

**UNIVERSITAT  
JAUME I**

## **Venture Capital: past evolution and current trends**

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Abstract:

Venture Capital (VC) is a high-risk investment form popular in the field of technological start-ups. However, its susceptibility to financial uncertainty and crisis is a crucial consideration. This study aims to examine the behavior of VC in relation to other macroeconomic indicators and investment vehicles, its historical evolution, and the sectors in which it is most commonly deployed, with a specific focus on its role in financial crises.

Keywords: Venture Capital, Financial crisis

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## Introduction

Investment is a crucial element of symbiosis between individuals seeking to maximize their savings and income surpluses and those seeking financing for projects or short-term needs. As more users engage in investment/financing methods over time, the number of investment possibilities and elements also increases. At the macroeconomic level, investment is a significant factor in a country's production, positively impacting its growth. During periods of bearish financial markets, there is a retreat in income as long as the other variables remain constant.

Venture Capital (VC) is a particular investment element not traded in organized markets. This method primarily focuses on risky investment operations, investing in the early stages of projects, and seeking a high return on invested capital. This investment method is relatively new compared to other organizations, such as the stock exchange. It gained importance in the late 1990s and early 2000s due to a significant increase in technology companies seeking funding for their projects. VC was widely used then because it provided the necessary capital for these projects.

Due to the lack of information available at the time about how to handle this investment method and the technologies being developed, the actions taken were not being correctly analyzed and regulated, leading to a financial bubble and, subsequently, it is bursting, resulting in an economic crisis known as the "dotcom bubble." Like any other form of investment, in the economic/financial environment, there are a series of elements and variables that affect VC, in addition to VC affecting other elements. Due to this relationship, this investment method has had moments of increases and declines in its trading level.

Over time, different moments have been seen where the economy begins to contract due to different situations, causing a recession and generating much uncertainty. The reasons for these shocks can be diverse. One of them is a crash in the stock markets, a situation that generates instability in a country, or bad economic decisions over a long period, among many others.

Considering that VC is one of the riskiest forms of financing and investment, it can be assumed that for adverse effects on this variable, the effect it will have on the economic environment will be influential. Due to this relationship between investment and income, this work seeks to analyze this existing relationship, focusing on one hand only on Venture Capital investment and, on the other hand, analyzing its behavior, reactions, and state before, during, and after a moment of the economic and financial crisis.

To do so, a historical overview will be made, an analysis of its behavior during recent economic crises, and a brief explanation of its basic concepts and fundamentals. Subsequently, the modern VC's behavior and its relationship with different variables, such as other forms of investment or macroeconomic indicators, will be analyzed in greater depth, as well as its current and historical structure, taking into account the sectors with the highest investment in this type of investment.

This analysis aims to obtain a clear conclusion about the role of this investment method in a moment of economic/financial uncertainty and to know the degree of importance that this variable has as a cause of economic crises.

## History

### Origins

The beginnings of Venture Capital are set back to the United States, where it was a type of investment used by high-income families with a significant surplus in their profits instead of private companies. According to the records, the first time the term Venture Capital was used was in the 1939 convention of the Investment Bankers Association, where its president, the American Businessman Jean Witter, used it in his speech. "No one in the high-income tax brackets is going to provide the venture capital and take the risk which new enterprises and expansion require, and thereby help create new jobs if heavy taxes take most of the profit when the transaction is successful." (Martha Louise Reiner, 1989, 1.)

Witter defined Venture Capital as a traditional component in the investments of wealthy individuals in businesses that are in the experimental phase. This definition was ahead of its time, as it already considered functions that the companies of Venture Capital would only consider after World War II. For example, to grow knowledge, evaluate specific risks, or work closely with venture companies.

Long before a formal industry of Venture Capital existed, there was a strong link between the degree to which Venture Capital increased and the cycle of life of new technology. For example, Gort and Klepper (1982) and Klepper and Graddy (1990) found a highly consistent pattern of massive entry by new firms that then is followed by a "jolt-in" of 46 different products ranging from cars, lasers, radio and television transmitters to penicillin and DDT (synthetic insecticides).

### The New Deal and its Consequences for Venture Capital

The New Deal refers to the policies the American president, Franklin Roosevelt, implemented, which focused on the reactivation of investment and consumption through theories developed by John Maynard Keynes—the measure of the New Deal that affected Venture Capital the most establishment of more regulations over banks.

As was explained before, the New Deal did not have a positive effect on Venture Capital. At the beginning of the 1920s, the changes in the investment environment started to obstruct Venture Capital financing. These changes and the accumulative effect of the social and economic crises, such as the crash of 29, the great depression, and the outbreak of the Second World War, caused the bankers to reduce their interest in new industries and local businesses during the 1920s. During the depression, the different economic agents participating in the investment markets, such as commercial banks and wealthy individuals' causal venture investments, were transformed. The changes in the market and the regulations reinforced the surge in risk-taking that intensified right after the stock market crash.

However, the changes in technology, the mentality of the investors, the markets, and the new institutional measures began to change the venture financing environment before the New Deal came into effect.

The problem with Venture Capital was more extensive than it identified at the beginning: the reduction of the causal venture investments of wealthy individuals. This issue also came from the changes in the risk environment. As industrial innovation had become highly sophisticated in the 1930s, independent, innovative companies needed the same specialized support that was given to well-established corporations for their internal projects. This support would not come from institutional finances because investment

banks avoided venture investment more than rich people. Subsequently, a specialized company in Venture Capital would be formed, a new industry capable of giving this support.

Despite these tendencies, the role of wealthy individuals as causal venture investors survived the decades of 1920 and 1930.

In the decade of 1920, the changes in the environment of investment attracted capital from high-income individuals to venture capital informally. Several individuals with high surpluses established a personal trust managed by financial institutions. The American banks and trust companies were named trustees of the people's states 5.899 times in 1923 and 44.3375 times in 1928. This tendency eroded the role of wealthy people as casual venture investors.

At the end of the 1930s, financiers, and analysts observed that wealthy individuals were no longer investing in new businesses because the tax system reduced to a significant extent their potential profits but left them all the risk of loss. Dr. Marcus Nadler, a professor in finance at the University of New York, argued that the high taxes, especially in the high sectors, were related to the lack of confidence from the investor to invest in new industries.

If analyzed, these changes were the transition to the investment of specialized venture capital. The boom of institutional investment brought new evaluation and tracing practices that influenced the venture capital companies' practices. This also created a stock market in the business that those venture capital companies helped to develop.

Four essential changes in the investment environment followed the announcement of venture capital in 1939: the decrease in causal venture investment, the decrease of the similar functions to venture capital in the institutional finances, the increase in the financing of intern corporate risk, and the increase of the public financing for industries.

### **The beginnings of the formal investment in Venture Capital**

Despite high-income families still being the main actors instead of companies, in the decades of the 1950s and the 1960s, the first activities under the modern concept of Venture Capital appeared. In 1946, the American Research and Development Corporation (ARDC), the first institution specializing in venture capital, was founded by the businessman George Diriot. Similarly, in 1958, venture capital was widely spread due to the emergence of Small Business Investment Companies, which had several similarities with current venture capital entities.

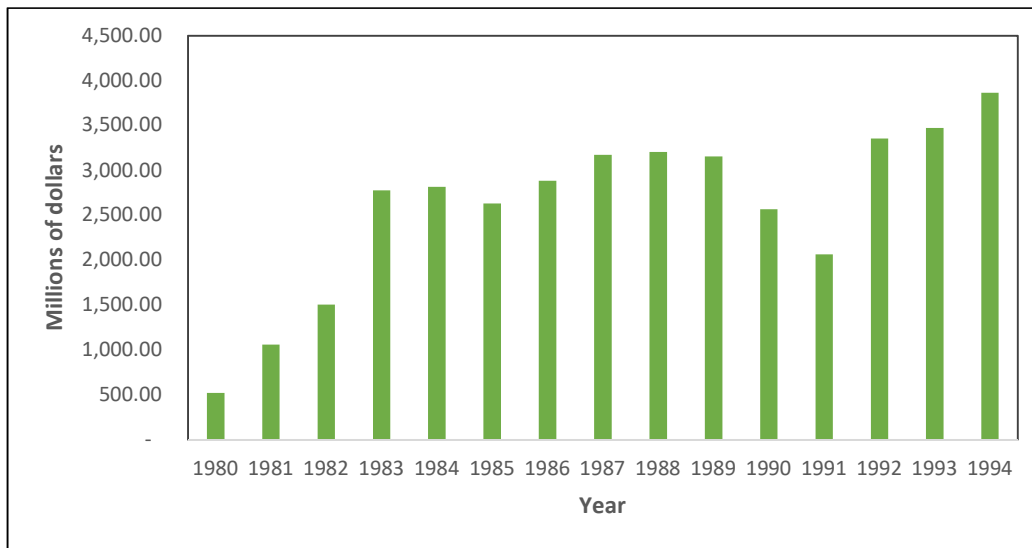
Between the 70s and the 80s, the American government began to develop a judicial and normative frame to follow when an investment like venture capital is made. At this point, the first private entities dedicated to this type of investment, such as companies specializing in venture capital, and the first venture capital funds were created. At this moment, documents and statistics about the operations started to appear. However, the restrictive policies which punished the venture capital investors in the New Deal started to be lifted, strengthening venture capital activities. In the middle of the 80s, venture capital crossed the Atlantic and started arriving in Europe, causing the founding of "Asociación Española de Entidades de Capital Riesgo" (ASCRI).

Moving on, in the period between the decades of 1970s and the 1980s, the American government developed the juridic and normative framework for venture capital investments.

After a significant increment in the number of leveraged buyouts registered in the last part of the 80s due to a similar credit expansion, the first part of the 90s was

characterized by a crisis of savings and credit, which skyrocketed the cost of financing, freezing the activity. Consequently, in the 90s, the industry returned to the path of development, consolidating and significantly incrementing its size and degree of correlation with the evolution of the economic situation and the credit market. The following graph shows the evolution of Venture Capital during the 80s and the first part of the 90s.

Figures 1. Venture capital investment in millions of dollars 1980-1994



Own elaboration. Source: NVCA Yearbooks.

### The nineties and the dotcom bubble

At the end of the 1990s and the beginning of the XXI century, Venture Capital suffered the biggest boom in its history. This happened due to the development of the "dotcom" companies. Some tech companies had an exponential increase in their stock shares quickly due to the intense speculation that surrendered them. Venture capital played an essential role in the bubble as it was a way of financialization most used by tech companies.

During this period, the Venture Capital industry suffered a significant increment in its levels of financialization. The investment in venture capital notably increased from \$2.2 billion in 1991 to \$4.1 billion in 1994. The most explosive of this growth was in 1995.

In 1995, the investment in venture capital reached \$7.9 billion, and the previous year, \$4.1 billion. This was the beginning of the Internet Era; investments in venture capital started to have spectacular efficiency, which influenced institutional investors to search for this type of assets, and the investments increased to \$11 billion in 1996, \$14.7 billion in 1997, and \$20.9 billion in 1998, before skyrocketing to unbelievable records of \$53.4 billion in 1999 and \$104 billion in 2000.

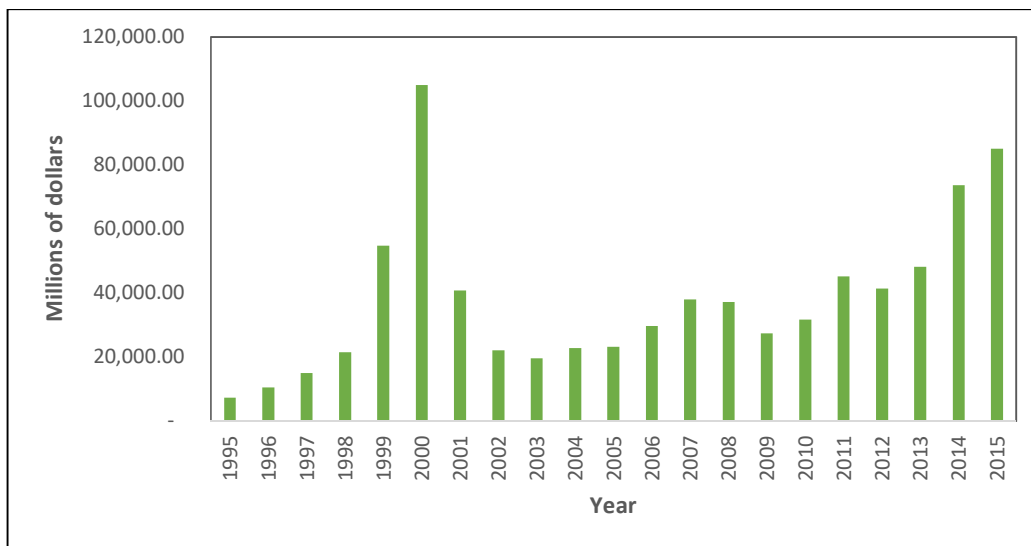
The rise finished in the middle of 2000 when the investment fell to almost half from the last term of 2000 to the first term of 2001. In sum, the dot com bubble was mainly due to the imperfect nature of venture capital markets, as the information arrived late, delaying the reactions and the overestimations of companies. The breakout of the bubble caused



a drastic fall in investment levels; further, it is also believed that this bubble changed the industry's investment pattern.

Even though the figures dropped well below the peak reached in 2000 after the bubble burst, the level of investment remained well above in comparison with the previous levels of 1995. If venture capital is analyzed as a percentage of the GDP, in 1983, venture capital represented 0.084% of the American GDP, constantly falling until 0.036% in 1991. From this point onwards, the figure started to increase, reaching 0.106% in 1995, then peaked in 2000 when it represented 1.045% of the American GDP. After the peak, the percentage stayed around 0.2% between 2002-2008, which was well above its level in the 1980s and similar to 1997 and 1998. In the following figure, it can be seen how after venture capital reached its peak in 2000 and fell in the subsequent year, the levels of investment remained over that of 1998.

Figures 2. Venture capital investment in millions of dollars 1995-2015



Own elaboration. Source: NVCA Yearbooks.

## Subprime Mortgages crisis

The 2008 financial crisis happened due to the fall of the Real-estate bubble created by the subprime mortgages in the USA, which then suddenly spread to other markets worldwide. This showed a lack of transparency from the regulatory entities and generated a liquidity crisis.

The financial crisis of 2008 left venture capital with a decrease in its activity. While the crisis intensified, its effects on venture capital were more evident. Block et al. (2011) argue that the crisis decreased the total number and the amount invested in each financing round. Two characteristics of venture capital affected by the financial crisis are the behavior of venture capital investment and the level of income of the investor funds.

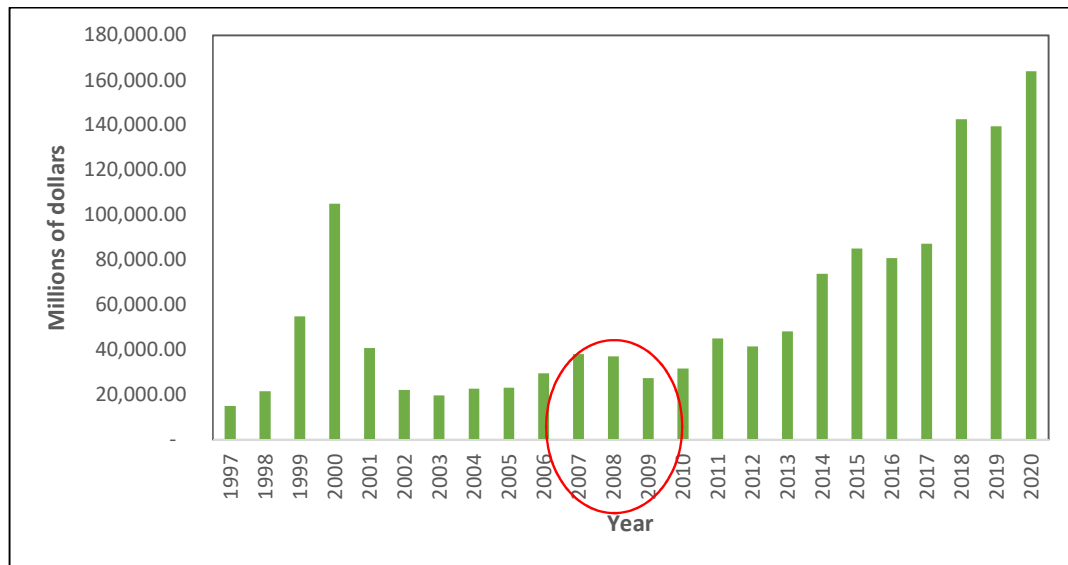
This crisis affected the behavior of investors in venture capital, as it worsened the IPO conditions. In sum, after the crisis, the acceptance of risk decreased. Hence, the investment in companies in the initial stages fell; this risk-off situation did not favor venture capital activities.

This can be seen perfectly in the investment in venture capital of other countries. The investment in 2009 compared to 2008 fell 26% in the US, 20% in Korea, 68% in Africa, and 30% in Spain (OCDE).

The level of acceptance that the risk had at this time also negatively affected those investors that gave capital to Venture Capital Companies. The most significant liquidity risk changes the openness of the investors to give more capital to venture capital companies.

Another element that also influenced the crisis was the weakening of transparency in the financial market because for the investors to obtain the correct and detailed information about the uncertainties and the risk is fundamental. As transparency decreased, so did the number of investments in venture capital companies. The figure clearly shows the fall of Venture Capital investments after the 2008 financial crisis.

Figures 3. Venture capital investment in millions of dollars 1997-2020



Own elaboration. Source: NVCA Yearbooks.

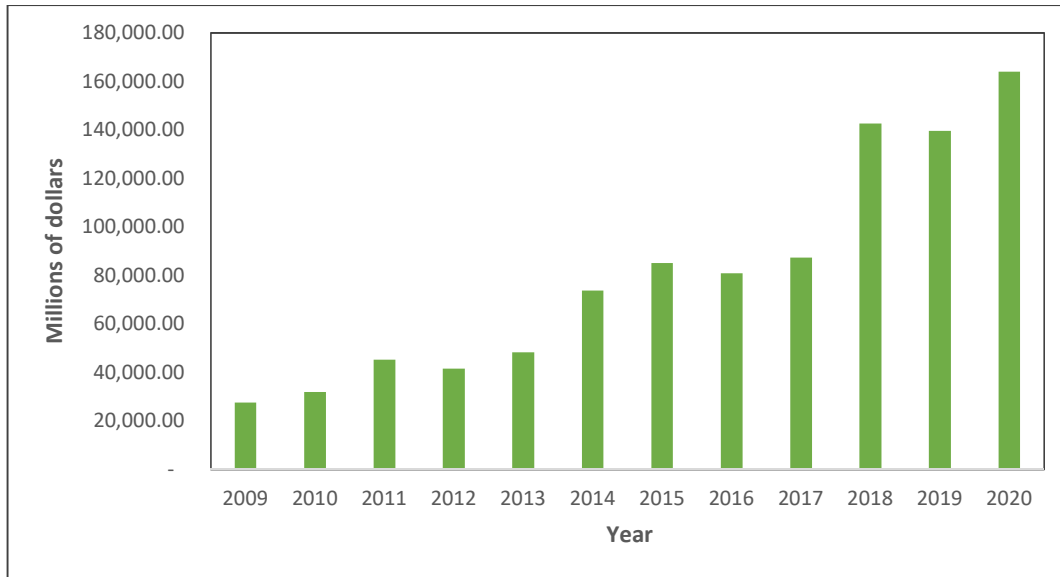
## Present

Despite the COVID-19 crisis, Venture Capital has experienced the most significant increment in the last few years. As the previous figure showed, after the 2008 financial crisis, the investment in Venture Capital has increased constantly, reaching an average growth of 10.38% in the last 23 years. The years 2000 and 2018 have the most considerable growth compared to their previous year. However, in the former years, there was a significant decrease in Venture Capital investment due to the dotcom bubble, as explained before.

The year 2020 was the third consecutive year where the new companies of growth gathered more than \$130 billion, and it was also the fourth consecutive year in which more than 10,000 companies received investments. Another significant fact is that the US was once again the destination of approximately half of the dollars invested in Venture capital worldwide, attracting 51% globally invested.

In conclusion, despite the COVID-19 crisis creating one of the most significant economic recessions in recent history, the data still shows that the venture capital industry is growing, and the investment and the yearly contracts are increasing.

Figures 4. Venture capital investment in millions of dollars 2009-2020



Own elaboration. Source: NVCA yearbooks.

## Framework

### What is Venture Capital?

In a minimalist manner, venture capital can be defined as a way of financing in which capital is provided in exchange for stock in a company. This method is commonly used by small and medium companies or newly created companies with difficulties participating in financialization.

The investment in Venture capital can be classified according to the moment in which the company is. If the investment is made before the company's start-up, it would be called Capital Seed. However, it could also be when the activities have already started, using this investment to finance the company's beginning and the product's first commercialization. Even though it is less common, it could also be used to ease access to new products or markets. This part will be developed in the following paragraphs.

An essential feature of Venture Capital is that those companies that invest in it are not listed in the stock markets. In this way, the financialization is based on the company's construction from its beginning, for example, when the business is established.

An element that follows Venture Capital is Private Equity. Without going into too many details, Private Equity (known in Spanish as Capital Expansion) refers to operations in advanced companies where both the risk and the potential growth are minors. Furthermore, it is common to find acquisition operations of companies of leverage in their different modalities (Leveraged buyout or LBO).

It can be easily known that private equity funds are more extensive than venture capital as the former is related to more consolidated companies, which need considerable capital to confront ambitious strategic challenges (product portfolio diversification and internationalization plans).

In summary, it can be confirmed that venture capital constitutes a source of financialization through the adoption of capital, with a temporary vocation, in exchange for obtaining a shareholding in investee companies, which usually have high growth potential associated in turn with a high level of risk. It is also a source of the initial stages of these companies and aims to facilitate the birth and takeoff of the same.

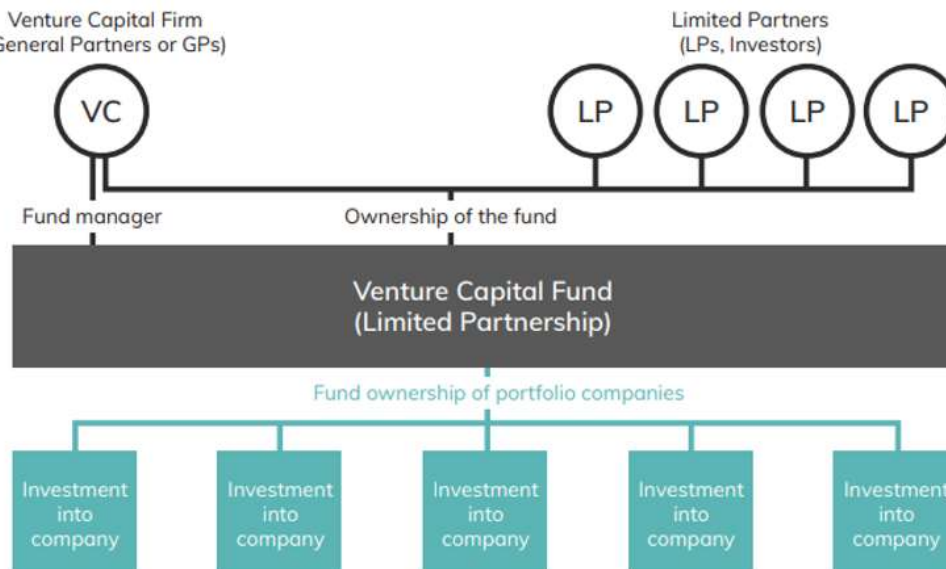
Venture capital is unique as an institutional investor asset class. Venture capital funds make equity investments in a company whose shares are essentially illiquid and worthless until it reaches maturity, approximately five to eight years. The follow-on investment provides additional financing as the company grows.

### Structure of Venture Capital

A Venture Capital fund is composed of Venture capital firms and limited partners. The venture capital firm is the main character in this activity, and the Limited Partners of a fund are the investors that support capital to the venture capital. Those Limited partners can be individual people or companies. Usually, those limited partners are institutional inverters, like pension funds or university endowments.

All of those participants that together conform to the venture capital fund invest in different companies that fit within the frame of venture capital.

Illustration 1. Venture Capital Structure



Source: NVCA Yearbook 2021.

## How does Venture Capital work?

The venture capital process begins from the moment of fundraising; these are for limited partners.

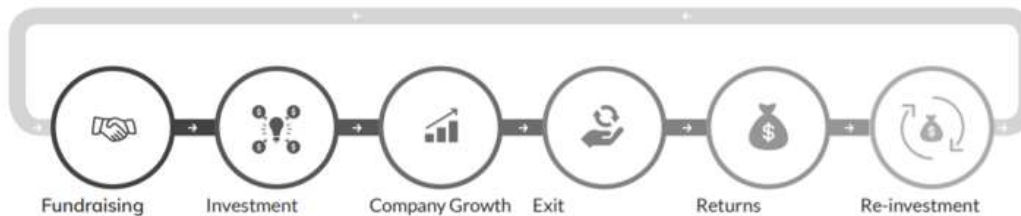
Once the fundraising is done, the investment is made in high-growth young companies seeking financialization. The American venture industry provides capital to create some of the most innovative and successful companies.

Apart from providing their money, these investors give active management and act as mentors and consultants through a secure place on the board to give strategic advice and help with the presentations.

Once the investment is done and reaches a period of maturation of the company (after approximately 5 to 10 years), venture capital gets out of its participants through an acquisition or an initial public offer (IPO). The IPO has more advantages: more capital fundraised, more returns, creation of local jobs.

After this moment, it is when the profits from the investment are collected if it is the case that the investment was successful. After the fund is finished and the profits are distributed, the limited partners can reinvest their profits in investment projects.

*Illustration 2. Venture Capital process.*



Source: NVCA yearbook 2021.

## Phases of the investment

Venture capital has a vital role in a company's growth, being present in the whole development of the company. There are 4 phases in the development of a company. When the investment phase changes, the state of the investment also changes. The creation process of a new company starts from the business idea and reaches the point where the company has constant growth and is forged, that is, to be a mature company. These phases are:

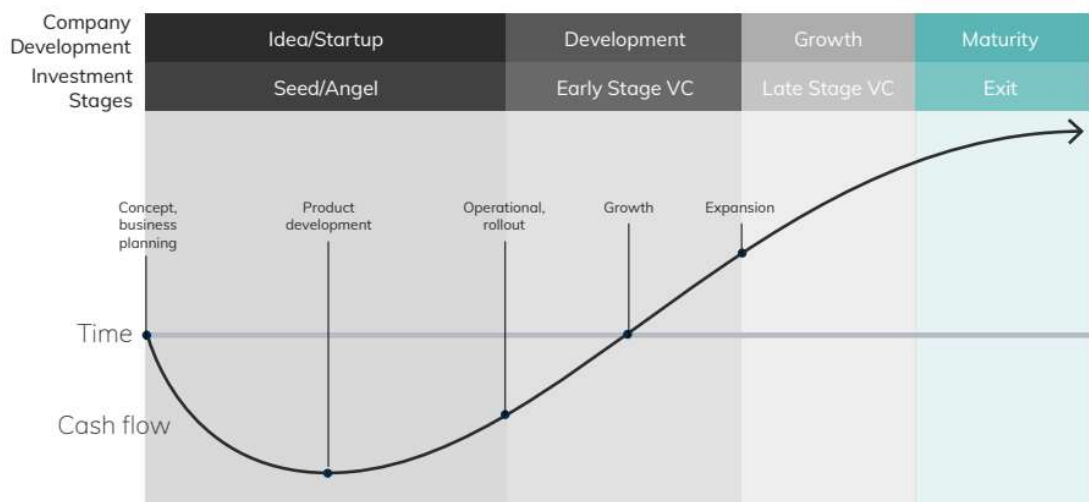
- **Start-up phase:** The first phase of the development starts with the business idea, defining concepts, characteristics, and strategies to develop in the future. The future cash flow is negative, as a significant investment must occur to start the company. The start-up phase finishes when the company operations start, and the investment can be smaller than initially. While this phase takes place, the investment is in the seed phase. The seed phase consists of developing the business plan and acquiring capital through family and friends or the contributions of the entrepreneur or the promoting team (Private Company, 2011). However, if the money comes from a private investor, it is called an Angel investor.
- **Development:** At this phase, an increment in cash flow can be perceived, and it finishes when the company starts to make decisions about growth and

expansion. At this time, venture capital correctly enters an initial stage in the company's investment. This phase usually constitutes the product's development and commercialization's beginning. Moreover, it is widespread to develop marketing campaigns. Generally, the company starts to produce its first profits, despite requiring more financialization (Heukamp et al., 2006). Here, the financialization of capital through venture capital enters the game.

- Growth: This is the sequel of the previous phase, as it is here where a significant increment in the company's cash flows can be seen here. Considering that the company's objectives and plans are coming out as expected.
- Maturation: It is here where the company obtains its place in the market and reaches a smaller level of growth but a more constant level.

In this last phase, investors usually disinvest in venture capital through one of the existing mechanisms, from which they hope to obtain a capital gain concerning their investment. This phase is characterized by the decrease or stagnation of the company's growth. It is given the IPO previously mentioned.

Illustration 3. Phases of the Venture Capital.



Source: NVCA Yearbook 2021.

## Investor Process

**Phase 1: Investment.** This first phase ends with the contractual signature between both parties. Before that, however, the investor would have evaluated the different alternatives and selected among them the most suitable. Subsequently, through a process of evaluation and investigation (due diligence), the venture capital investor would decide whether they want to proceed to sign a bilateral agreement that works to define the operation's final price after analyzing the company's characteristics.

**Phase 2: Tracing.** It constitutes the most crucial source of value added. For that, the venture capital investor gets involved in the invested project by giving their knowledge and investing in the company's activities, generating a value-added but to a lesser extent than a business angel (Urbano & Toledano, 2008).

**Phase 3: Exit.** Through the same, the venture capital investor waits for a positive return from the investment, that is, a capital gain or profit concerning the investment initially made in the investee company. There are different mechanisms to carry out

disinvestment, among which the IPO stands out, especially in the US, where the stock market is highly developed (Nueno, 2009).

## **Methodology**

This research will analyze the behavior of a VC investment in the United States from 1997 to 2020. This range of time has been selected as it will give perspective to study the behavior of VC through an economic cycle and also in those moments of economic and financial crises, as is the case of the dotcom bubble crisis, the subprime mortgage crisis, and the COVID-19 crisis. As a time of 23 years will be used, the periodicity will be annual, although there may be some changes.

Firstly, the VC investment in the United States in this timeline will be analyzed, comparing its behavior with the different macroeconomic indicators such as GDP or financial indicators such as stock indices to observe how it reacts and what affects it. Once the evolution of VC in the US is studied individually, its evolution will be compared with that of other countries in different regions of the world and with different economic conditions. This will test whether there is any variation in the behavior of this type of investment. The selected countries are South Korea, South Africa, and Spain. Also, at the geographic level, the comparison will only be made from 2007 to 2020.

Moreover, the behavior of the main sectors where this investment takes place will be analyzed, observing how the five main sectors that obtain the most from VC investments nowadays have behaved throughout time while comparing them with those that received the most considerable investment each year.

Despite considering all the previously mentioned years, there will be special attention to those moments of crisis and their aftermath. This will be done to analyze how VC behaves in those moments and the effect of VC in times of economic and financial crises.

## **Venture Capital in the USA**

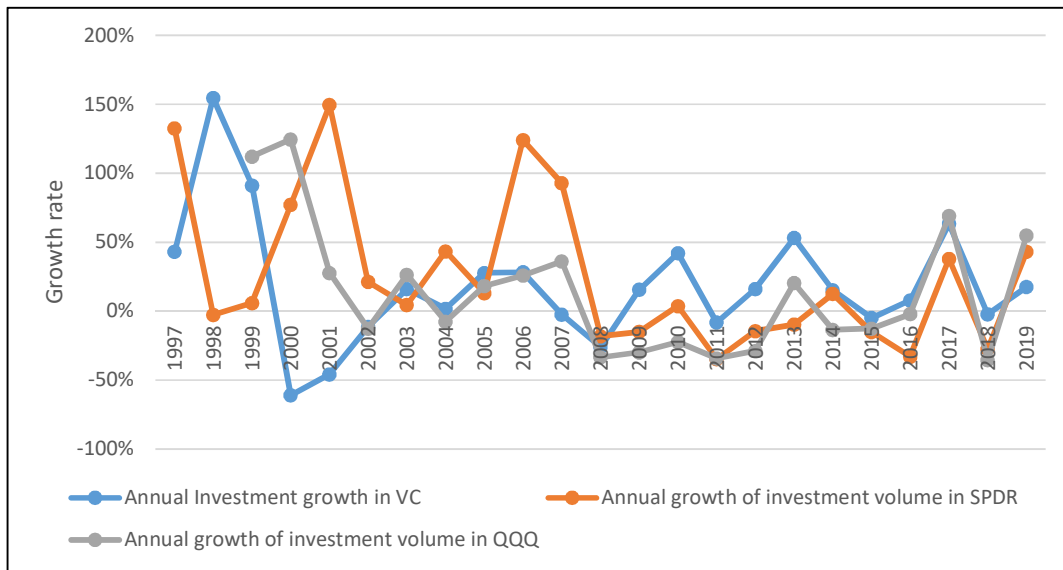
### Analysis of VC compared to Stock Indices (S&P 500, NASDAQ 100)

First, an analysis of the VC investment will be done to its relationship with the stock market movement in the US. For that, the stock indices S&P 500 and NASDAQ 100 were selected. Specifically, the variables are the Amount of money invested in Venture Capital and the average annual volume of these stock indices. The average annual volume is estimated through ETFs that replicate those indices. The EFTs selected are SPDR (S&P 500) and QQQ (NASDAQ 100). It is worth mentioning that the EFT QQQ surged in 1999, being the oldest of its kind.

The following graph shows the annual growth of these three variables. At the general level, they have similar growth and volatility. The highest growth variable is the Average Annual Volume of SPDR, with 25.74%. It is also the one with the most variation of almost 30%, which can be appreciated in the graph. The VC and the average annual volume of QQQ have had similar average growth and variation behaviors with 18.79% and 20,12%, respectively, for VC and 13.47% and 21.30% for QQQ. The most volatile behaviors

happened right before the beginning of the new century, which was the time of the dotcom bubble crisis. Once the external shock on the economy was over, the three variables converged (2003). In this crisis, it can be observed that there were different reactions between the variables SPDR and VC. While investment in organized markets was falling, investment in VC was increasing.

Figures 5. VC, QQQ, SPDR annual investment growth



Own elaboration. Sources: NVCA Yearbooks & Investing.

At the rentability level, SPDR kept growing, but it kept its transactions the same; the moment when the average annual volume increased was also when the rentability started to go negative. This tendency repeated itself in the 2008 subprime mortgage crisis, as those moments when SPDR obtained the most volume were those before the crash of the stock markets. After this, it can be seen that there are some similar movements both in tendency and level of weight.

In sum, this graph shows that similarly to when the attention was focused on Venture Capital, the investment volume was increasing. When the dotcom bubble exploded, this type of investment was the most affected. However, during the time of the subprime mortgage crisis, the most involved element was the stock markets and the most affected by the crisis.

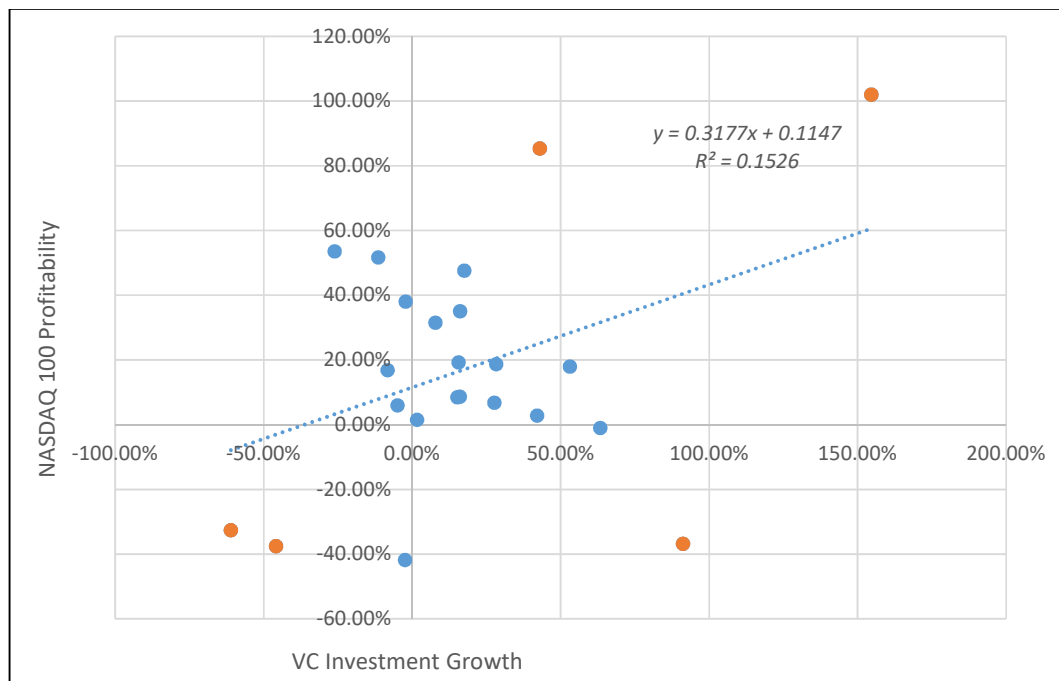
VC investment and SPDR present a negative correlation of -18.85%, while the VC and QQQ correlation is 12.29%. The negative correlation is mainly observed in the first years when the different economic and financial situations affected these two investment tools. However, if the correlation between these variables is calculated from 2009 (after the subprime mortgage crisis), the correlation will be positive with 59.17% VC-SPDR and 63.48% VC-QQQ. After the two external shocks, these two forms of investment started to have similar behavior in terms of magnitudes and tendencies.



A linear regression test was implemented between the volume growth of venture capital investment and the rentability growth of NASDAQ. NASDAQ was used because it was found a better correlation between these variables. The independent variable (X-axis) is the growth of investment in VC, and the dependent and explained variable (Y-axis) is the rentability of NASDAQ.

In the figure, the first that can be observed is a positive tendency between the variables. However, the weight that volume growth of investment over the rentability of NASDAQ 100 is 15.26% (Determination coefficient). The orange dots that can be seen in the figure are the data from 1998 to 2002, and these are also some of the dots with the most significant difference with the tendency line.

Figures 6. Investment growth in VC - NASDAQ Profitability (%)



Own elaboration. Sources: NVCA Yearbooks & Investing.

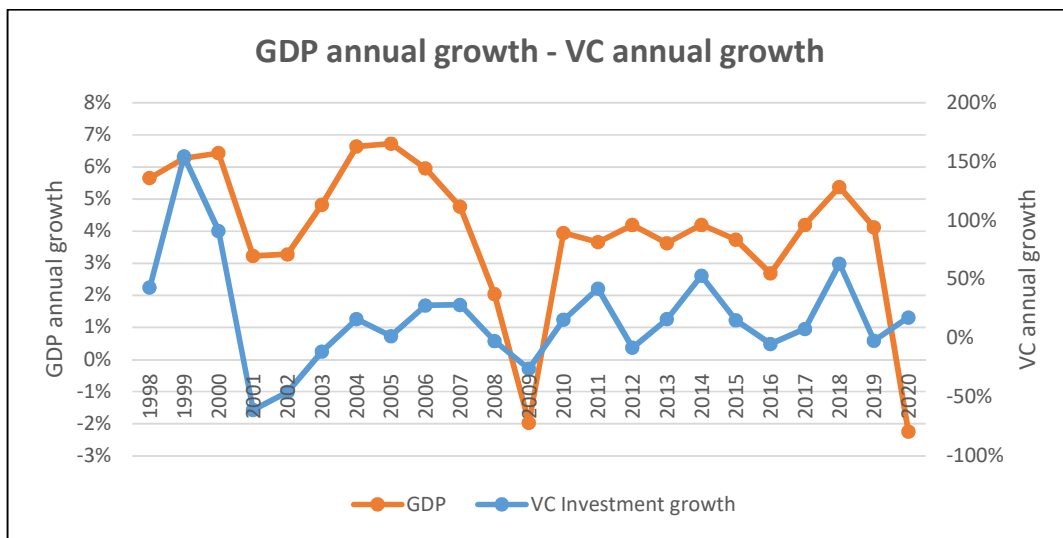
From this analysis, the different shocks caused by the dotcom crisis and the subprime mortgage crisis have affected the investment in this variable differently. The former has increased the volume of VC, thus causing a fall in the aftermath.

When the VC falls, the average annual volume of investment in SPDR significantly increases. When this shock is done, a small phase of convergence between booths assets can be observed, but in 2006 it can be seen how the SPDR increased the growth of the average annual volume significantly; once the second shock is done, the SPDR is the one that suffers the biggest decreased of growth. In these times, it is interpreted that a negative correction is exceptionally high, which, after these phenomena, comes back to the convergence phase. With the linear regression, it can be observed how the relationship between these variables diverges from the tendency line as a result of the external shocks.

## Analysis of Venture Capital for Macroeconomic Indicators (GDP, Unemployment Rate).

An analysis with macroeconomic variables from the USA will be carried out to understand the effect of VC investment on the economy. The indicators that were selected are GDP and unemployment rate, the former has been chosen as it is the most precise way to measure a country's economic growth, and the latter has been chosen as a result of its sensitivity in times of crisis as the labor market is the most affected in recessions and economic contractions.

Figures 7. GDP annual growth - VC annual growth

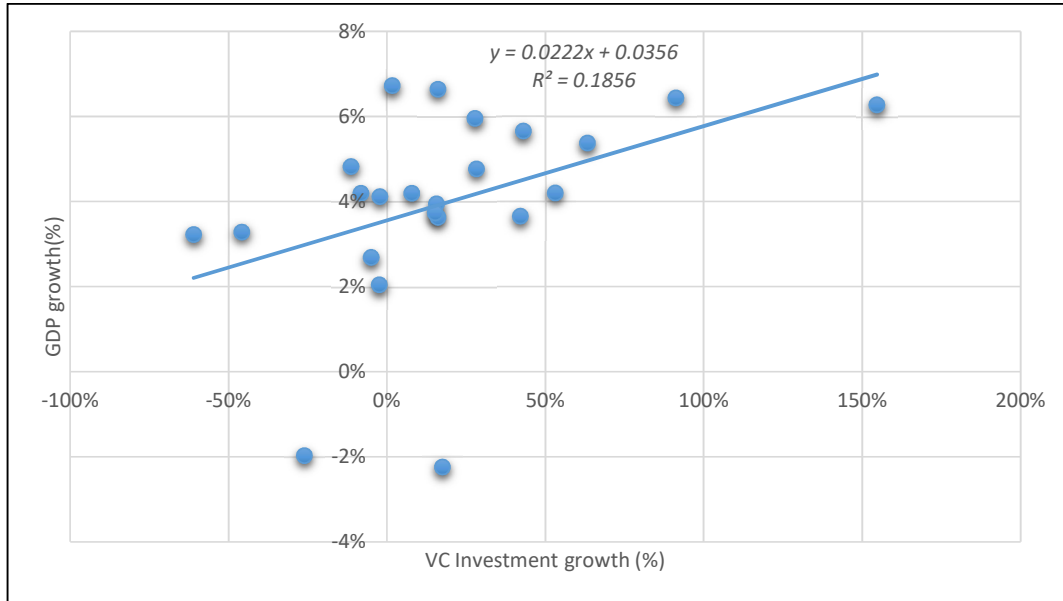


Own elaboration. Sources: NVCA Yearbooks & Statista.

The first figure introduces both variables. The X-axis is the years, the principal Y-axis (left) is GDP growth, and the secondary Y-axis (right) is the venture capital investment growth. In general terms, both variables have similar behavior in terms of tendency with a correlation coefficient of 43.09%; however, the magnitudes of VC are much more pronounced than that of GDP. Even though the figure does not show the difference in volatility, the GDP's variance is 0.05%, which is lower than that of the previously mentioned VC.

In the following figure, a simple econometric study was carried out, implementing a linear regression between these two variables, the independent variable is the growth of venture capital investment, and the dependent variable is the growth of GDP. As has previously shown us the correlation coefficient, the investment in VC has a positive effect on GDP growth. In this study, VC investment explains 18.56% of GDP growth.

Figures 8. Relation between VC investment growth rate and GDP growth rate

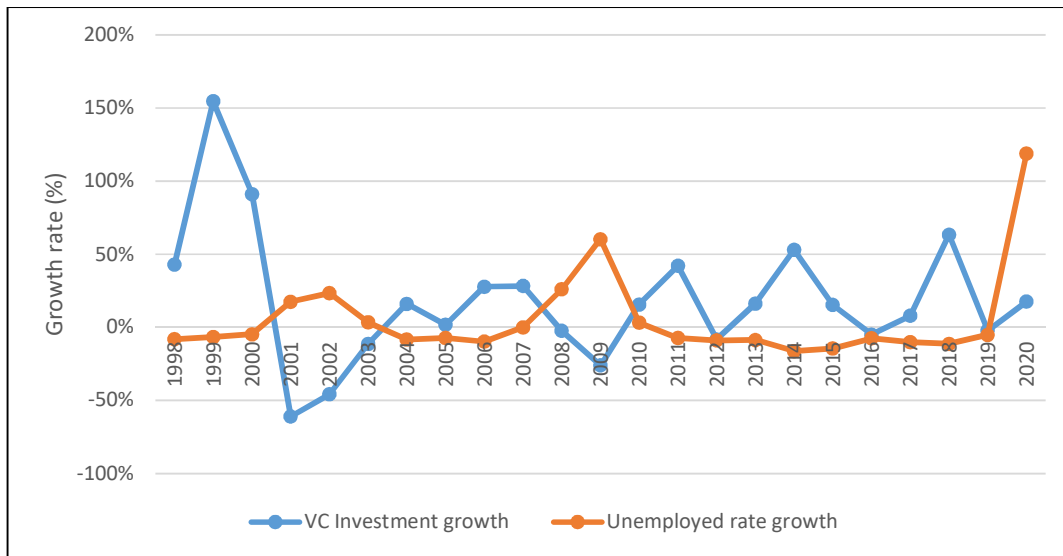


Own elaboration. Sources: NVCA Yearbooks & Statista.

Similarly, to what happened with the financial indicators, the farthest dots from the tendency line arise in those years of crisis and uncertainty. The figure's farthest dots from the tendency line are those of 2009 and 2020. Both the subprime mortgage crisis and the COVID-19 crisis have a more significant effect at the macroeconomic level than the dotcom bubble crisis, where the American GDP decelerated, as shown in Figure XXX, never decreased.

The other variable that is taken into consideration is the unemployment rate. The following figure shows the relationship between the evolution of the VC investment growth and the unemployment rate growth. VC presents more volatility (20.12%) than the unemployment rate (9.13%). Also, graphically opposing movements between the variables can be denoted from the graph, as it was expected that there would be a positive effect on the unemployment rate in times of economic crisis, contrary to what happens with VC (Correlation coefficient -27.96%). The COVID-19 crisis was when both variables had similar behavior, leaving aside the negative correlation.

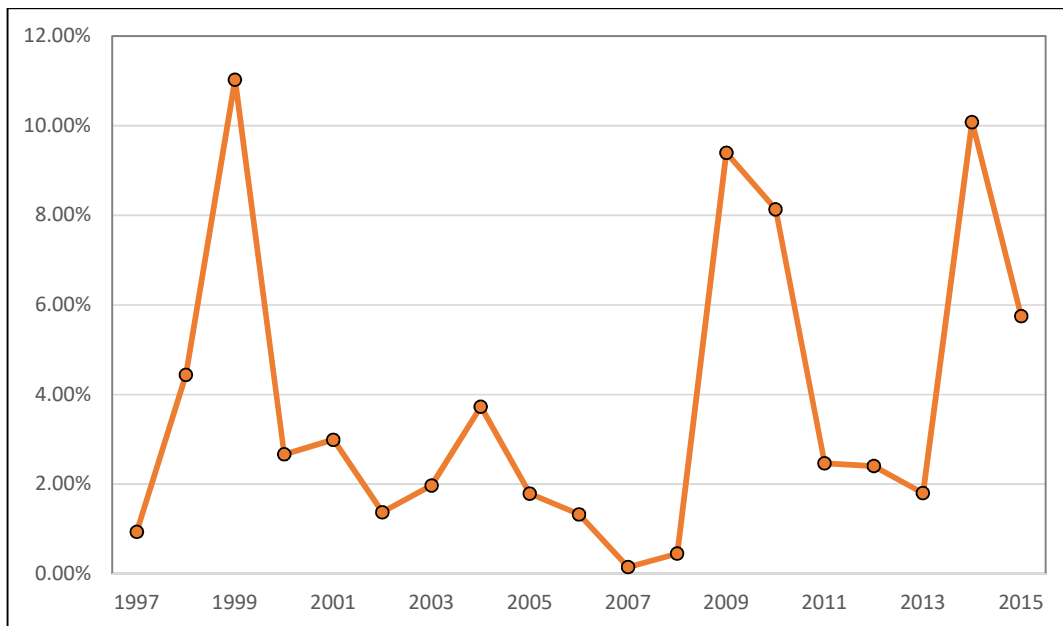
Figures 9. VC investment growth- Unemp.Rate growth



Own elaboration. Sources: NVCA Yearbooks & Federal Reserve Bank of St. Louis.

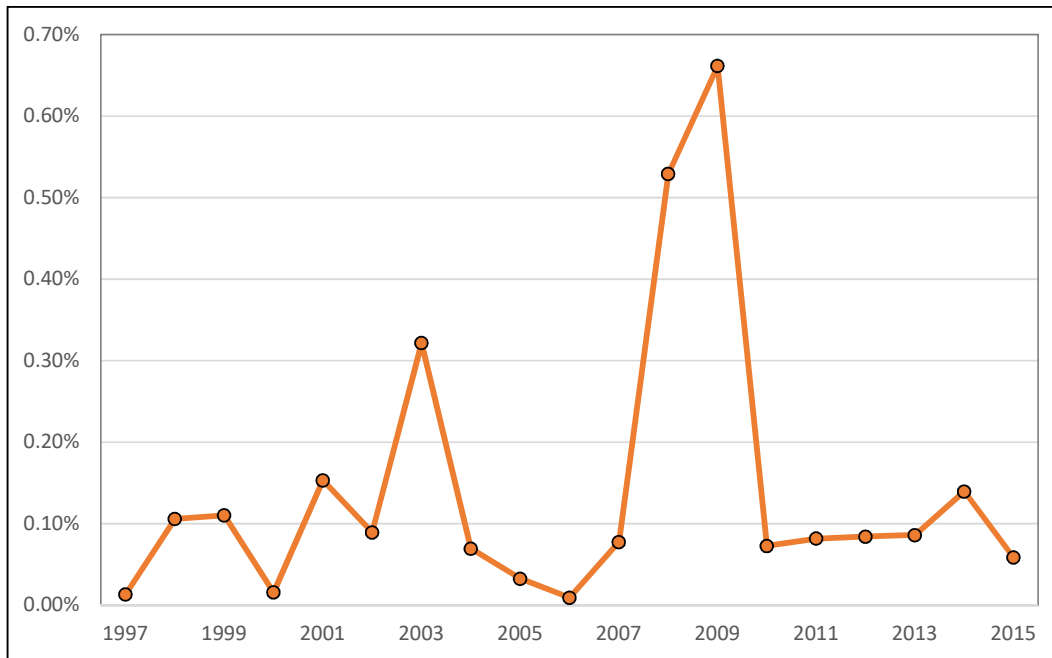
Also, focusing on volatility, a graph with the median volatility from 1997 to 2015 was done. The time between 2015 and 2020 is not covered due to the need for more information. For this, the VC and UR data for the four quarters of each year were taken.

Figures 10. Average annual variation of VC



Own elaboration. Sources: NVCA Yearbooks.

Figures 11. Unemp. Rate Average annual variation

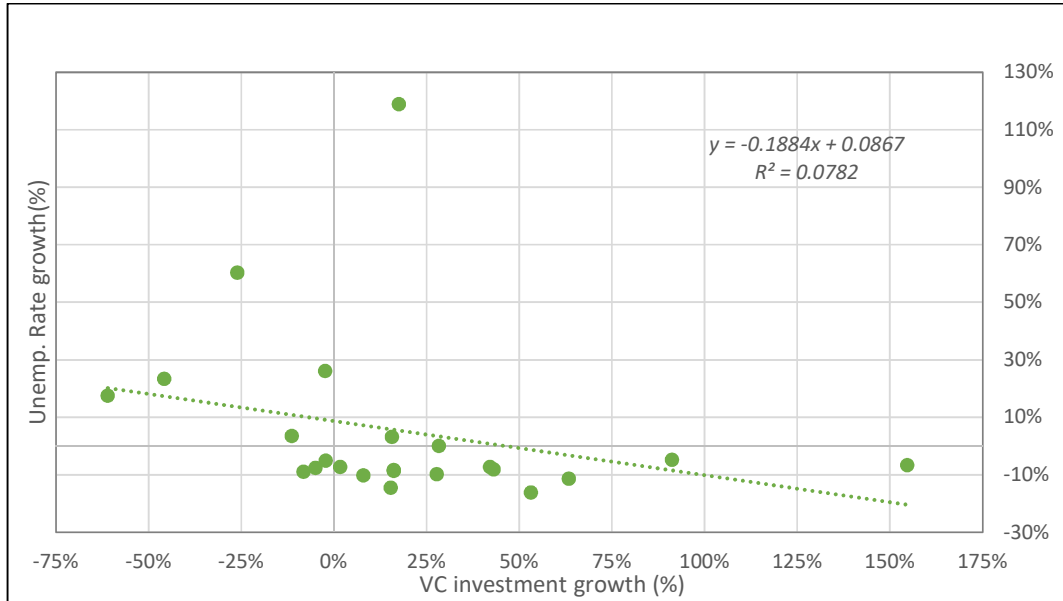


Own elaboration. Sources: Federal Reserve Bank of St. Louis.

It can be seen how during the dotcom crisis, the volatility of VC was high, while it was not the case for the unemployment rate, which, as it was controlled during that time, experienced a constant increment. In the years of the subprime mortgage crisis, when the unemployment rate had more considerable volatility, VC also experienced an increment in their annual volatility. However, it did not reach the levels of 1999. After that considerable increment, the unemployment rate returned to normal, and volatility decreased. However, VC still had another moment of high volatility in 2014. It can be deduced from both graphs that the average annual volatility of VC is much higher than the unemployment rate, 3.84% against 0.14%.

A linear regression was carried out to study the effect of VC growth on the unemployment rate, with VC growth as the independent variable (X-axis) and the unemployment rate as the dependent variable (Y-axis). Here it can be seen the negative correlation previously mentioned and how according to the regression per each percentual point that VC increases, the unemployment rate will fall 0.1884 percentile points. Nevertheless, if the determination coefficient is observed, the investment in VC explains a minimal percentage of the growth of the unemployment rate, only 7.82%.

Figures 12. VC investment growth - Unemp. Rate growth (%)



Own elaboration. Sources: NVCA Yearbooks & Federal Reserve Bank of St. Louis.

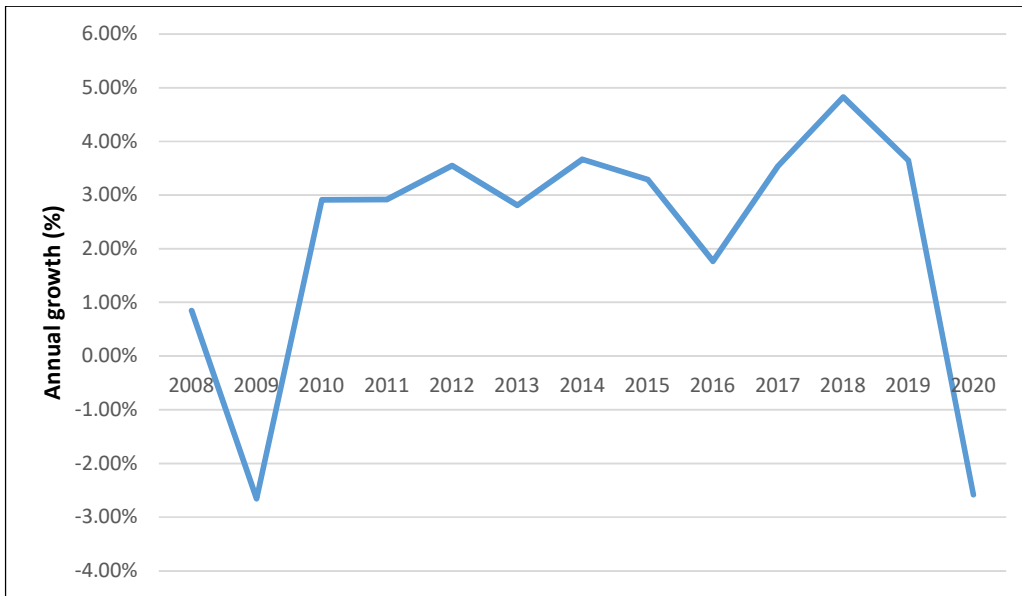
If the P-value is observed, the constant and the variable appear statistically not significant, which means that according to linear regression, the growth of VC investment is not statistically significant in the growth of the unemployment rate. Moreover, according to the P-value of the linear regression between the growth of VC investment and GDP growth in the US, the variable (in this case, growth of VC) is statistically significant over GDP growth. Therefore, VC has a direct influence on GDP but not on the unemployment rate. If the basic foundations of macroeconomics are considered, the obtained results are highly logical, as the investment positively affects rent according to the production function. Hence, if there is an increment in the volume of investment in VC, it can be expected that it would positively affect GDP growth. Also, the unemployment rate has a negative effect on a country's production. Therefore, it can be expected that in those moments of economic contraction, there would be an increment of this variable.

### Analysis of the behavior of VC in different economies

It is worth mentioning before starting as this section relates to countries with different characteristics, data related to the population (GDP per capita) will be used. This has been decided because those countries with more significant populations will have a higher GDP, making the data significantly different. Also, as mentioned in the methodology section, this analysis will be done from 2007 onwards, and the selected countries are South Korea, Spain, South Africa, and the USA.

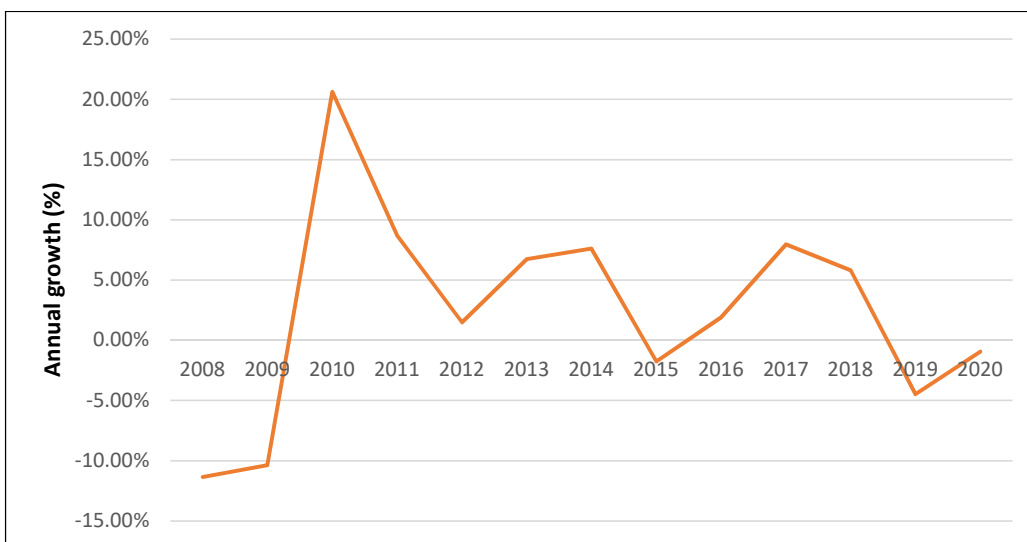
The following figures show the annual growth of the selected countries' GDP per capita. At first instance, each country presents different behaviors concerning the GDP per capita. The USA shows considerable GDP per capita growth stability, with a volatility of 0.05% and an average of 2.19% per year. This makes it the country that has grown the most since 2007 with a growth of 32.19% base to 2007. The second country that has grown the most is South Korea, with 31.25%. However, this economy has a more volatile behavior, which explains why even though it has a more considerable average growth (2.45%), it has yet to be able to grow over the USA (0.74%).

Figures 13. US GDP annual growth rate.



Own elaboration. Source: Statista.

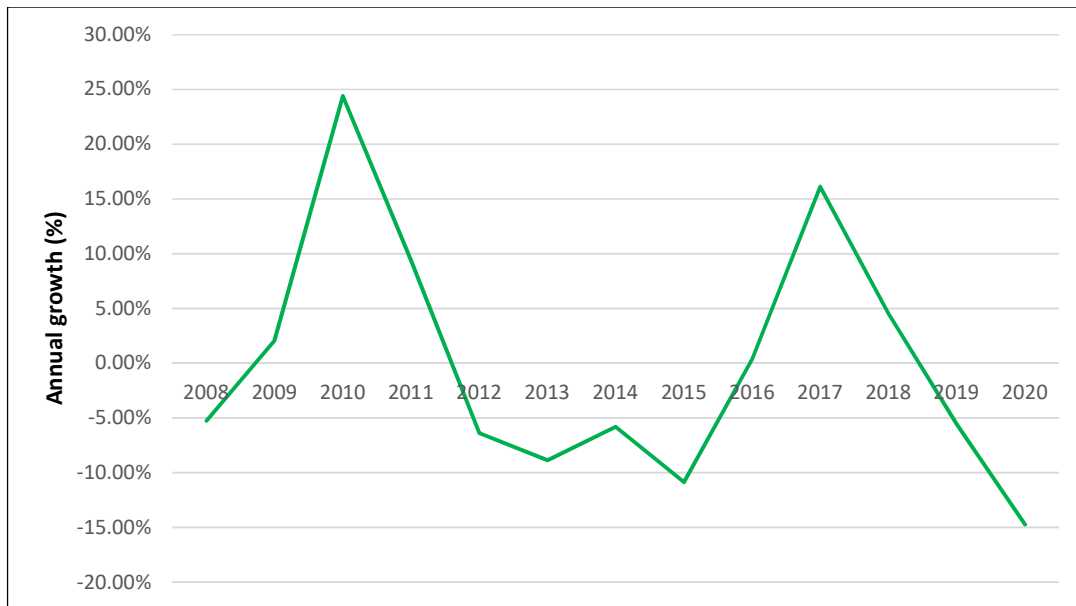
Figures 14. South Korea GDP annual growth rate.



Own elaboration. Source: Statista.

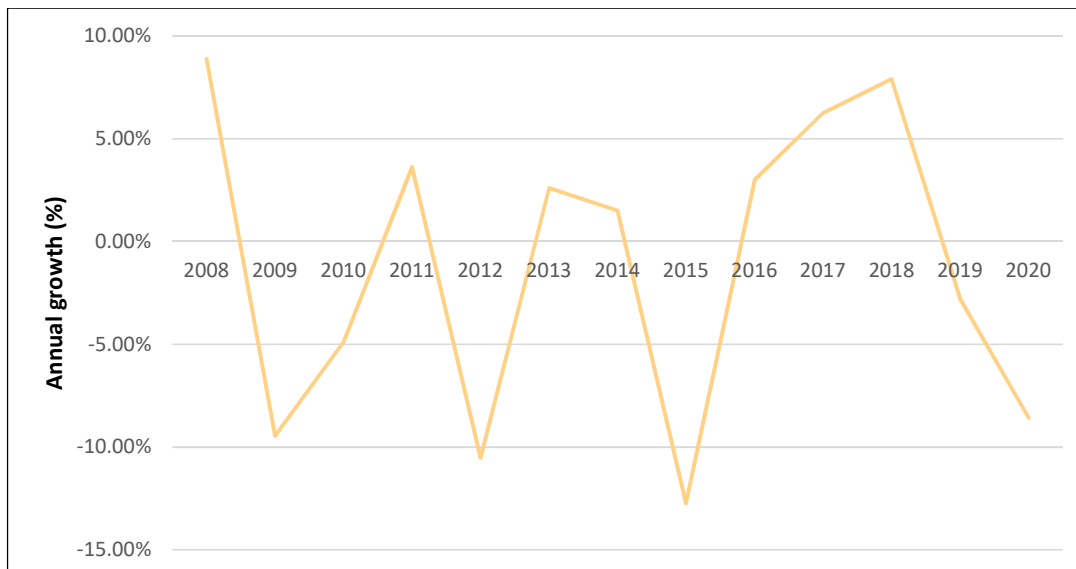
The most unstable country concerning economic growth is South Africa, with a volatility of 1.26%. This volatility means that the country's average growth is -0.05% each year. However, the country that presents the most significant contraction in its GDP per capita is Spain, with an average annual growth of -1.16%; also, the volatility of Spain's average growth is the second lowest. Hence, Spain has the sample's lowest GDP per capita growth, with -17.02% base to 2007.

Figures 15. South Africa GDP annual growth.



Own elaboration. Source: Statista.

Figures 16. Spain GDP annual growth.



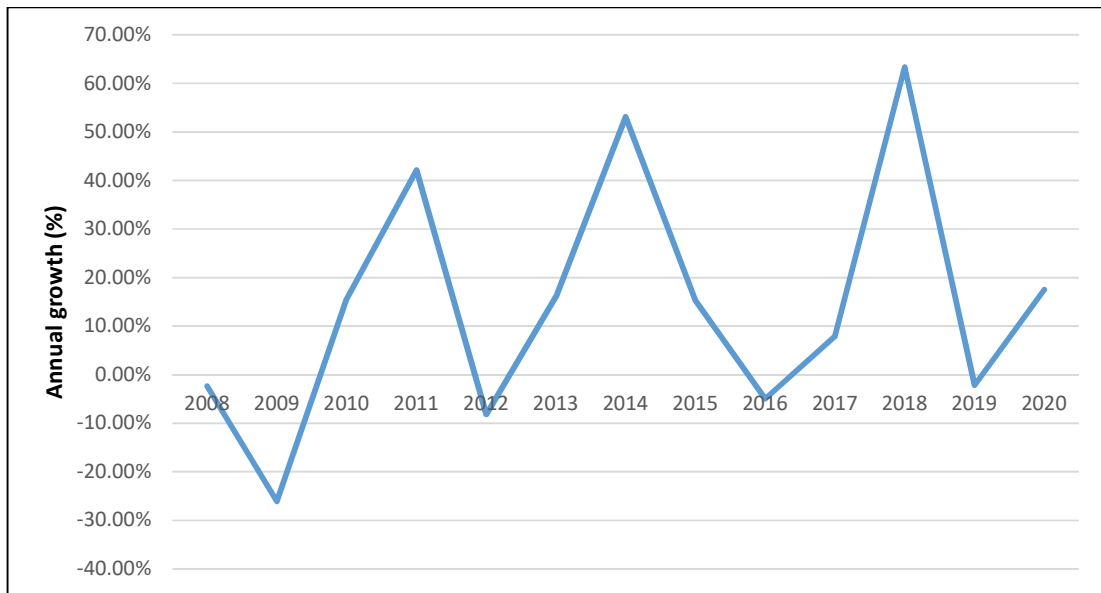
Own elaboration. Source: Statista.



Based on this, it can be deduced that each of these economies has a different structure, behavior, and situation, whether we compare the following trends and the movement's magnitudes. In addition, it can be seen how those non-western economies such as South Korea and South Africa were affected to a lesser extent in the time of the subprime crisis than the American and the Spanish. This is because the main focus of this housing bubble was the US, and the spreading was higher in Western economies. On the other hand, the COVID-19 crisis was an economic shock that affected all the countries similarly due to the high exposure to globalization in 2020.

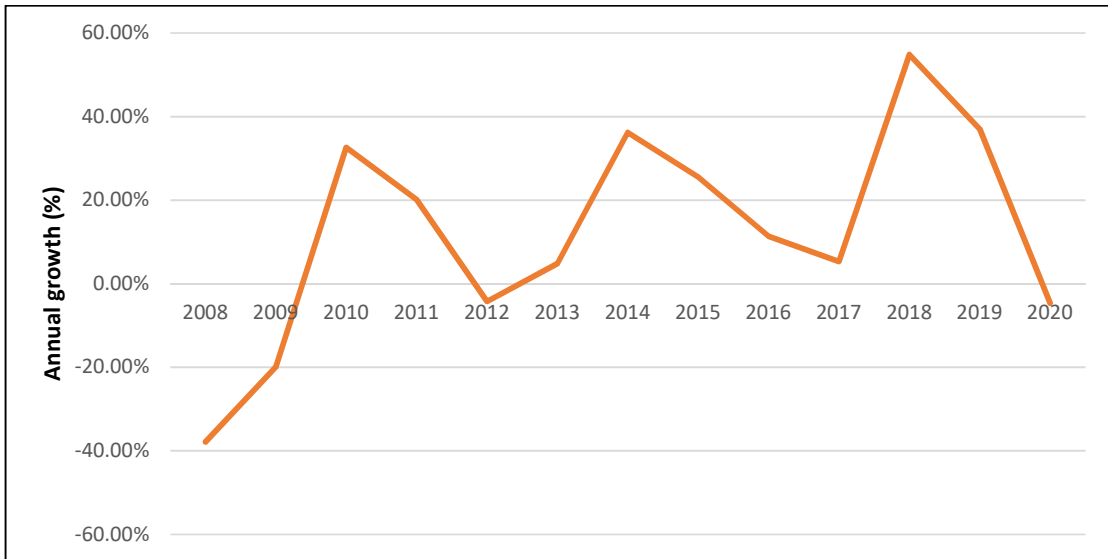
Once the different GDP growth of each country has been analyzed, we moved to study the behavior of the volume growth of VC in these countries. The following figures show the growth of this variable in the 4 selected countries. Generally, these countries present a similar cycle in VC growth, especially if we observe the US and South Korea cases. VC growth of these countries experienced a phase of high development, reaching 30-40% levels based on the previous year. After this phase, VC growth started to decrease, even reaching levels of 2012 when the US and South Korea reached a lower level than in 2011.

Figures 17. US VC investment annual growth.



Own elaboration. Source: NVCA Yearbooks.

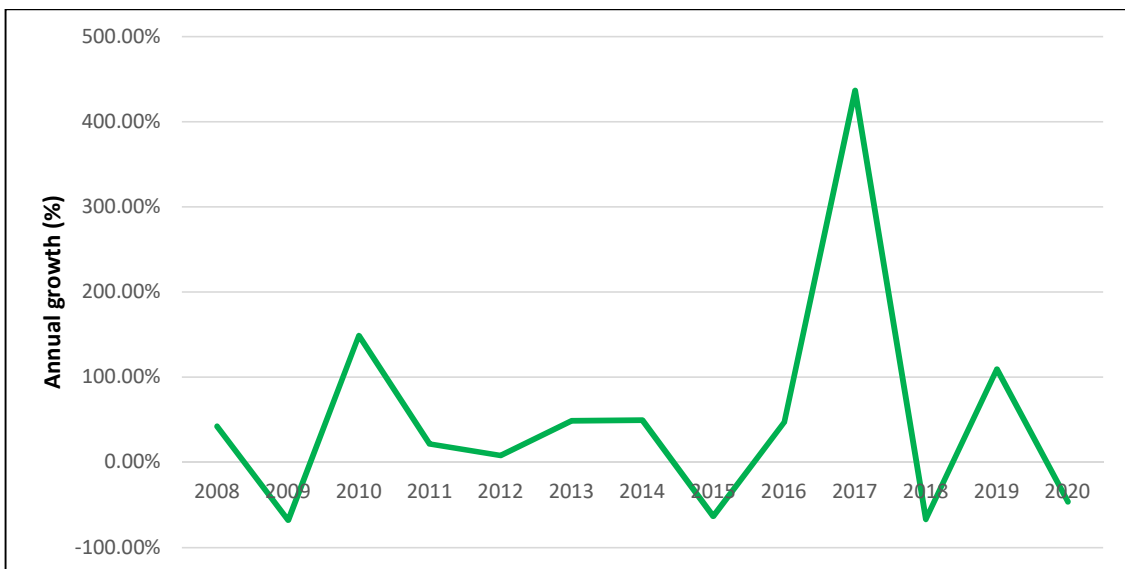
Figures 18. South Korea VC investment annual growth.



Own elaboration. Source: OECD Venture Capital Investments.

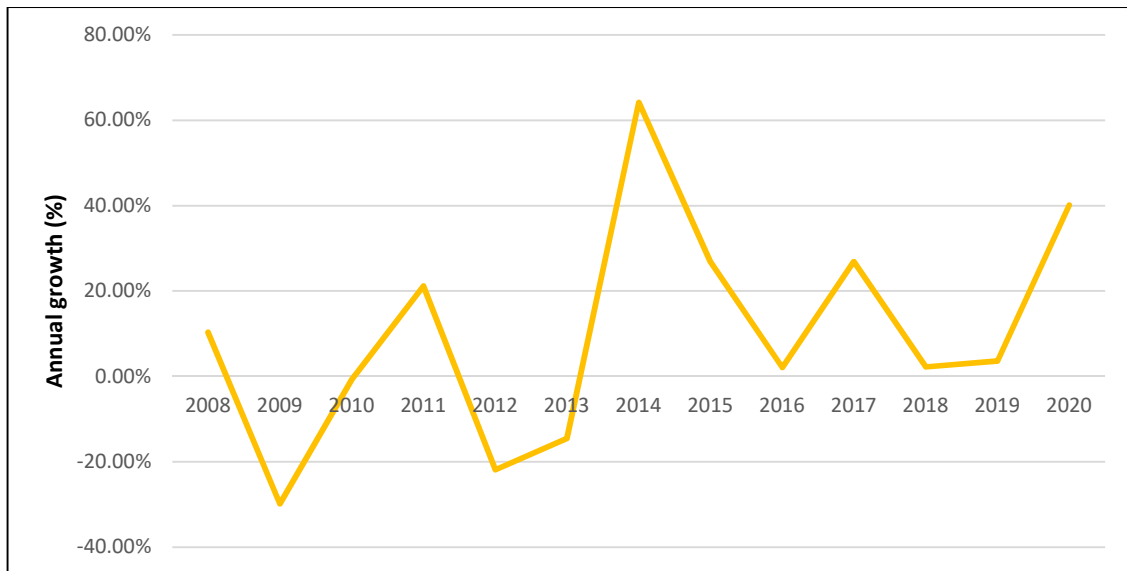
A higher trend can be found in these two countries, although in Spain it can also be seen to a lesser extent. The only country where it cannot be seen is South Africa due to its high instability over its investment structure in VC, with an average variance of 179.25%.

Figures 19. South Africa VC investment annual growth.



Own elaboration. Source OECD Venture Capital Investments.

Figures 20. Spain VC investment annual growth.



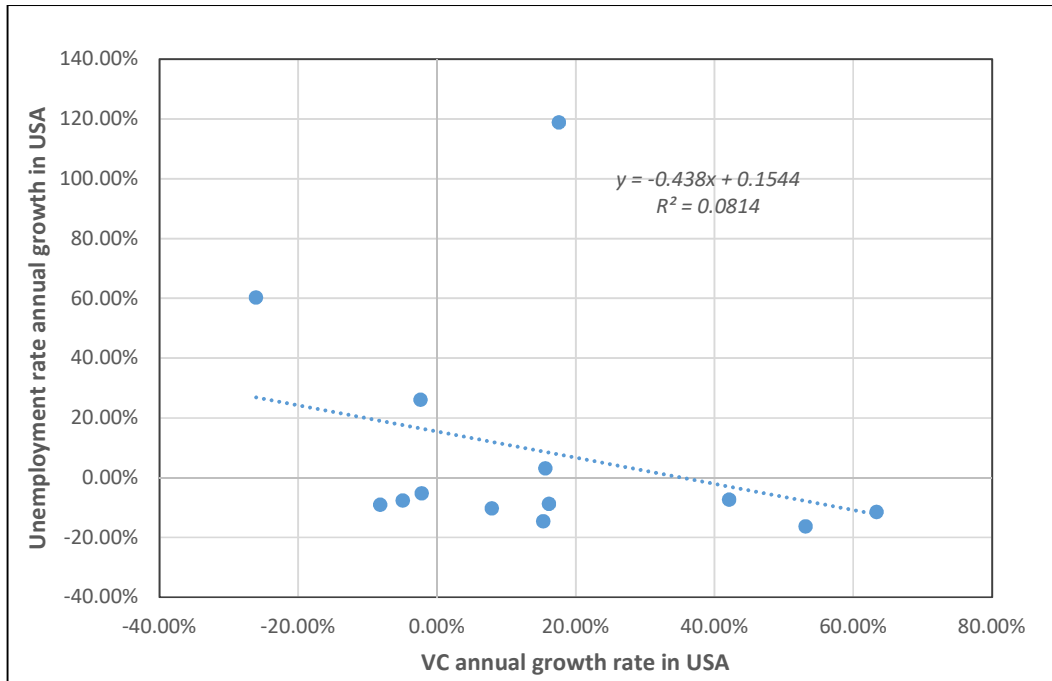
Own elaboration. Source: OECD Venture Capital Investments.

Observing this, the investment structure in VC is highly similar in the sampled countries, following a similar trend, and its changes happen practically in the same period. Also, if we look at the average growth and the average variance, they are highly similar, with growth between 10% and 14% and variance between 6% and 7%. The only country that does not present this trend is South Africa, which experiences high instability with the higher volatility previously mentioned, an average growth of 51.39%.

In the growth of VC in these countries, it can be seen how the first significant increment was just after the subprime mortgage crisis. However, in the second fall of VC, no economic shock of high relevance could explain this. There was a change of trend (As we focus on the periods previously mentioned and the economic shocks previously mentioned, this period will not be explained).

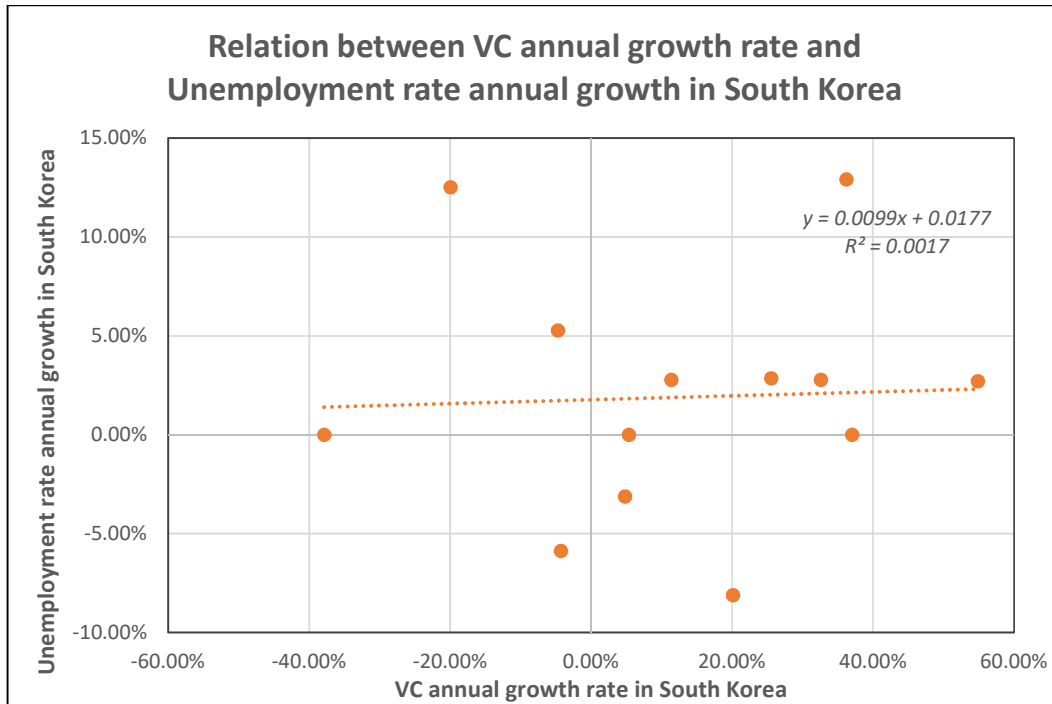
Suppose the VC growth in these countries is analyzed against their unemployment rates. In that case, it can be seen how the predictable level of VC on the unemployment rate is lower compared to the US—even reaching lower determination coefficients and even with a positive correlation, as is the case of South Korea and South Africa. The only country with a high determination coefficient and a negative correlation is Spain, with a correlation of -48.51% and an  $R^2$  of 23.53%. At first look, the behavior of VC in Spain can seem to have a significant role in the unemployment rate growth. However, if we look at the P-value in all cases, it says that the growth of the investment in VC is not significant over the behavior of the unemployment rate, with a high P-value in all cases.

Figures 21. Relation between VC annual growth rate and Unemployment rate annual growth in the USA.



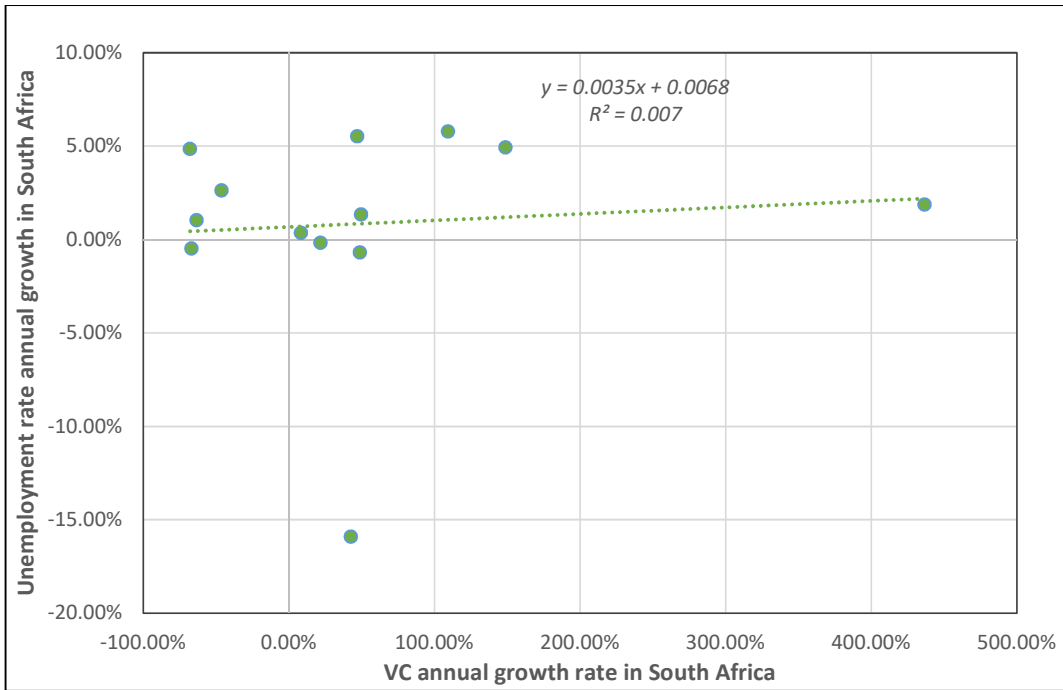
Own elaboration. Source: NVCA Yearbook & Federal Reserve Bank of St. Louis.

Figures 22. Relation between VC annual growth rate and Unemployment rate annual growth in South Korea.



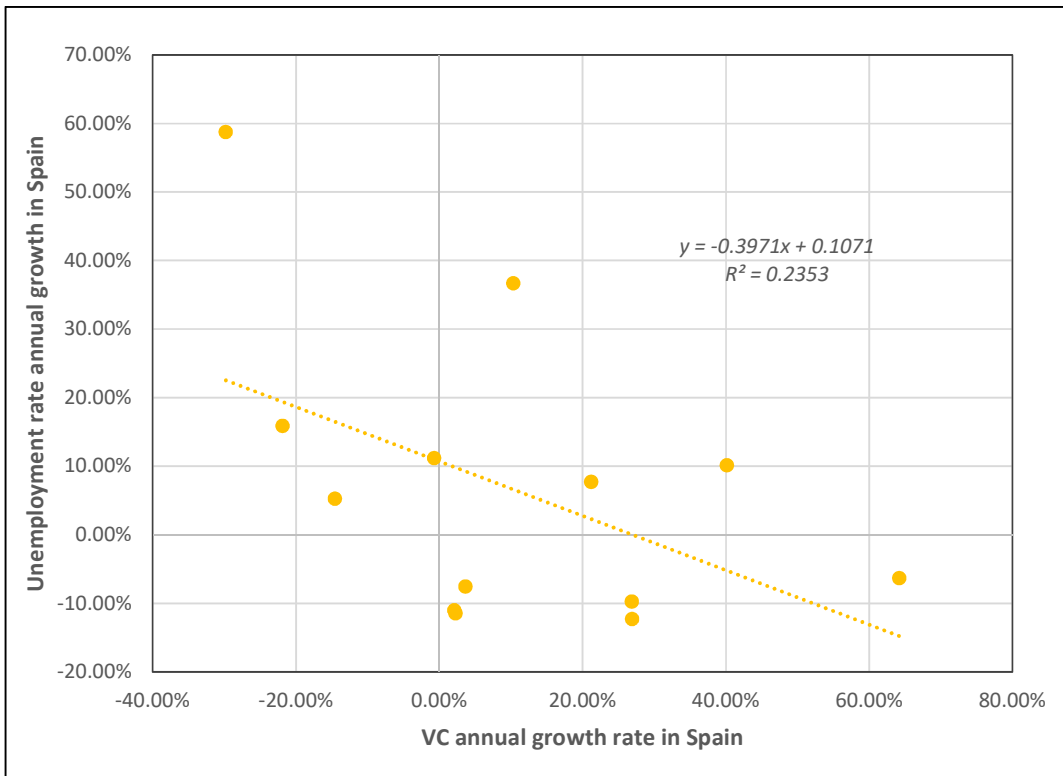
Own elaboration. Source: OECD Venture Capital Investments & OECD Unemployment Rate Indicator

Figures 23. Relation between VC annual growth rate and Unemployment rate annual growth in South Africa.



Own elaboration. Source: OECD Venture Capital Investments & Macrotrends.

Figures 24. Relation between VC annual growth rate and Unemployment rate annual growth in Spain.



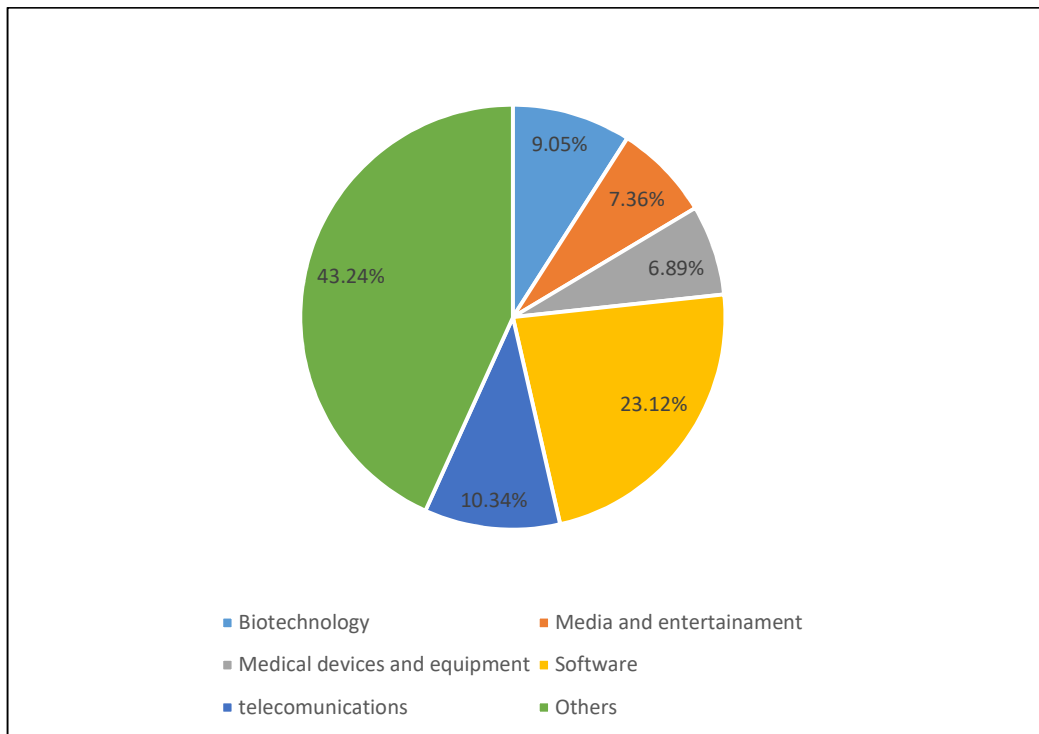
Own elaboration. Source: OECD Venture Capital Investments & Statista.

## Analysis of the Structure of VC Investment in the USA

For the analysis of the sectors of VC, several factors would be dealt with, such as the sectors with the most investment from 1997 to 2020 or the historical behavior of those sectors with the most investment in 2020. The analysis will not be done with specific periodicity, it will be done by studying the investment of VC by sectors during and after the economic-financial shock. This has been chosen as it would be beneficial to look at what trend they followed and the reaction of the investment structure.

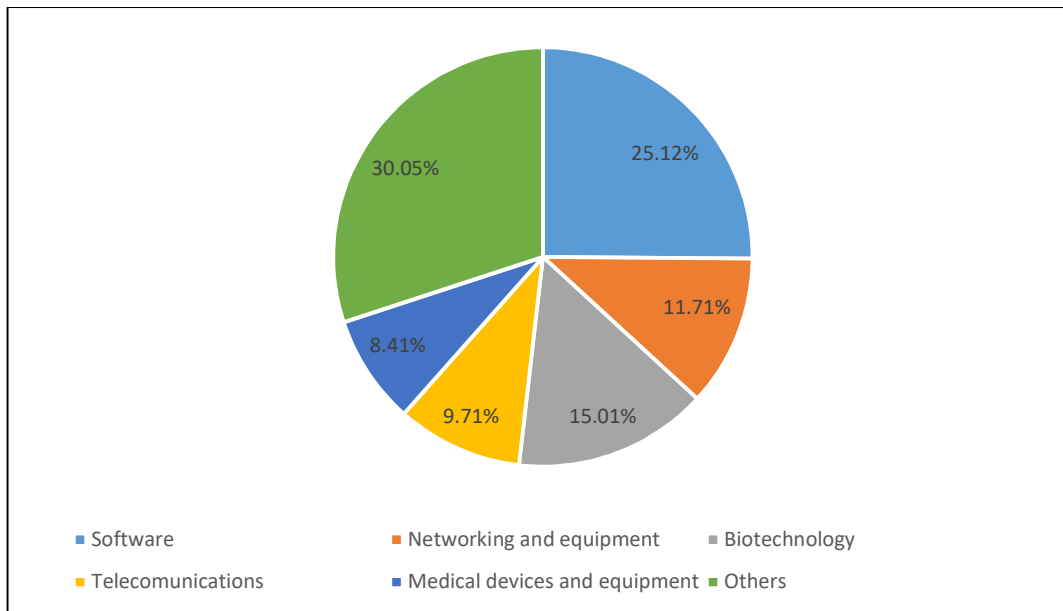
In 1997, 2000, and 2002, there was high participation in the technology, health, and communications industries. Software has been the sector with the most significant investment in VC in these years. The second was telecommunications, even though in 2002 it fell to fourth place, with 9.71%. Another sector that followed a falling trend was the media and entertainment, which in 2002 was no longer among the top 5 with the most investment. On the other hand, biotechnology has been increasing its domain, reaching second place in 2002.

Figures 25. VC investment by sectors (%) in 1997.



Own elaboration. Source: NVCA Yearbooks.

Figures 26. VC investment by sectors (%) in 2002.



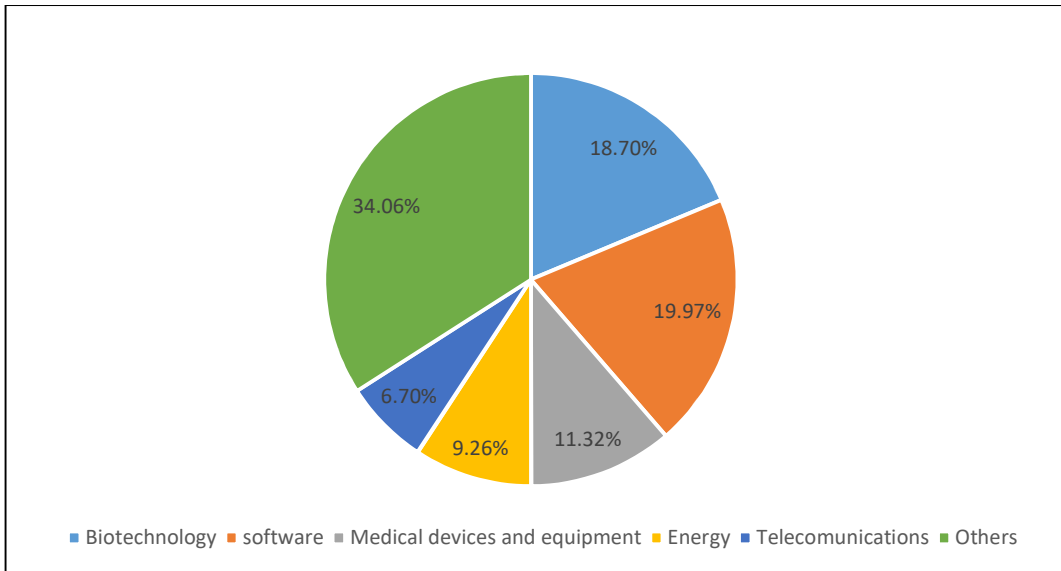
Own elaboration. Source: NVCA Yearbooks.

The most important thing that can be said from this data is that VC has historically been the most used investment type in the technological industry. Nowadays, its use in health industries is growing. Moreover, it is also a type of investment specialized in a few sectors, where the top 5 correspond to more than 50% of the entire investment in VC and have commonalities.

Those technology-related sectors suffered a fall in their importance in VC investment. This is due to the dotcom bubble crisis. However, they remain an essential group for VC investment. This can be seen especially in 2002 and 2007 when only software and telecommunications sectors related to the technological industry reached the top 5. This is alarming as in 2000 there were 4 sectors related to the technological industry.

In 2007, 2009, and 2012, the technology and health sectors were those with the most vital weight in VC investment. This is a period where the investment structure did not change much, staying the same sectors in these three years. The energy industry, which had never been in the top sectors of VC investment, was present during these periods.

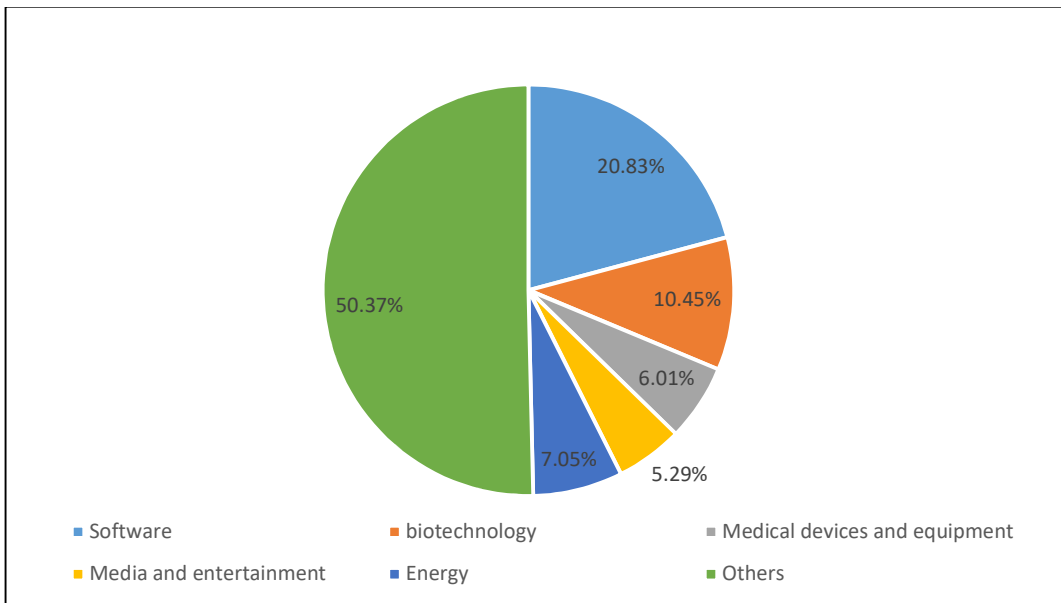
Figures 27. VC investment by sectors (%) in 2007.



Own elaboration. Source: NVCA Yearbooks.

A structure focused on specific sectors is still in place, presenting little changes in the sectors with the most investment. The presence of energy can be understood as a result of the spike in the different energy prices, such as oil and gas, during 2007 and 2008.

Figures 28. VC investment by sectors (%) in 2012.



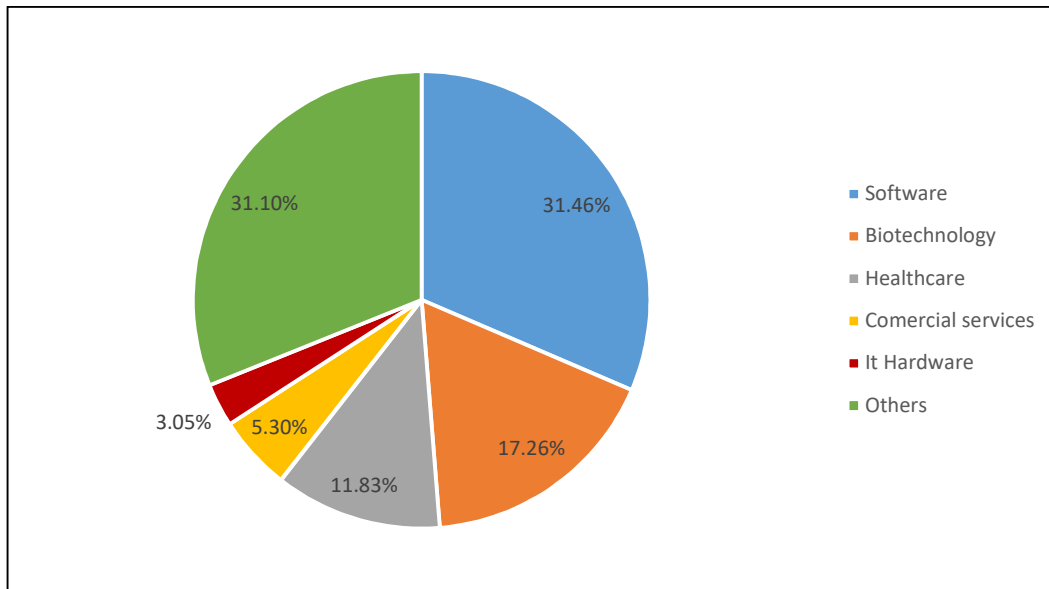
Own elaboration. Source: NVCA Yearbooks.

2015 and 2020 were years when investment in software and biotechnology remained stable. However, new sectors emerged. One of these is commercial services, IT services, and IT hardware, whose annual growth can be explained by increased E-commerce, home office, and social media. The other sector was healthcare, which received a high percentage after the COVID-19 crisis.



Giving a focus on the year 2020, the sectors with the most VC investment are:

Figures 29. VC investment by sectors (%) in 2020.



Own elaboration. Source: NVCA Yearbooks.

Here it is more evident that the VC investment has been focused on specific sectors, especially biotechnology, and software. These two sectors have always represented a critical percentage of investment. This may be because these industries need significant initial investment and the risk that this has, resulting in entities and particular investment in them. Examples are Google, Amazon, and Facebook, all companies from the technological sector with a big necessity for servers.

Economic-financial shocks do not highly alter the structure of VC investment. After a shock, the alterations are primarily negative in money invested; however, in a few cases, there was an alternation or a radical change in the types of sectors where VC is invested. After the dotcom crisis, technology-related sectors lost importance from VC investors. However, they remained among the top sectors. In the case of the subprime mortgage crisis, there were few changes in the structure, and it must be considered that this crisis affected sectors where there was not a significant presence of VC investment.

## **Conclusion**

This paper presents the history of Venture Capital in the US since 1939, explaining the consequences of the new deal policy, up to the most formal investment and its behavior during and after the dotcom bubble. The current situation of VC, its concepts, and its basic foundations have been explained for its understanding. Moreover, a study has been carried out on VC concerning the geographic location of this investment and the types of sectors that received the most investment from 1997 to 2020. With all the information collected in this paper, it can be concluded:

VC is a method of investment with a specific structure focused on defined needs and characteristics, exceptionally in companies and/or sectors that need a high level of investment in the first years after the creation of the company. This investment is made by individuals or companies willing to do this operation in return for long-term benefits. Therefore, those sectors that receive the most significant VC investment are companies related to technological development; specifically, there is a clear trend in the Software and Biotechnology sectors. These sectors have been among the top since 1997 and, in most of the years, positioned as the top 1 and 2. This happens as these sectors need significant capital investment in the company's first years, and the growth potential is extremely high, but at the same time, with high levels of risk. Apart from these sectors, telecommunication, IT Hardware, and healthcare also have had a significant percentage of VC investment. As can be observed, they all are sectors with some common ground among them.

Due to these precise characteristics and despite experiencing several economic shocks, there were no considerable alterations in the investment structure, remaining most of the time with the same sectors in the top 5 most invested. Nevertheless, some consequences can be observed due to the experienced economic shocks. Firstly, in the aftermath of the dotcom crisis, there was a significant decline in the relative weight of the investment in technological sectors of the total VC investment. This created a significant fall in general VC, as these were among the principal sectors of this form of investment. Secondly, during and in the aftermath of the financial crisis of 2007, energy prices, such as oil and gas, skyrocketed, which boosted the energy sector to become one of the most critical sectors for VC investment, remaining among the top during these years. Lastly, during the COVID-19 crisis, there was an increment in the demand for electronic products and home-office. Therefore, those sectors that could increase work-from-home benefited. Similarly, the use of social networks and streaming services increased, which benefited these sectors in 2020. Another sector that grew and gained importance in VC investment was healthcare.

A way to observe the critical role that VC plays in the technological sector is through the correlation between NASDAQ100 and VC investment, which despite being different investment methods, present a positive correlation and is higher compared to the S&P500. Ultimately, the principal sector that shapes these two variables is the same. Hence, if an alteration affects the technological sector, both will be affected by it.

Although those economic shocks previously mentioned did not affect in significantly the VC investment structure, it can be seen throughout this research that periods of crisis and uncertainty are the moments in which the behavior between the investment in VC and other macroeconomic and financial variables is out of adjustment and moves away from the trend they followed. Especially during the dotcom crisis and the subprime mortgages crisis, the behavior between the average annual growth of SPDR, QQQ, and the VC capital investment growth was adverse. It must be considered that the first crisis affected mainly not organized markets, such as VC, while the second affected the most

organized, such as these ETFs with variable income. On the other hand, the subprime and COVID-19 crises were when GDP and VC were furthest from the trend they were following. Both crises hit complex production, even causing a reduction. In the case of the dotcom bubble, growth was reduced. However, it never reaches moments of recession.

In addition, the VC trend is homogenous in different economies, as can be observed in the figures .... Despite having a different economic structure and being in different geographic zones, VC behaves similarly in each economy, except for South Africa, which presents a highly volatile investment structure. In the case of the unemployment rate, in those moments of economic shocks, it is when both variables move away from the trend. Nevertheless, at the statistical level, none of these countries presents a growth of the VC that is statistically significant to the growth/decline of the unemployment rate, in fact, the coefficient of determination is too low in most cases to be a key variable in itself.

After analyzing the historical context, the fundamental principles, the current situation as well as the VC of the USA in a sectorial and geographical way, comparing the behavior in different countries, it can be concluded that there is not enough evidence to support that the investment in VC significantly affects the moments of economic/financial crisis. As with any other financial instrument, it has a relationship with those instruments that work in the financial markets. Therefore, if there is an economic/financial shock, it will experience an alteration. However, it is observed how the behavior of VC has different magnitudes in different situations. For example, in 2007, the economic shock did not cause so much decrease in the investment of VC, and in 2019 it even increased investment of this type while the GDP contracted.

As a result of the relationship between all the variables that compose the economic environment, it is observed that when there is a decrease in the GDP are the times when all the types of investment start to decrease in the majority of the cases, including VC. However, more than the relative weight of this investment method is needed to become the cause of a crisis. There must be other affected factors and variables.

In the dotcom crisis, VC played an essential role because it is the sector's primary financing source. Therefore, when the crisis erupted, it can be seen how there was a substantial decrease in VC investment which is not translated to a decrease in the US economy, slowing down only the country's economy during some periods. In other periods of economic shock, the USA's and other countries' economies decrease, and a higher impact can be observed.

What is true is that during moments of economic crisis and uncertainty, VC's behavior is to contract itself without altering its structure.

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