, we evaluated two regressions that varied only in the dependent variable utilized: *VCAmount* and *VCNumber*. All regressions were calculated using fixed and random effects estimators. The Hausman test was used to choose the best estimate for each regression. The results are presented in Table 8.1. As R-squared and Adjusted R-squared statistics may suggest, in both cases, fixed effects analyses have a higher proportion of variance in the dependent variable that can be explained by the independent variables, 0.20 and 0.35, respectively. Several general conclusions can be drawn. First, all computed models have a substantial overall significance. Using the F and Wald tests for the joint significance of all variables, we can clearly reject the null hypothesis that all coefficients are zero. Second, tests for the joint relevance of each set of factors (macroeconomic and institutional) show that each group contributes significantly to explaining VC investment intensity. Third, the Hausman test results reject the null hypothesis that the fixed effect and random effect estimators are the same. This suggests that country-fixed unobserved effects are linked to explanatory variables, implying that fixed effect estimators are more consistent and efficient. Now, we examine the impact of each independent determinant individually.

8.1 Macroeconomic determinants

8.1.1 GDP per Capita

GDP per capita measures a country's economic output that accounts for its number of people. It is an important indicator of economic health and a key determinant in the analysis of venture capital investments. According to the results, GDP per capita has a positive impact in the fixed effects model for *VCAmount*. However, this effect is not statistically significant. For *VCNumber*, GDP per capita shows a positive and statistically significant effect at 1% level. The *Hypothesis 3* in Chapter 6 is confirmed. However, previous studies have shown mixed results regarding GDP per capita's impact on VC investments. While higher GDP per capita can indicate a strong market with potential for growth, it can also lead to higher costs and increased competition. For instance, Gompers et al. (1998) found a positive relationship between economic growth and venture capital activity. In contrast, Jeng and Wells (2000) suggested that while GDP per capita is an important economic indicator, its direct impact on venture capital might be overshadowed by other factors, such as market conditions and government policies.

8.1.2 Inflation

Inflation is the rate at which the general price level of goods and services rises, decreasing purchasing power. For *VCAmount*, inflation has a positive but statistically insignificant effect. For *VCNumber*, the effect of inflation is also positive but statistically insignificant. Although the impact of inflation on venture capital is not widely studied, high inflation generally discourages investment by increasing uncertainty. A study by Baum and Silverman (2004) indicates that stable economic conditions, including low inflation, are conducive to venture capital activity. On the other hand, inflation can positively impact VC investments by pushing investors towards higher-return opportunities and increasing demand for venture capital as a financing option. The result is consistent with the *Hypothesis 5* in 6 but at a statistically insignificant level.

8.1.3 Real Interest Rate

The real interest rate is the lending interest rate adjusted for inflation. It influences the cost of borrowing and the attractiveness of investment opportunities.

For *VCAmount*, the real interest rate has a negative but insignificant effect. For *VCNumber*, it also has a negative and statistically insignificant impact. Lerner (1994) found that lower interest rates reduce the cost of borrowing, encouraging investment in higher-risk ventures, including startups. Thus, higher real interest rates may negatively affect VC investments because it makes it more expensive for startups to finance their growth and operations, potentially reducing their profitability and attractiveness to venture capitalists. Additionally, higher real interest rates can lead investors to favour safer, more predictable returns from fixed-income investments. This is consistent with the *Hypothesis 1* in Chapter 6; however, at a statistically insignificant level.

8.1.4 Unemployment Rate

The unemployment rate measures the percentage of the labour force that is jobless and actively seeking employment. The unemployment rate has a negative impact across all models, except for *VCAmount* fixed effects model. There, *VCAmount* has a positive effect; however, statistically insignificant. For *VCNumber*, it has an insignificantly negative impact. A higher unemployment rate is likely to be associated with lower economic expectations and, thus, lower entrepreneurial activity. Also, a high unemployment rate generally indicates economic distress, deterring venture capital investments. Kaplan and Stromberg (2009) noted that high unemployment could signal poor economic conditions, reducing entrepreneurial activity and venture funding. This is consistent with the *Hypothesis 2* in Chapter 6 for *VCNumber* at a statistically insignificant level, but is not consistent with the *Hypothesis 2* for *VCAmount*.

8.1.5 Market Capitalization

Market capitalization refers to the total market value of a company's outstanding shares of stock. It is a measure of a company's size and investment potential. In this case, it stands for the cumulative market value of all listed domestic companies. For *VCAmount*, the market cap effect is positive and significant at 0.1% level. For *VCNumber*, the determinant has a positive and statistically significant effect at 10% level. The reasoning is that an increased market cap is expected to make the investment environment more favourable as it corresponds to increases in funds available for VC investments. A study by Kortum and Lerner (2000) supports market capitalization's positive impact on venture capital. They found that larger, more established markets provide better op-

portunities for exits and returns on investment. The result is consistent with the *Hypothesis 6* in Chapter 6.

8.1.6 GDP Growth

GDP growth measures the increase in the value of goods and services produced by an economy over time. For *VCAmount*, GDP growth has a negative and statistically significant effect at 5% level in the fixed effects model. For *VCNumber*, it also indicates a negative impact with significant results at 5% level. This rejects the *Hypothesis 4* in Chapter 6. These results may be counter-intuitive; however, as suggested by Gompers et al. (1998), rapid GDP growth might not always translate to VC growth since it indicates that economic volatility can deter long-term investments in venture capital. Additionally, during periods of robust economic growth, investors may shift their focus towards more stable, established companies that promise safer returns, thereby reducing the capital available for high-risk, high-reward VC investments in startups.

8.2 Institutional determinants

8.2.1 Government Effectiveness

Government effectiveness reflects the quality of public services, the quality of the civil service, and the degree of independence from political pressures. For *VCAmount*, government effectiveness has a positive and significant impact at 5% level. For *VCNumber*, it has a significant positive impact across all models (significant at 1% level). Government effectiveness is crucial for venture capital, as it ensures a stable and predictable regulatory environment, which reduces risks for investors. Porta et al. (1997) found that effective governance fosters a favourable business climate, encouraging VC investments. The result is consistent with the *Hypothesis 10* in Chapter 6.

8.2.2 Patent Applications

Patent applications per capita measure the number of patent filings relative to the population, indicating the level of innovation in an economy. For *VCAmount*, patents per capita have a negative but not statistically significant impact. For *VCNumber*, they also show a negative impact but significant at 5% level. This does not confirm the *Hypothesis 12* in Chapter 6. The

relationship between patents and venture capital is complex. Obtaining and defending patents is often a costly and time-consuming process. It also may lead to legal challenges and create barriers to entry, as they grant exclusive rights to the patent holder, potentially blocking new entrants from developing similar products or technologies. Kortum and Lerner (2000) highlighted that innovation drives venture investments; however, excessive patenting without commercialization potential can deter investments.

8.2.3 Political Stability

Political stability measures the likelihood of political instability and/or politically motivated violence, including terrorism. For *VCAmount*, political stability has a positive but statistically insignificant effect in the fixed effects model. For *VCNumber*, it shows an insignificant and negative impact. Political stability could be essential for VC investments. However, no scholars researched its significance for the startup environment. The closest paper to this was Gompers et al. (1998), where they found that stable political environments reduce risk, making venture capital investments more attractive. This confirms the *Hypothesis 9* in Chapter 6.

8.2.4 Regulatory Quality

Regulatory quality reflects the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. For both *VCAmount* and *VCNumber*, regulatory quality has a negative but statistically insignificant impact. This is consistent with the *Hypothesis 7* in Chapter 6. Regulatory quality may negatively affect VC investments if overly stringent or complex regulations increase the cost and complexity of compliance for startups. According to Cumming and Johan (2007), stringent regulations can stifle innovation and investment, while high-quality regulatory environments foster VC growth.

8.2.5 Total Tax and Contribution Rate

The total tax and contribution rate measures the amount of taxes and mandatory contributions payable by businesses, expressed as a percentage of commercial profits. For both *VCAmount* and *VCNumber*, taxes show a negative

but statistically insignificant impact. High tax rates can deter venture capital investments by reducing after-tax returns. An academic paper by Djankov et al. (2010) indicates that lower taxes encourage entrepreneurial activity and venture investments. On the other hand, a higher tax rate decreases the entrepreneur's profit and hence lowers the incentive to become an entrepreneur (Poterba (1989)). The result is consistent with the *Hypothesis 8* in Chapter 6.

8.2.6 New Business Density Rate

The new business density rate measures the number of new businesses registered per 1,000 working-age people. For *VCAmount*, the variable has a positive and significant impact at the 0.1% level in the fixed effects model. For *VCNumber*, it also shows a positive and significant effect at the 0.1% level. A high new business density rate indicates a vibrant entrepreneurial ecosystem, which is conducive to VC investments. Research by Acs and Szerb (2007) supports the claim of a positive correlation between new business formation and venture capital activity. This is consistent with the *Hypothesis 11* in Chapter 6.

Table 8.1: Empirical results

Empirical results for *VCAmount* and *VCNumber*. This table shows the results for various panel data models. The R-squared provides the goodness of fit for each of the panel models, the adjusted R-squared is a modified version of the R-squared that has been adjusted for the number of predictors in the model, the Hausman test tests the null hypothesis that the unobserved effect is uncorrelated with the explanatory variables, the F test tests the hypothesis that all effects are equal to zero, and Wald tests test the joint significance of all covariates. In parentheses, the we present the values of the t-statistics for each variable.

Determinants	*VCAmount*		*VCNumber*	
	Fixed effects	Random effects	Fixed effects	Random effects
Macroeconomic conditions:				
GDPPerCapita	9.51e-04 (0.10)	9.48e-04 (0.18)	5.12e-10 (2.60)***	1.69e-10 (1.12)
Inflation	6.48 (1.31)	2.49 (0.55)	1.99e-08 (0.20)	-2.84e-09 (-0.03)
InterestRate	-2.51 (-0.39)	-6.04 (-1.10)	-8.59e-08 (-0.67)	-1.52e-07 (-1.23)
UnemploymentRate	4.26 (0.46)	-3.51 (-0.65)	-1.80e-07 (-0.97)	-3.51e-07 (-2.37)**
MarketCap	9.65 (4.43)****	2.39 (1.76)*	7.70e-08 (1.79)*	3.44e-08 (0.96)
GDPGrowth	-16.92 (-2.51)**	-6.64 (-1.00)	-3.11e-07 (-2.33)**	-2.60e-07 (-1.93)*
Institutional variables:				
GovernmentEffectiveness	401.58 (2.04)**	147.52 (1.17)	1.25e-05 (3.21)***	9.01e-06 (2.87)***
PatentsperCapita	-177645.34 (-1.57)	-63765.71 (-0.97)	-5.19e-03 (-2.32)**	-3.65e-03 (-1.97)**
PoliticalStability	88.90 (0.95)	-49.07 (-0.64)	-1.40e-06 (-0.76)	-3.20e-06 (-1.84)*
RegulatoryQuality	-104.38 (-0.55)	-143.34 (-1.23)	-6.00e-07 (-0.16)	-3.18e-06 (-1.06)
Taxes	-0.53 (-0.13)	0.35 (0.10)	-8.72e-08 (-1.04)	-1.11e-07 (-1.37)
NewBusinessDensityRate	135.40 (8.17)****	58.22 (7.30)****	3.69e-06 (11.26)****	2.67e-06 (11.21)****
R-squared	0.20	0.17	0.35	0.34
Adjusted R-squared	0.14	0.14	0.30	0.32
Hausman Test		111.75		37.84
F-statistics	8.21		17.35	
Chi-square		82.72		212.18
P-value	8.02e-14	1.25e-12	2.22e-16	2.22e-16
Wald Test		1.22		0.03

Note: * p<0.1; ** p<0.05; *** p<0.01; **** p<0.001

Chapter 9

Conclusion

This thesis has explored the macroeconomic and institutional determinants of venture capital (VC) investments in Central and Eastern European economies from 2002 to 2022. The primary objective was to analyze how various macroeconomic and institutional factors influence the volume and number of VC investments in startups. This study has provided insights into the dynamics of VC investments in the CEE region using panel data analysis, including a fixed-effects model and a random-effects model.

The empirical analysis includes many of the previously studied drivers, e.g. by Jeng and Wells (2000), Romain and van Pottelsberghe (2004) and Felix et al. (2013), including GDP per capita, GDP growth rate, real interest rate, inflation, market capitalization, unemployment rate, patents and taxes. In addition, we investigated the influence of institutional determinants, such as government effectiveness, political stability, regulatory quality and new business density rate, in explaining significant determinants of VC in CEE. Results revealed several key determinants. Among the macroeconomic determinants, both GDP indicators and market capitalization were found to be significant. Higher GDP per capita positively affects VC investments, indicating that economic prosperity encourages venture capitalists to invest in startups. However, while higher GDP per capita can indicate a strong market with potential for growth, it can also lead to higher costs and increased competition. Conversely, rapid GDP growth might not always translate to VC growth since it indicates that economic volatility can deter long-term investments in venture capital. At the statistically insignificant level, the results show that lower real interest rates are associated with increased VC activity, supporting the notion that cheaper borrowing costs stimulate investments. Also, a higher unemployment

rate is likely to be associated with economic instability and, thus, lower entrepreneurial activity.

Institutional determinants also play a critical role in shaping VC investments. Government effectiveness, patent applications and new business density rate were identified as significant factors. Effective governance facilitates efficient business operations and fosters trust, encouraging investors to invest more in startups. The relationship between patents and venture capital is complex. Obtaining and defending patents is often a costly and time-consuming process, which may lead to legal challenges and create barriers to entry. Nevertheless, the high new business density rate indicates a vibrant entrepreneurial ecosystem, which is conducive to VC investments.

This thesis contributes to the literature by providing a comprehensive analysis of both macroeconomic and institutional factors affecting VC investments in the CEE region. Unlike previous studies that predominantly focused on developed economies, this thesis sheds light on the dynamics of an emerging market context. The findings highlight the importance of a favourable macroeconomic and institutional environment for fostering VC activity, which can be crucial for policymakers aiming to stimulate innovation and economic growth.

The results of this study have several practical implications. For policymakers, the findings suggest that to attract more VC investments, governments in the region should focus on improving its effectiveness, economic stability, and enhancing regulatory quality. Special attention should be given to policies that support innovation, such as facilitating patent applications and providing incentives for R&D activities. On the other side, investors should consider macroeconomic indicators such as GDP growth and market capitalization when making investment decisions. Additionally, understanding the institutional landscape, including tax environment and political stability, is vital for assessing investment risks and opportunities. Entrepreneurs and startups seeking VC funding should be aware of the broader economic and institutional factors that influence investor decisions. Demonstrating innovative potential and operating within a stable and efficient regulatory framework can enhance their attractiveness to VC investors.

While this thesis provides valuable insights, several limitations must be acknowledged. The study primarily relies on data from 2002 to 2022, which may not capture all developments and shifts in the VC landscape. Additionally, the analysis is limited to the CEE region, and the findings may not be generalized to other emerging markets. It is also important to mention that the data used

in the analysis are unbalanced, with a considerable amount of not available data for explanatory variables, given the geography and nature of the dataset obtained. Future research could address these limitations by extending the analysis to a wider set of data and exploring other emerging markets.

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Appendix A

Table A.1: Period of analysis and variable averages per country

Country	Period	VC Amount (per capita)	VC Number (per capita)	GDP (per capita)	Inflation (%)	Interest Rate (%)	Unemployment Rate (%)	Market Capitalization (% of GDP)	GDP Growth (%)	Government Effectiveness	Patents (per capita)	Political Stability	Regulatory Quality	Taxes (%)	Business Density (%)
Albania	2002-2022	4.92	2.52e-07	4141.14	2.64	7.27	14.66	NA	3.81	-0.24	4.59e-06	-0.02	0.09	20.77	1.28
Belarus	2002-2022	7.39	4.40e-07	7296.23	4.03	-5.05	8.93	19.12	3.71	-0.87	2.50e-05	0.07	-1.16	8.71	1.03
Bosnia & Herz.	2002-2022	1.45	2.67e-07	4649.23	1.99	3.50	24.42	NA	3.16	-0.73	1.35e-05	-0.43	-0.21	12.13	0.98
Bulgaria	2002-2022	38.86	4.92e-06	5565.79	17.68	2.88	6.57	1.42	3.27	-0.02	1.36e-04	0.28	0.59	26.89	8.80
Croatia	2002-2022	37.34	4.12e-06	19159.51	2.78	6.00	5.34	19.89	2.22	0.51	1.75e-04	0.62	0.41	13.66	4.31
Czechia	2002-2022	30.47	6.04e-06	17407.39	3.84	2.73	8.20	NA	2.50	0.95	3.53e-06	0.97	1.16	36.55	3.51
Estonia	2002-2022	1159.96	4.63e-05	13286.65	2.26	4.41	11.77	40.83	3.34	1.06	1.79e-04	0.69	1.44	35.97	17.86
Hungary	2002-2022	16.34	6.36e-06	13630.92	4.30	1.96	6.82	20.19	2.49	0.64	6.26e-05	0.80	0.88	31.77	4.55
Kosovo	2002-2022	8.55	3.46e-07	14273.65	3.42	8.71	9.58	NA	3.85	-0.36	4.99e-05	-0.36	-0.17	NA	2.61
Latvia	2002-2022	94.27	1.39e-05	13600.80	4.23	4.41	10.64	NA	3.28	0.75	6.53e-05	0.55	1.03	18.87	8.48
Lithuania	2002-2022	70.41	1.37e-05	2758.14	8.39	4.41	5.31	NA	3.90	0.84	5.15e-05	0.79	1.09	37.63	3.37
Moldova	2002-2022	15.70	5.80e-07	4727.79	2.28	5.10	28.26	NA	3.90	-0.60	1.67e-05	-0.27	-0.16	9.80	2.48
Montenegro	2002-2022	6.96	5.37e-07	6570.41	3.96	4.06	20.41	80.99	2.97	0.08	2.58e-05	0.26	0.13	NA	7.59
N. Macedonia	2002-2022	12.31	1.04e-06	12427.09	2.79	4.98	9.44	30.83	2.73	-0.15	1.63e-03	-0.40	0.22	28.89	4.53
Poland	2002-2022	7.48	3.63e-06	9084.44	6.34	6.73	6.33	10.84	3.83	0.51	2.67e-05	0.67	0.87	25.97	1.21
Romania	2002-2022	9.43	1.88e-06	6035.73	6.54	4.03	16.32	26.74	3.80	-0.15	1.25e-05	0.25	0.44	32.90	6.04
Serbia	2002-2022	22.08	1.45e-06	16390.65	3.28	-5.72	11.78	5.19	3.24	-0.15	2.80e-05	-0.26	-0.16	21.57	1.95
Slovakia	2002-2022	30.42	2.94e-06	22784.15	2.61	4.41	6.52	21.02	3.58	0.70	6.00e-05	0.86	0.94	35.99	4.77
Slovenia	2002-2022	79.00	1.20e-05	2976.60	11.88	4.41	8.17	10.31	2.36	1.01	1.22e-03	0.96	0.76	25.37	3.53
Ukraine	2002-2022	3.06	7.88e-07	3892.80	2.20	1.09	8.38	NA	0.38	-0.61	NA	-0.85	-0.45	26.74	1.11

Table A.2: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Amount of VC Investments Per Capita	1.000													
(2) Number of VC Investments Per Capita	0.652	1.000												
(3) GDP Per Capita	0.076	0.167	1.000											
(4) Inflation	0.030	0.017	-0.169	1.000										
(5) Market Capitalization	0.018	0.057	0.005	-0.085	1.000									
(6) Real GDP Growth	0.008	-0.032	-0.067	0.062	0.037	1.000								
(7) Real Interest Rates	0.013	-0.035	-0.039	-0.058	0.138	-0.045	1.000							
(8) Unemployment Rate	-0.028	-0.184	-0.440	-0.187	0.076	0.044	0.170	1.000						
(9) Government Effectiveness	0.142	0.419	0.338	0.102	0.053	-0.051	0.121	-0.479	1.000					
(10) Business Density Rate	0.441	0.719	0.173	0.040	0.254	0.031	0.006	-0.062	0.391	1.000				
(11) Patents Per Capita	-0.013	-0.012	-0.065	0.092	0.095	-0.055	0.078	-0.135	0.084	-0.005	1.000			
(12) Political Stability	0.060	0.226	0.220	0.155	0.021	0.118	0.049	-0.423	0.754	0.213	-0.056	1.000		
(13) Regulatory Quality	0.134	0.401	0.274	0.127	0.091	-0.034	0.199	-0.370	0.898	0.441	0.033	0.677	1.000	
(14) Taxes	0.041	0.153	0.132	0.104	0.130	0.038	0.079	-0.347	0.458	0.239	0.068	0.329	0.538	1.000