Universidade do Minho
Escola de Economia e Gestão

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The development of Venture Capital in Portugal: the role of the public investor

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The development of Venture Capital in Portugal: the role of the public investor

Master Dissertation in Finance

Master in Finance

Supervisor:

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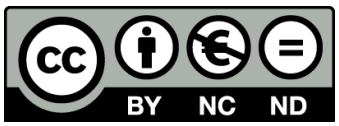

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Statement of Integrity

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

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Abstract

The main purpose of the present dissertation is to study the intervention of the Portuguese State as an investor and to understand if it has a preponderant role in the dynamization of the venture capital sector in Portugal. This sector has a two decade-long history in the country; however, it is still under development and there is still little information available about it. Therefore, through the present investigation, we pretend to contribute to the state-of-the-art in this area. We intend to understand by the application of our methodology whether the public investor attracts other potential investors, which in turns are private investors, and if this makes the venture capital industry grow. In this regard, the development of our methodology went through two processes: firstly, the application of the model developed by Kraemer-Eis et al. (2016); and then, by interviewing players of this industry in Portugal, whose testimonies will allow us to get more accurate and robust conclusions. In addition, we also want to study the impact that the COVID-19 pandemic had in this sector and how this industry was important to the economic recovery.

Keywords: venture capital, venture capital in Portugal, public investor, innovation, development stages of invested firms

Resumo

A presente dissertação tem como principal objetivo estudar a intervenção do Estado português enquanto investidor e perceber se tem um papel preponderante na dinamização do setor do Capital de Risco em Portugal. Este setor conta já com mais de duas décadas de história no país, contudo permanece ainda em desenvolvimento e ainda existe pouca informação disponibilizada sobre o mesmo. Assim sendo, pretendemos através da presente investigação contribuir para o *state-of-the-art* nesta matéria. Queremos perceber, através da aplicação da nossa metodologia, se o investidor público atrai outros investidores, por sua vez privados, e se tal faz crescer a indústria de Capital de Risco. Para isso, o desenvolvimento da nossa metodologia passou por dois processos: primeiramente, pela aplicação do modelo matemático desenvolvido pelo Kraemer-Eis et al. (2016); e, em seguida, pela realização de entrevistas a *players* deste setor em Portugal, cujos testemunhos nos permitirão obter conclusões mais precisas e robustas. Além disso, pretendemos também estudar o impacto que a pandemia da COVID-19 teve neste setor e de que forma este foi importante pata a retoma económica.

Palavras-chave: capital de risco, capital de risco em Portugal, investidor público, inovação, fases de desenvolvimento das empresas investidas

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List of abbreviations

CMVM - *Comissão do Mercado de Valores Mobiliários*

DW - Durbin-Watson test

EIF - European Investment Fund

GDP - Gross Domestic Product

GP - General Partner

GVCF - Government Venture Capital Funding

GVCs – Government Venture Capitalists

INE – *Instituto Nacional de Estatística*

OLS – Ordinary Least Squares

PVCF – Private Venture Capital Funding

PVCs – Private Venture Capitalists

SMEs – Small and Medium Enterprises

USA – United States of America

VC – Venture Capital

VCs – Venture Capitalists

VIF – Variance Inflation Factor

1. Introduction

Frequently, start-up firms have difficulties in accessing financial resources (Nunes et al., 2014) given the lack of evidence of continual profitability. For this reason, banks are reluctant to provide credit to these small businesses, and therefore the industry of venture capital (VC) assumes a huge relevance as an important financing alternative (Gompers & Lerner, 2001).

Characterized as a risky investment, VC is also recognized for the management skills of its investors that bring many benefits to firms (Pradhan et al., 2019). VC allows the development and the increase of attractiveness of the invested firms (Snieska & Venckuviene, 2009), fostering their innovation and amplifying their know-how and network (Del Gaudio et al., 2020). By fostering innovation, VC is promoting the growth of the competitiveness of the economies. Young innovative companies, such as those funded by VC, are seen as innovative initiatives as well as a way to create jobs and, consequently, economic growth (Caviggioli et al., 2020). Many studies demonstrate a positive causal relationship between the VC industry and the economic advancement of the countries (Pradhan et al., 2019). That is why policymakers have been paying more attention to this sector and Portuguese politicians are no different.

In this sense, one way to identify valuable innovative firms is through the patent rights since these are related to high levels of technology or disruptive innovation. Some studies concluded that there is a positive causal effect between patenting and VC investments (Kortum & Lerner, 2000; Caviggioli et al., 2020). Such positive correlation seems to vary among industries and development stages of invested firms (Caviggioli et al., 2020).

The Portuguese VC market, established in 1986 through the establishment of the first management company (Caetano, 2013), is composed of three entities: VC management companies, VC funds and business angels. Overall, this industry has revealed a higher dynamism over the years. However, the Portuguese VC market remains a small one (Nunes et al., 2014). According to the Comissão do Mercado de Valores Mobiliários (CMVM, 2020), the amount invested in Portugal in 2019 was around €5 249.8 million, whereas the amount invested in the US reached €116.3 billion

(Lavender et al., 2020). This situation is not only explained by the dimension of the country or the development of its economy, but also, and perhaps even better explained by the risk averse culture and the low level of financial literacy in Portugal.

In order to stimulate the VC in Portugal and to promote private venture capital funding, the Portuguese government has been developing some strategies. The one that is most applied is its significant participation in the VC investments. The venture capital funding provided by this public investor is not just a reality in Portugal. In fact, it also occurs in other countries since governments attribute great importance to entrepreneurship and innovation in their economies.

Thereby, many studies have been debating the success or unsuccess of government intervention. Some studies suggest that the presence of the public investor promotes private venture capital funding, indicating that it has a crowd-in effect. While other studies indicate the opposite effect. Therefore, we aim to study the development of the VC in Portugal and the impact of the public investor in this market.

This research intends to contribute to the empirical literature of VC in Portugal, considering the lack of study on this specific topic. It is also important to note that the present dissertation brings something new to the state-of-the-art, once there isn't any study yet that particularly investigates the role of the public investor in the development of the Portuguese VC market.

This dissertation is divided into five main parts. The first part corresponds to the literature review, where we address the topic of venture capital in general, the Portuguese VC market, the development of VC in Portugal and the Portuguese public investor. In the second part, we explain our methodology and its implementation process. After that, in the third section, we display the data obtained to apply the econometric model and the sample of our interviews. Additionally, we present the outcomes resulting from each methodology, separately, in section 4. Finally, we proceed to the final conclusions of our investigation, where we correlate the results of both methodologies and point out some limitations felt in the process as well as some suggestions for future investigation.

2. Literature Review

During the past several years, venture capital has been allowing the development and the continuity of many firms, becoming fundamental in several economies. However, this financing alternative presents certain differences from one economy to another. One of these differences is whether or not there is public participation in the investments. The pertinence of venture capital and the public participation in the investments has been discussed among various authors, and in Portugal is no different. So, in this chapter, we will address these themes and display the main empirical evidence with the state-of-the-art.

2.1. Venture Capital

Venture capital is a form of private equity which started to take its first steps after the Second World War (Hayes, 2021). It was precisely during the 1940's, that the first VC operations, as we know them today, arose in the United States of America (IAPMEI, 2006).

Venture capital is described as a very risky investment (Nunes et al., 2014) since it provides financing to firms that are in their early stage. However, the VC investors, who are called venture capitalists (VCs), assume such risk because they believe that these firms have growth potential (Pradhan et al., 2019) or because these firms have been presenting a quick growth. Simultaneously, VCs monitor the management of the companies in order to support their development (Fulghieri & Sevilir, 2009). Afterwards, venture capitalists intend to disinvest and then, get a return that covers the risk associated with the investments applied to the firms (Kaplan & Stromberg, 2004). Thus, venture capitalists 'gains are strongly dependent on the firms' success and unsuccess, which is different from the traditional financing forms in which the banks get their gains through interest and loan repayment (IAPMEI, 2006). The banks' gains are not so directly correlated with the company's performance.

Normally, the VC investments are realized through VC management companies, VC funds and business angels in some companies, usually start-ups or small and medium enterprises (SMEs). The VC management companies intend to invest in firms in which

they recognize a growth potential, doing it for a period of time no longer than a decade (IAPMEI, 2006). Furthermore, the VC management companies have the responsibility to manage the VC funds and support the development of the invested firms. VC funds are a form of investment funds, and they should be composed of stocks, share of equity, and bonds not quoted in the stock exchange (Caetano, 2013). Typically, the funds have a life cycle of ten years (to be invested during the first half and to be disinvested during the second half), and they are managed by one management company, which is called general partner (GP). The GP analyses potential deals and is responsible for making the final investment decision. The investors of the funds are called limited partners and pay a fee to the management company (Metrick & Yasuda, 2011). Business Angels are individual investors, who invest in firms in early-stage through their own money.

Additionally, it is important to note that VC is not only important for the development of the invested firms, but also because by fostering the innovation of said firms, it promotes the competitiveness of the economies (Pradhan et al., 2019). In all fairness, it's also true that VC is not always the sole responsible for a company's innovation (Faria & Barbosa, 2014). Innovative firms tend to be more autonomous and voluntarily look for this type of financing. So, VC also plays as a signal which indicates that companies related to venture investments are normally of high worthiness.

Apart from innovation, VC is also associated with other positive effects which invested companies can take advantage of. The most common effects are financial – associated with the lower cost of capital; knowledge related – given the fact that VC brings know-how to the companies; and network related – once firms establish contacts with banks, customers, and suppliers through VC (Del Gaudio et al., 2020). These advantages are the element which allows us to distinguish the VC from the traditional credit provided by banks. Moreover, banks usually finance companies that are in a mature stage, specially because in an early stage there is a higher risk. Hence, VC cannot be perceived as a "lender of last resort" (IAPMEI, 2006, p. 7), since it contributes to the business valorization of the companies with high growth potential by supporting their management and innovation (IAPMEI, 2006).

Curiously, the concept and features of venture capital is influenced by its Anglo-Saxon origins, so in the USA there are two distinguished investment forms: venture capital and private equity (IAPMEI, 2006). Venture capital, as referred above, is a form

of investment that provides capital to companies that are in early development stage. Contrarily, the Private Equity is an investment made in a company that's not publicly traded and is in a mature stage. The concept may sometimes be different in Europe, where the Private Equity defines all the VC sector (IAPMEI, 2006).

Therefore, it is possible to identify different development stages in the firms when the investments are realized (IAPMEI, 2006):

- **Seed Capital** – It is oriented towards entrepreneurial projects in development phase. The business is not yet established, so it frequently demands a support for market study. Seed capital represents the riskiest VC investment.

- **Start-Up** – It involves an investment in the firms' capital. These firms are already working or in the final installation process with a developed project. However, the products or services are not already commercialized.

- **Other Early-Stage VC**– It is an investment related to firms newly installed. Normally, these firms have already started the products/services commercialization, but they haven't profit yet.

- **Later-Stage VC**– In this stage, the company already proves the worthiness of its business and reach revenues, which are higher than its competitors. The company approaches a future expansion and a positive net income.

- **Growth** – It is designed for companies which have already reached maturity, but don't have the capability to expand more their business, to rise their production capacity, to develop commercial and promotion techniques, or to launch new products or services.

- **Management Buy-Out** – It is an investment related to control acquisition of the company by its managers or minority shareholders.

- **Management Buy-In** – It is an investment that only differs from the Management Buy-Out by the fact that the control acquisition of the company is realized by an external investor or a group of external investors.

- **Replacement Equity (or Secondary Transaction)** – It happens when a traditional investor of the company acquires the fraction of another investor.

- **Turnaround** – It is a stage that arises when a company is in a difficult financial situation. In that stage, the investment has the purpose of implementing restructuration projects in the company.

According to the VC Anglo-Saxon origins, the stages that usually represent venture capital operations are Seed Capital, Start-Up, Other Early-Stage and Later-Stage VC. All the following stages correspond to Private Equity, as illustrated by the following figure.

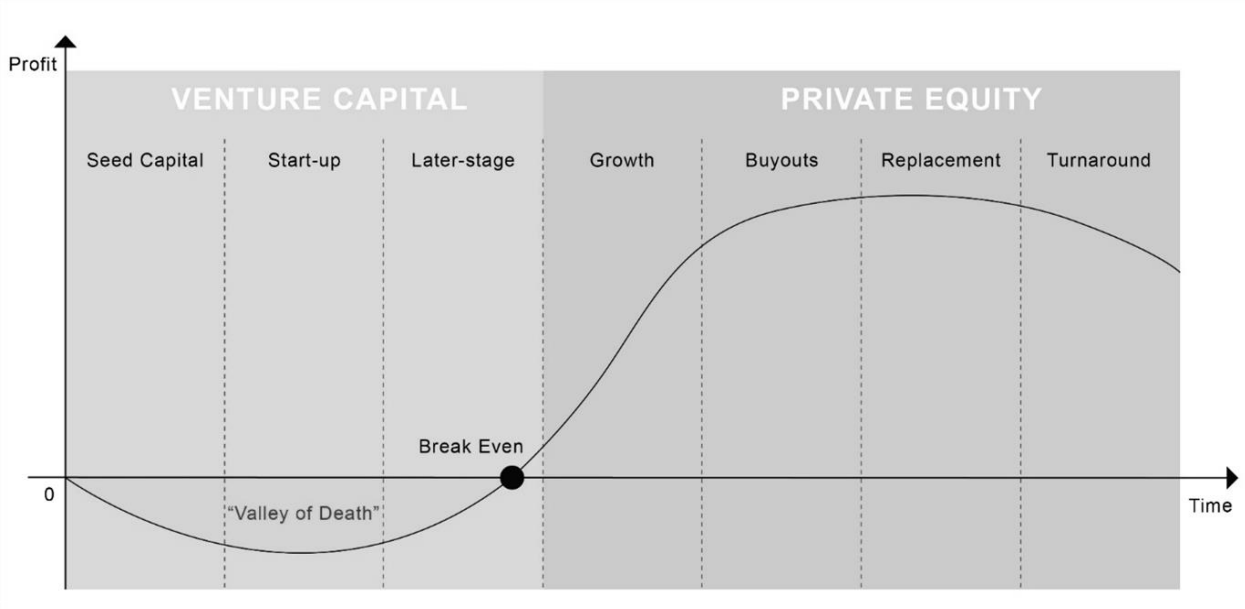


Figure 1: The development stages of the firms when they are invested. (Own elaboration, based on Relatório Anual da Atividade de Capital de Risco - 2019.)

As mentioned previously, VC is an investment with a limited period of time. In the end of that period, the VCs move on to the disinvestment procedure, which

represents a crucial point in the VC investments (Neus & Walz, 2005). Therefore, it is possible to identify different disinvestment mechanisms (Félix et al., 2009):

- **Buyback** - It can be pre-negotiated or realized in a spontaneous form. The disinvestment conditions are established, and this disinvestment mechanism can be realized through the exercise of the options of calls and puts and Management Buy-Out.

- **Secondary Sale or Trade Sale** – It corresponds to the participation sale to a strategic third party. The third party can be traditional investors, or private equity investors, or other VC investors. It is important to note that this exist strategy sometimes cannot be possible, since the agreements of the company may limit the entry of new partners.

- **IPO - Sale in stock exchange** – This disinvestment mechanism is more popular in developed markets, since the IPO market is more active and liquid (Raghupathy & Rajan, 2010). So, usually IPO is more profitable in these conditions rather than other exit forms.

- **Write-off** – It is an exit form with loss since it represents the liquidation of the company. When investors opt to write off a deal, it means that the company is no longer able to have profit in the future. So, the investors just want to "walk-away" from the firm.

In the Portuguese market, buyback and secondary sale are the disinvestment mechanisms more adopted by VCs. However, the IPO does not have a strong expression in Portugal by the fact that (Félix et al., 2009):

- There isn't a specialized exchange market in small and medium enterprises;

- The company's accounts need to provide better and more transparent information;

- Some stockholders show reluctance in selling a portion of the capital, even if it's a minority participation (for example, family businesses).

2.2. Portuguese VC Market

In Portugal, the VC market appeared in 1986 through the establishment of the first management company, in order to promote the funding by equity of the Portuguese firms' investment (Caetano, 2013). At first, the Portuguese VC activity could only be made by management companies and its regulation tended to be essentially public (Caetano, 2013), managed by Banco de Portugal and Comissão do Mercado de Valores Mobiliários (CMVM). However, the Portuguese VC legal regime suffered a revision in 2003 and since that time the VC sector in Portugal is only supervised by CMVM (IAPMEI, 2006).

Nowadays, the Portuguese VC activity can be made through three entities: VC management companies, VC funds and business angels. In Portugal, the entities that have the higher participation in the VC sector are the VC funds. At the end of 2020, there were 56 VC management companies and 166 VC funds to operate in Portuguese VC industry (CMVM, 2021).

Portugal is engaged in the fomentation of VC funding as an incentive to innovation, as it happens in other countries of the European Union (Nunes et al., 2014). Nevertheless, the Portuguese VC market isn't still in a mature state, which is due to many reasons. Firstly, the Portuguese entrepreneurial sector is determined by SME's and business families, which are many times risk averse (Cabral-Cardoso et al., 2016), becoming less receptive to different alternatives of funding like venture capital. In accordance with the classification by Black and Gilson (1998, as cited in Cabral-Cardoso et al., 2016), Portugal is characterized as a bank-centered capital market, which means that Portuguese SMEs seek essentially banks to get funding. Secondly, the development of the VC market in Portugal was strongly affected by the international financial crisis, and consequently by the sovereign debt crisis, which results in the intensification of uncertainty (De Vries & Block, 2011). The intensification of uncertainty led companies and private investors to become more risk averse (Ning et al., 2015), this is something

that especially happens in relatively small economies like Portugal (Cabral-cardoso, 2016). For this reason, there is a need to attract private investors to the Portuguese VC market.

Venture capital has been assuming a huge relevance in the global economy and the USA remains the main participant in the VC market. Europe continues to engage in the progress of the European VC market by diversifying and attracting investors (Lavender & Hughes, 2019). Despite the increase of the VC importance, the Portuguese market remains a small one (Caetano, 2013). To promote and to create the best conditions to the VC activity development in Portugal, the Portuguese government can adopt some measures (Caetano, 2013):

- To stimulate the investment in the creation of new firms, particularly in the technological area;
- To mitigate the inhibitor factors to the VC activity development;
- To promote networks among business angels;
- To eliminate institutional and regulatory barriers to the business dynamization;
- To promote the entrepreneurial and innovative ability.

Similarly to other European countries, Portugal has been trying to diversify the VC investments, but there are still some sectors which have been predominant over the last years, like communication and information activities, real estate and the manufacturing industry. Furthermore, a large part of the Portuguese VC investments is also canalized to holding companies (management companies of social participations), which are non-financial companies, though they work as a vehicle to make investments in other companies (CMVM, 2021). Such investment operations are more frequently applied in firms that are in a mature stage (private equity), however it is not possible to identify the activity sector of the invested firms. The investment tendency for some sectors verified in Portugal evidences that the VC investments are mostly made in

sectors with higher stability and economic consolidation (CMVM, 2009), although there are also investments in companies in an early development or restructuring stage.

Regarding the development stages of the firms once the investments are realized, in the USA the VC investments are made mainly in seed capital and start-up. However, Portugal follows the European countries' tendency, so the more dominant development stages are those of growth and turnaround.

2.3. The Development of VC in Portugal

Since the emergence of the Portuguese VC industry in 1986, the development of this market has been suffering oscillations as a result of some economic and financial situations. Nevertheless, it is possible to note a growth tendency over time, revealing a higher relevance of this sector in Portugal, despite it still being a small one.

In its first years, the VC in Portugal grew rapidly, but immediately after that the evolution of the sector suffered a deceleration, especially in the beginning of the 1990's, because of the slowdown in the growth of the Portuguese economy, which led to a shortage in the funds available for investments (Caetano, 2013). In that time, the VC investments were mostly allocated for the tertiary sector, the manufacturing industry, and essentially to firms in growth stage (Caetano, 2013). However, in 1997, 55.6% of the Portuguese VC investments were made in the financial service sector (Caetano, 2013).

From 1999 to 2000, the total value invested[1] in Portuguese VC industry increased significantly, passing from 118.6 million euros to 183.2 million euros, even though the growth tendency did not continue in the following period (Caetano, 2013). In 2002, the total value invested only reached an amount of 69 million euros, which represented a significative decrease. The number of investments realized in start-ups rose, but firms in growth stage were still predominating, and the disinvestment mechanism mostly adopted was buyback (Caetano, 2013).

In the subsequent period, from 2003 to 2004, there was a significant increase in the total amount of VC investments realized, reaching an amount of 161 million euros

[1] The total value represents the total amount of VC investments realized in that period.

(Caetano, 2013), which corresponded to a total value under management[2] of 679 million euros (CMVM, 2022). This growth tendency remained in the next years, once in 2005 and 2006 the total value under management was 823.8 million euros and 1 029.3 million euros, respectively (CMVM, 2022). In 2005, the investments were mostly designed for replacement equity (secondary sale), contrarily to the pattern verified in the past, and seed-capital stage had a significative increase (Caetano, 2013). Although in 2006 seed-capital had also rose, the investment phases that had more expression were growth and buyouts (Caetano, 2013). In 2007, the Portuguese VC activity continued increasing, reaching an amount of 1 525 million euros of total value under management (CMVM, 2008). This higher dynamization of the Portuguese VC was namely due to the increase of the number of the VC management companies and VC funds. In that period, there were 42 VC funds and 23 VC management companies (CMVM, 2008), revealing that the VC investments in Portugal were essentially made through funds instead of being realized by management companies. It is also relevant to note that the internationalization process of the Portuguese VC industry had been gaining more highlight with the increase in the number of investments realized in foreign firms.

In 2008, there was a reduction in the Portuguese VC activity due to the intensification of uncertainty as a consequence of the International Financial Crisis, as referred previously. The total value under management decreased to 1 472.7 million euros, which corresponded to a percentage of the GDP of around 0.9% (CMVM, 2009). Nevertheless, at this point the overview of the VC industry in Portugal was positive, since in the 2003-2008 period the industry presented a growth tendency, which revealed a higher relevance of this market, by the fact that the Portuguese VC legal regime suffered a revision in 2003 (CMVM, 2009). In terms of the activity sector invested by venture capital, in 2008 the financial and assurance services and manufacturing industry were the activity sectors mostly preferred by the Portuguese VC investors (CMVM, 2009). Moreover, the development stages of the invested firms that were more prevalent in 2008 in the VC investments were growth, start-up, and buyouts (CMVM, 2009).

[2] The total value under management corresponds to the VC investments already made which are still under management, plus the the total amount of subscribed and non-realized capital, plus the the total amount of VC investments realized in a specific period.

In the following year, the total value under management presented a recovery in the form of an increase from 1.472.7 million euros to 3 106.9 million euros, which represented 2% of GBP (CMVM, 2010). Such significant increase in 2009, was strongly correlated with two situations. Firstly, it is linked with the fact that a significative part of the capital raised by the VC funds were not completely realized (CMVM, 2010). And secondly, it is associated with the transformation of one holding company into a VC management company (CMVM, 2010). Thus, these circumstances led to an increment of the number of activity operators in the Portuguese VC industry, resulting in 50 VC funds and 27 VC management companies (CMVM, 2010). Similarly to 2008, the activity sectors with more expression in the Portuguese VC market in 2009 were the financial and assurance services, and the development stage of the firms once the investments were realized was growth, having a weight in the total investments of around 50% (CMVM, 2010). Furthermore, the mechanism of disinvestment mostly adopted by VC investors was buyback (CMVM, 2010).

Allied with the international financial crisis, in 2011 arose the Portuguese sovereign debt crisis. Although it had already started to take effects in the Portuguese venture capital back in 2010, it caused further problems to the VC market in that following year. The most significant consequence of this sovereign debt crisis was "a shortage of capital inflows" (Cabral-Cardoso et al., 2016, p.6) leading Portugal to a financial assistance program (Moro, 2014). This situation resulted in strong constraints in the bank credit market, that consequently translated in a higher cost of debt (CMVM, 2011). In that panorama, the VC market could have been a good alternative for the firms but considering that the Portuguese entrepreneurial sector is characterized as a bank-centered capital market, the limited access to funding became a trouble for SMEs, once the market of private equity was not an evident alternative of financing for them (Silva, 2004). Thereby, in 2011, the total value under management decreased to 2 642.5 million euros (CMVM, 2012). However, the decrease was not only related to the crisis, but also related to the fact that with the adoption of the new accounting normalization system in force in the country since January 1st, 2010, the total value under management of the funds no longer included the subscribed and non-realized capital, contrarily to what happened in the past (CMVM, 2011).

From 2012 to 2016, the total value under management grew progressively (CMVM, 2013; CMVM, 2014; CMVM, 2015; CMVM, 2016; CMVM, 2017), reaching an amount of around 4 642.4 million euros, which represented 2.4% of GDP at current prices in 2016 (CMVM, 2017). Over all these years, the manufacturing industry and the holding companies were the more predominant targets of the Portuguese VC investments (CMVM, 2017). As referred previously, the holding companies work like a vehicle to make investments in other companies, and they are non-financial companies. In regards to the development phase when the firms were invested on, turnaround and growth were the most expressive development stages from 2012 to 2016. Regarding the disinvestment mechanism more adopted by the Portuguese VC investments, secondary sale and write-off were the most preferred and there was not any exit through IPO, during this period.

In the following period, from 2017 to 2020, the Portuguese industry of VC continued to grow progressively as a result of the mild recovery of the national economy (CMVM, 2018; CMVM, 2019; CMVM, 2020; CMVM, 2021). Thereby, the total value under management reached an amount of 5 648.1 million euros in 2020 (CMVM, 2021). The increase of the total value under management was essentially due to the VC funds, which grew more than VC management companies. In 2020, the VC funds and VC management companies had a quota around 95% and 5%, respectively (CMVM, 2021). Regarding the development stages by the time the investments were made, the growth and turnaround continued to be the most applied, although the seed-capital has been gaining more expression, in recent years. Additionally, the information and communication activities, the real estate and the manufacturing industry were the predominant sectors of the VC investments. In the period under consideration, the disinvestment mechanisms most adopted were the same verified in the past periods.

It is also important to mention the financial crisis resulting of the COVID-19 pandemic, which inevitably had impact in the VC industry. The uncertainty and the disinvestment in the sectors affected by the COVID-19 increased, leading to a slowdown in the venture activity, in the first semester of 2020 (CMVM, 2021). Nevertheless, in the second semester there was a mild recovery once investors saw an investment opportunity in the sectors that became fundamental to fight against the pandemic, like the communication activities, the science and health industry, social support activities

and the manufacturing industry. This recovery continued in the beginning of 2021, revealing the importance of the venture capital for the economic upturn, during crisis situations (CMVM, 2021).

2.4. Portuguese Public Investor

Innovative young firms assume a huge role in the development of economies, since they work as a source of employment, innovation, and entrepreneurship (Colombo et al., 2016). However, these firms need financing to overcome the so common great liabilities in the beginning of any business activity and continue to growth. Therefore, given the lack of equity capital in the early-stage firms, governments around the world have been working on various initiatives (Buzzacchi et al., 2013; Soleimani Dahaj & Cozzarin, 2019). The main one is the public direct co-funding of venture capital funds, namely by providing seed money for the VC market (Soleimani Dahaj & Cozzarin, 2019). Governments recognize that "there is a market failure in terms of risk capital" (Soleimani Dahaj & Cozzarin, 2019, p.1) that is not completely solvable only by private VC (Colombo et al., 2016). Thus, governments are committed to fill this equity gap, because they care a lot about promoting entrepreneurship and innovation in their economies (Dahaj & Cozzarin, 2019). In this sense, when governments take part as an investor, they adopt a hands-on approach, which means a direct and active involvement in the invested firms (Cumming et al., 2017b).

Thereby, various studies have been researching the success or unsuccess of government intervention, leading to “a controversial academic debate” (Colombo et al., 2016, p.2). Some studies suggest that the presence of the public investor promotes private venture capital funding (PVCF), that is, the government participation stimulates private investment (Brander et al., 2015; Cumming, 2007a; Colombo et al., 2016). Nevertheless, other studies indicate that the government venture capital funding (GVCF) represents an unsuccessful intervention, since they argue that the presence of the public investor in the VC funds has a crowding-out effect (Bertoni et al., 2015; Soleimani Dahaj & Cozzarin, 2019). There are some authors like Lerner (2009) that exhibit a certain resistance in relation to the pertinence of governments' intervention in the VC market (Brander et al., 2015).

Apart from the discussion of the success of the government's direct participation in the VC investments, many authors referred the importance of a mixed structure in the VC funds, meaning that, according to them, VC funds must be composed by public and private investment, simultaneously. They contend that when a company is financed by a mixed structure VC fund, it gets more investment than companies funded purely by private venture capitalists (PVCs), or by government venture capitalists (GVCs) (Brander et al., 2015).

Dahaj and Cozzarin (2019) said that the results of their study showed that a mixed structure (public and private) in the VC funds has a crowding-in effect in the attraction of domestic and international private venture capital, increasing the total amount of PVCF (Soleimani Dahaj & Cozzarin, 2019). Additionally, Brander et al. (2015) suggest that when there is more GVCF there are also more invested companies, indicating that "GVC finance largely augments rather than displaces PVC finance" (Brander et al., 2015, p.1). This can be explained by the fact that when governments participate in the VC funds, the investment amount of the fund is higher, since they bring more money. Thus, this allows the investment in more companies, which consequently mitigates the risk. For this reason, private venture capitalists feel more propension to invest in those conditions. Therefore, companies that are financed with a mixed structure VC fund have more VC investors, and because of that they are most likely to be successful (Brander et al., 2015).

Just like in other economies, the government of Portugal also gives support to the Portuguese VC market once it believes that this sector has a positive impact in the economy. The Portuguese State provides support in two ways: through the promotion of this financing alternative for companies, and through its direct participation in the VC investments. The public direct co-funding of venture capital funds in the country is realized through various governmental agencies (Félix et al., 2009), namely *Banco Português de Fomento*.

In relation to the promotion, some investment programs have been launched by the Portuguese national promotional institution (*Instituição Financeira de Desenvolvimento* – IFD) and the European Investment Fund in order to leverage investments in Portugal. The most recent ones were:

- Portugal Tech - 2018, whose purpose was to fund technological firms and firms in early and growth development stage (IFD, 2018);

- Portugal Growth - 2020, which had the focus to provide funding to growth VC funds and support internationalization strategies (IFD, 2020); and,

- Portugal Blue – 2020, which had the objective to support companies inserted in the Portuguese blue economy (Portugal 2020, 2020).

Furthermore, the 200M Co-investment fund managed by *Banco Português de Fomento* has been having a crucial contribution to the improvement of this market, especially in promoting cross-border investment between Portuguese and international investors. So, it works as a channel between international funding (from Silicon Valley, for instance) and firms. Additionally, the Portuguese national promotional institution (*Instituição Financeira de Desenvolvimento* – IFD) has been developing some public tenders through quasi equity in order to promote the government co-funding with PVCs. The idea here is that the PVCs and business angels apply for the public financing of their funds. For example, in 2016, occurred the first tender for business angels and, around the same time, arose the first tender for VC funds (IFD, 2016).

In regard to the direct participation in the VC funds by the Portuguese government, it is the highest contribution to the development of this market in the country (Tejada, 2003/19). According to Félix et al. (2009), the direct governmental financing is largely responsible for the progressive growth in the VC market in Portugal over the years. The Portuguese public support is strongly related to the European Community Support framework, since it tries to canalize European structural funds to the VC market (Félix et al., 2009). In 2019, the Portuguese government invested an amount of 58 482 015.38 €, in the VC market.

Besides the 200M Co-investment fund, the Portuguese government also has other funds with which it participates directly in the VC market, for example, *Revitalizar Funds* and FINOVA. *Revitalizar* funds are a set of regional based venture capital funds, which were sponsored by *PME Investimentos* and are managed by *Banco Português de Fomento* these days. FINOVA is also a venture capital fund that was sponsored by *PME*

Investimentos and is currently managed by *Banco Português de Fomento*. This fund has the purpose to support innovation, growth, and internationalization of SMEs[3].

It is also important to note that the present dissertation brings something new to the state-o-f-the-art, once there isn't any study yet that investigates in particular the role of the public investor in the development of the Portuguese VC market. In this sense, it becomes relevant to study the intervention of the public investor and its impact on the dynamization of this sector in Portugal, understanding if the involvement of the State as an investor in venture capital motivates private venture capitalists to participate in certain investments that otherwise they would not.

[3] Decree-Law No. 175/2008, 26th August.

3. Methodology

In this chapter, we will explain in detail the whole process and the strategy applied to the implementation of our methodology, in order to make clear the way we chose to achieve the answers for our investigation.

For us, it seemed pertinent to start our study by defining the research questions to be answered, as well as the assumptions to be tested. We formulated the hypotheses shown below taking into consideration, firstly, the main study question – which is whether the presence of the public investor has a stimulating effect on the private VC investment and, consequently, in the VC market in Portugal – and, secondly, the macroeconomic indicators that also have an impact in the private VC investment.

- **Hypothesis 1:** The participation of the public investor stimulates the private VC investment.
- **Hypothesis 2:** Higher unemployment rates discourage private VC investment.
- **Hypothesis 3:** The greater the exports are, the greater the private VC investment is made.

In this regard, the development of our methodology went through two processes: firstly, the application of the model developed by Kraemer-Eis et al. (2016); and then, by interviewing players of this industry in Portugal whose testimonies allowed us to get more accurate and robust conclusions. So, our methodology is composed not only by a quantitative analysis, but also by a qualitative analysis. In this chapter, we will focus on each one separately, and then, in the conclusion section, we will correlate them.

3.1. Model

To test the hypotheses presented, our methodology was based on the model developed by Kraemer-Eis et al. (2016). This model was built with the purpose of studying the impact of the European Investment Fund's (EIF) participation in the VC ecosystem, that is, studying a causal effect of EIF's engagement in the European VC investments made by other entities (private investment). In the original model,

Kraemer-Eis et al. (2016) analysed the data simultaneously, per NUTS and per year, resulting in a dataset in panel. Their results showed that the EIF's investment presented positive and statistically significant coefficients. So, they concluded that the participation of EIF in the VC investments had a crowd-in effect on the investment amounts provided by other market players. Curiously, such positive causal effect was more pronounced in less economically developed regions and in economies where the VC market was less established (Kraemer-Eis et al., 2016).

Considering that the EIF is a public entity like the Portuguese State, we adapted the original model for our research purpose:

$$pvt_t = \alpha_0 + \alpha_1 pbt_t + \alpha_2 pbt_{t-1} + \alpha_3 pbt_{t-2} + \alpha_4 pbt_{t-3} + \alpha_5 unemp_{t-1} + \alpha_6 produc_{t-1} + \alpha_7 exp_{t-1} + u_t \quad (1)$$

Our model had a dataset of time series once the study was conducted by the analysis of the Portuguese VC market by quarter in a time horizon of 18 years – from 2003 to 2020. From this resulted our sample which amounted to a total of 72 observations.

Our dependent variable is the *pvt* variable that represents the private investment. Therefore, *pvt* is the total amount of the Portuguese VC investments minus the amount provided by the State-owned entities at time *t*. The fact that the private investment is the dependent variable makes it harder to correlate our results so directly with the purpose of the study because our main research question is whether the participation of the public investment stimulates the growth of the Portuguese VC market, and not if it has a crowd-in effect in the private VC investment.

However, we can easily infer that an increase in the amounts of the private VC investments, as a consequence of a greater amount of public investment, means a higher dynamization of the VC market. Thus, this dependent variable guarantees a significant thoroughness and robustness in the study.

Additionally, the *pbt* is the public investment, i.e., the amount of VC provided by the State in the previous quarters. This explicative variable also represents a lagged variable because just like in the original model, we studied the impact of the public investment lagged in time. Meanwhile, the *unemp t-1* variable, represents the

unemployment rate in the previous period. The *product t-1*, in turn, stands for the labour productivity in the previous quarter. The *exp t-1* variable is the proportion of exports in the percentage of GDP regarding the previous period. Finally, the *u* is the error term. In table 1, all the variables are listed along with their descriptions.

Table 1: The description of the variables.

Variable	Description
pvt t	the private VC investment in time *t*
pbt t	the public VC investment in time *t*
pbt t-1	the public VC investment in time *t-1*
pbt t-2	the public VC investment in time *t-2*
pbt t-3	the public VC investment in time *t-3*
unemp t-1	the unemployment rate in time *t-1*
produc t-1	the labour productivity in time *t-1*
exp t-1	the proportion of exports in percentage of GDP in time *t-1*

Own elaboration.

The choice of the variables was not solely based on the Kraemer-Eis et al. (2016) study, but also in the research questions of our study. Such decision was meant to select variables that could be more related with the study's purpose, and it allowed us to do so. Additionally, we tried to pin down variables that could be representative of the Portuguese macroeconomic scope. Besides that, we attempted other variables, like the employment rate, the direct investment in the percentage of GDP, the amount of people that have completed a tertiary education and the gross domestic product. Nevertheless, they only brought noise to the results, which can be observed in the appendixes 4-10. Thereby, we opted to remove them from our model.

In relation to the independent variables selected, we expected the following impact in the *pvt t* variable:

Table 2: The expected effect in the dependent variable.

Variable	Expected Effect
pbt t	positive
pbt t-1	positive
pbt t-2	positive
pbt t-3	positive
unemp t-1	negative
produc t-1	positive
exp t-1	positive

Own elaboration.

Taking into consideration that the Portuguese VC market is still under development and where the government has been giving support, we expected a positive effect of the lagged variable *pbt* in the dependent variable, like in the Kraemer-Eis et al. (2016) results, namely in the economies where the VC market was less established. Relatively to the *unemp t-1*, we were expecting a negative impact in the explained variable, due to the fact that as the unemployment rate increases, the market becomes less attractive. Through the same line of thought, as the productivity and exports increase, the market becomes more attractive for investors, and thus, we expected a positive effect from the variables *produc t-1* and *exp t-1* in the explained variable.

3.2. Interviews

In addition, we conducted interviews to a total of 18 players. These were all general partners of VC funds, like business angels, VC investors and VC fund managers working in Portugal. We decided to make interviews in order to get more accurate conclusions, this is explained by the fact that VC players are the ones who closely accompany this market in the country, meaning that they have a more realistic perspective of the national market. Thereby, their testimony allowed us to associate their answers with the results obtained in the quantitative analysis, leading us to a more robust conclusion.

In finance, the dominant approach is mainly quantitative, but we thought that a combination of both quantitative and qualitative analysis would particularly enrich our investigation, considering that the Portuguese VC market is still recent and small in dimension. Sometimes, the numbers do not truthfully translate the reality of a subject, but only a part of the whole reality. So, we thought that the testimonies of the people who deal regularly with this market could bring additional and more relevant information, which could certainly complement the numeric results. In this specific case, we were adopting an epistemological orientation of the interpretivism. According to Saunders et al. (2009), in interpretivism the reality and knowledge are constructed by the human being.

Alternatively, we considered conducting a survey. Nevertheless, because in an interview it is possible to know the thinking perspective of the respondent and the reasons that explain each given answer, we ended up opting for the interviews rather than the survey. Moreover, the interviewee can develop his answers as well as justify them, giving us access to information that otherwise we would never be able to infer from a quantitative analysis. Because of that, we managed to get information with higher accuracy, once the respondents can clarify their perceptions (Ongena & Dijkstra, 2021). The interviews allowed us to ask questions that were more complex and could not be answered in a brief manner (Wahyuni, 2012). Whereas, in surveys the answers tend to be more direct and objective, given the frequency of yes-no questions.

In regard to the interview process, we started by selecting the VC management companies which are most active in the market. After that, we contacted a representative of each of these VC management companies via e-mail. We started the e-mails by briefly presenting ourselves, then, we explained in what consisted our study and the pertinence of testimonies of the general partners for the investigation. Finally, we ended the e-mail by proposing three alternatives of scheduling.

Overall, we contacted 25 general partners and obtained responses from 18 of them, saying that it would be a pleasure to give their contribution and indicating one of the three schedules for the interview. The interviews were conducted remotely, using video conferencing platforms like Zoom and Microsoft Teams. In average, the interviews had a duration of 30 minutes. However, they lasted between 20 and 40 minutes, depending on the availability of time of each interviewee and on the flow of the

conversation, that is, how extensive and detailed the interviewees were in answering the questions. The interviewing process took place between January and March 2022.

The interviews were semi-structured as it can be possible to observe in appendix 1. The semi-structured interview is characterized as a series of questions to be covered by the interviewer ordered in the form of an interview guide. In our research, the questions were divided into three parts. The first part was related to the personal information of each interviewee, like age and its role in the VC management company. The second part was about their fund portfolios and the participation of the public investor in the VC funds, covering topics such as: the proportion of innovative firms; the ratio of public investment in the VC funds and, whether the involvement of the public investor stimulates private VC activity. And finally, the last part was related to the impact of the COVID-19 in the investment activity and the VC players' future expectation. Although the interviews were semi-structured, the venture capitalists were free to talk about any subject raised during the interview. This was possible due to the flexibility feature that semi-structured interviews are recognized for (Wahyuni, 2012), allowing the conversation to be more dynamic. At times, we also felt the need to make additional questions to clarify the perception of the respondents.

It is also important to note that the interviews had a part composed of five statements, to which the respondents had to answer on a scale from 1 to 5 according to their degree of agreement, as it is possible to observe in the Appendix 1. Such interview approach enabled us to make some statistical inferences, thus making the interview a quantitative analysis as well. We thought that this approach would enrich our investigation once the interpretation of the interviews becomes clearer and more objective.

4. Data

In this section, we will explore our sample of both methodological approaches. In relation to the quantitative analysis, we will present the sources and interpret the descriptive statistics. Relatively to the qualitative analysis, we will display the venture capitalists' features and the entities which they belong to.

4.1. Model Data

As explained previously, our model was a multiple linear regression, which was composed by seven explanatory variables. However, four of them represent the same actual variable, but lagged in time. Similar to the original model, it seemed pertinent to proceed in the same way in our study once the investments made today are usually related to the investments made in the previous period. It wouldn't seem rational to change dramatically the investment dynamics from one period to another. Because of that we expected a positive causal relation between the lagged variables of the public investment and the variable of the private investment.

All the variables were obtained with a quarterly time frequency, in a time horizon of 18 years – from 2003 to 2020. We got the data through various sources, as shown in the table 3.

Table 3: The sources of the variables.

Variable	Source
pvt t	PitchBook Data
pbt t	*Banco Português de Fomento*
pbt t-1	*Banco Português de Fomento*
pbt t-2	*Banco Português de Fomento*
pbt t-3	*Banco Português de Fomento*
unemp t-1	*Instituto Nacional de Estatística* (INE)
produc t-1	Eurostat
exp t-1	Eurostat

Own elaboration.

The dependent variable *pvt t* was obtained in the database of the PitchBook Data and the variable *pbt t* was granted to was by *Banco Português de Fomento*. Next, we inferred the *pbt t-1*, *pbt t-2* and *pbt t-3* variables through the *pbt t* because, as mentioned before, these variables are lagged in time. The *unemp t-1* was conceded by *Instituto Nacional de Estatística* (INE). At last, we got the variables *produc t-1* and *exp t-1* from the Eurostat database.

The table 4 provides a summary of the descriptive statistics for all variables. The private and public investment at time *t* have a mean value of 10 288 819.44 and 1 444 600.413 respectively. The minimum of these variables is zero, which was expected due to the natural relation between these specific variables and the other variables. However, there is a great difference among the minimum and maximum values of these variables, leading to a higher standard deviation, as the table 4 makes it clear. The private and public investment variables are positively skewed once the skewness values are higher than zero. And these variables are characterized by an excess kurtosis. Concerning the unemployment rate, the productivity and the exports, the standard deviation values are much lower than the first variables, that is explained by the smaller disparity between the minimum and maximum values. Only the exports variable has a skewness which is very close to zero, namely 0.0364 approximately. Regarding the kurtosis, the unemployment rate and the exports are *mesokurtic* and the productivity is excess kurtosis. In conclusion, we can verify that any variable follows a normal distribution.

Table 4: Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max	Skewness	Kurtosis
pvt t	72	1.03e+07	1.23e+07	0	6.34e+07	1.817181	7.172967
pbt t	72	4780631	8475024	0	4.72e+07	2.830242	12.51952
pbt t-1	72	4544891	8366466	0	4.72e+07	2.98045	13.4526
pbt t-2	72	4432400	8372450	0	4.72e+07	3.011304	13.57684
pbt t-3	72	4173113	8212911	0	4.72e+07	3.209529	14.93727
unemp t-1	72	9.695833	3.232208	5.6	17.5	0.7453818	2.354943
produc t-1	72	.2039861	2.56566	-10.9467	13.50224	0.6573002	15.90315
exp t-1	72	34.93453	6.135577	26.41332	43.92148	0.0363613	1.415776

Own elaboration, using Stata program as a support tool.

The table 5 provides the values of the correlation matrix in order to identify possible correlation between the explanatory variables. The results don't indicate any significant correlations between the independent variables once these are relatively low. The correlation coefficient between the public investment and exports, placed at 0.5290, is the largest observed correlation. Thus, we can infer that collinearity between the explanatory variables does not exist.

Lastly, it is also important to refer in this model data section that we only got the amounts of private and public investment relative to the venture capital, that is, we didn't get the amounts of investments concerning the private equity. It would not make much sense to consider the values of the private equity because the public investor only made investments in development stages of companies such as pre-seed, seed, start-up, other early-stage, and later-stage.

Table 5: Correlation Matrix.

	pbt t	*pbt t-1*	*pbt t-2*	*pbt t-3*	*unemp t-1*	*produc t-1*	*exp t-1*
pbt t	1.0000						
	72						
pbt t-1	0.3837*	1.0000					
	0.0009						
	72	72					
pbt t-2	0.4028*	0.3836*	1.0000				
	0.0005	0.0009					
	72	72	72				
pbt t-3	0.3059*	0.3838*	0.3842*	1.0000			
	0.0090	0.0009	0.0009				
	72	72	72	72			
unemp t-1	0.1823	0.1851	0.2106	0.1464	1.0000		
	0.1253	0.1195	0.0758	0.2197			
	72	72	72	72	72		
produc t-1	0.0566	-0.0914	-0.0430	-0.0510	0.0123	1.0000	
	0.6369	0.4450	0.7199	0.6705	0.9186		
	72	72	72	72	72	72	
exp t-1	0.5290*	0.4852*	0.4701*	0.4487*	0.3549*	0.0075	1.0000
	0.0000	0.0000	0.0000	0.0001	0.0022	0.9504	
	72	72	72	72	72	72	72

Own elaboration, using Stata program as a support tool.

4.2. Interviews' Sample

As referred previously, our sample of interviewees was composed of general partners of VC funds, like business angels, VC investors and VC fund managers in Portugal. We reached out to 25 players having gotten answers from 18 of them. Regarding the selection process, we started by looking for the management companies of VC funds that have the most activity. Then, we contacted someone employed by said companies who was willing to share their testimony with us. Table 6 provides the name of the VC management companies where the interviewed players work at along with their locations. Most of the VC management companies are based in the capital city of Lisbon, but some of them are from Porto as well. This demonstrates the distribution of the sector in Portugal, which is essentially located in the two national metropolitan areas, namely Lisbon and Porto.

Table 6: List of the VC management companies.

VC Management Companies	Location
VegaVentures	Porto
COREangels	*Aveiro*
Indico Capital Partners	Lisbon
BYND Venture Capital	Lisbon
Ideias Glaciares	*Ermesinde*
Quadrantis Capital	Lisbon
Growth Partners Capital	*Cascais*
Hcapital Partners	Lisbon
Crest Capital Partners	Lisbon
Vallis Capital Partners	Porto
ActiveCap	Lisbon
Iberis Capital	Lisbon
C2 Capital Partners	Lisbon
Oxy Capital	Lisbon
LC Ventures	Lisbon
Explorer Investments	Lisbon
Armilar Venture Partners	Lisbon

Own elaboration.

Moreover, it is relevant to mention that, although some players come from management companies that are a private equity manager, they also have some investments in venture capital. Another aspect is the fact that in Portugal, the concept of *Capital de Risco* includes venture capital and Private Equity. Thus, the market, the regulations, and the general environment are mostly the same. So, the testimony of these players, even though they work at a management company of private equity, they have knowledge and well-founded opinions about this research topic.

In table 7, it is possible to see the main characteristics of our sample outlining a general profile of the interviewees. Firstly, regarding the gender, our sample is composed of seventeen men and a woman which reflects the reality of the sector, one that is male dominated. The majority of the players is between 40 and 50 years old. Overall, the whole sample reveals a significant experience in the industry once all participants have been in the VC market for 5 to 10 years. Four of them have even been in the industry for more than two decades.

Concerning the reasons that let them to enter in the VC industry, the main ones were the interest in the VC sector and the emergence of a business opportunity, or in another cases, a professional opportunity. It should be noted that the players from our sample cover a variety of positions between them in their respective companies. Also, most of the interviewees have simultaneously more than one function in the VC management company. For example, some of them are, at the same time, partners, or CEOs as well as VC investors.

Table 7: The characteristics of the interviewees.

Characteristics	Number of VC players
Gender	
Female	1
Male	17
Age	
> 35 years	5
40-45 years	4
45-50 years	5
> 50 years	3
Time period in the VC industry	
5 -10 years	10
10 -20 years	3
20 -25 years	3
>25 years	1
Reason that led them to enter in the VC sector	
Enterpreneurship	3
Interest in the industry	5
Business opportunity	4
Career opportunity	5
Other	
Main function in the VC management company	
Business angel	3
Partner	7
CEO	5
VC fund manager	1
Board member	1
Company's average annual investment	
1-5 millhion euros	9
5-15 million euros	3
15-50 million euros	5

Own elaboration.

5. Empirical Results

In this chapter, we will present the results of the application of our quantitative and qualitative methodology. The presentation of our results will be divided into two parts: firstly, the interpretation of the numerical results; and secondly, the interpretation of the respondents' answers.

5.1. Model Results

The analysis process started with the selection of the variables. As referred previously, the implementation of our model was based on the Kraemer-eis et al. (2016) methodology. However, we adapted the original model for our study. The kraemer-eis et al. (2016) methodology, studies several economies at the same time, whereas in our case, we only study the Portuguese reality. So, we had to change some variables. Additionally, it is also important to note that the choice of variables also took into consideration macroeconomic indicators already referenced by other authors as having a positive or negative effect on venture capital (Félix et al., 2012; Ueda and Hirukawa, 2008; Groh and Wallmeroth, 2016). The public investment variable should be combined with other indicators which show the economic condition of the country.

We started to test the results with various combinations of variables, like education, GDP and direct investment. Nevertheless, these variables brought some noise to the results because, most of the time, they were not statistically significant, or the R^2 was low in the presence of these variables. Furthermore, they even brought negative effects to the other variables, so we decided to remove them. The appendices 4-10 demonstrate these conclusions. Thereby, we concluded that the best combination of variables was private VC investment, public VC investment (lagged in time), unemployment rate, labor productivity, and exports in percentage of GDP.

Once the variables were selected, we started by obtaining the descriptive statistics. We realized that the variables were not in the same scale, which resulted in really different coefficients. So, we tried to set the variables in logarithm form, but we missed many observations. Thereby, we discarded such method and elaborated another alternative. We opted for the standardization of all the variables because it not only

allows to put the variables in the same scale, but also enables the distribution of the data to tendentially be normal. And so, in order to standardize the variables, we had to calculate the mean and the standard deviation of each variable. Then, for each observed value of the variables, we subtracted the mean and divided it by the standard deviation as shown in the following formula:

$$Z = \frac{X - \mu}{\sigma} \tag{2}$$

Thus, we got these first results, when we estimated the regression model, applying the OLS (ordinary least squares) estimator:

Table 8: Estimated results after the standardization of the variables.

Variables	Private VC Investment
pbt t	0.1942**
	(2.448)
pbt t-1	0.1062
	(1.358)
pbt t-2	0.1718**
	(2.208)
pbt t-3	0.0394
	(0.520)
unemp t-1	-0.3473***
	(-4.986)
produc t-1	0.2124***
	(3.232)
exp t-1	0.5788***
	(6.389)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.730

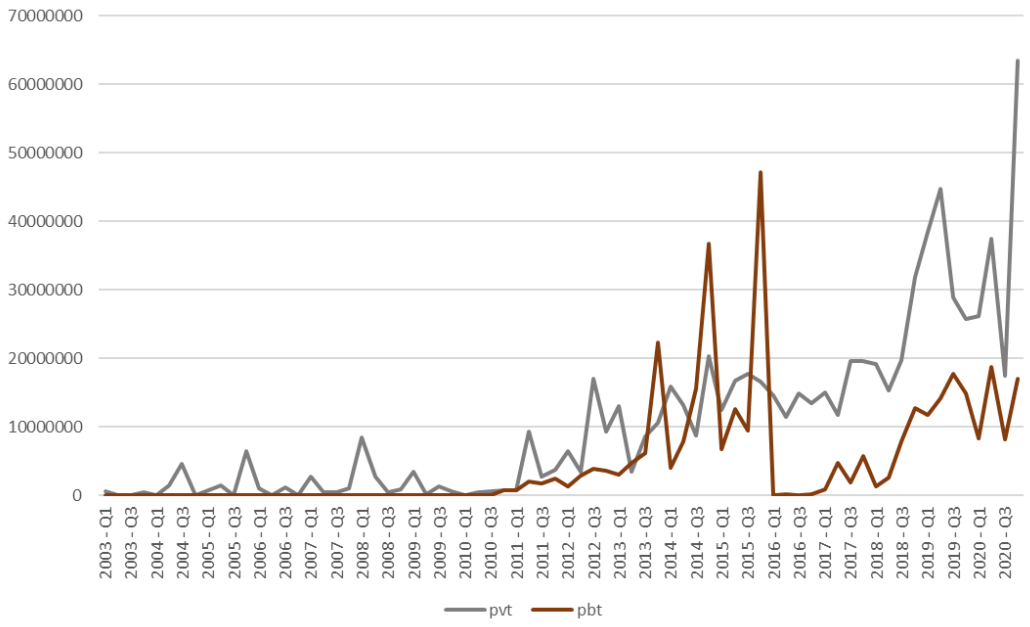
t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Through these first results, we can infer that the model fits the data well since the square of the correlation coefficient, the R^2, is higher than 0.70.

In relation to the impact that each explanatory variable has in the dependent variable, we concluded that the main explanatory variable of our study, which is the public investment at time *t*, has a positive impact in the private investment and it is statistically significant at a 5% level, as we expected. Thus, the statistical evidence supports our first research hypothesis. Such result also corroborates the study by Brander et al. (2015), in which they suggest that governmental participation stimulates private investments. Moreover, we got the same conclusions that Kraemer-eis et al. (2016) got in their methodology, where they determined that the coefficients associated with the first lag EIF investment variable are positive and statistically significant. The following graph makes clear the positive causal relationship of both variables that is supported by the first results. As the amount of public VC investment rises, the amount of private VC investment rises too.



Graph 1 - The evolution of investment VC amounts. (Own elaboration.)

In regard to the coefficients of the other lag public VC investments, the *pbt t-2* is the one which has more impact in the dependent variable and is statistically significant

at a 5% level. Although some of the lag public VC investment variables are not statistically significant, all of them present a positive coefficient.

However, the unemployment rate has a negative effect in the private VC investment once an increase in the *unemp t* variable stimulates a decrease in the private VC investments, as we expected in the first place. The coefficient of the unemployment rate is negative and statistically significant at 1% level, so that statistical evidence supports our second research hypothesis. According to Félix et al. (2012), the unemployment rate is a macroeconomic variable that impacts the economic expectations of the entrepreneurial players along with the decisions they make, just like venture capitalists. When there is a higher unemployment rate, the market becomes less attractive for investors because, as Félix et al. (2012) states "a higher unemployment rate lowers the expected return on the start-up since in the event of failure, a longer period can be expected till he becomes employed again" (p.265).

Regarding to productivity, it is clear in table 8 that the variable has a positive influence in the private VC investment and is statistically significant at 1% level, as we expected. Some authors, like Ueda and Hirukawa (2008), studied the impact of the venture capital in the labor productivity, and they concluded that indeed there is a positive effect. In our research, we studied the opposite variables relationship, that is, we examined whether high levels of productivity stimulate private VC investment. It is possible to verify both causal effect because they work like a cycle where an increment of productivity stimulates private VC investment due to a bigger attractiveness of the market and, as a result, the private VC investment is higher, leading to an increase in the productivity (Ueda & Hirukawa, 2008).

Similarly to the unemployment rate and the productivity, the exports represent a macroeconomic indicator. Through the results in table 8, it is notable that exports influence positively the dependent variable with a statistically significance level of 1%**,** which meets our previous expectations and sustains our third research hypothesis. This result is also in line with a paper by Groh and Wallmeroth (2016) that says that the exports are a determinant of venture capital once, as they argue, when exports raise it attracts more venture capital. Finally, from the results on table 8, we can also conclude that the exports are the variable that has more impact in the dependent variable since the exports have the greater coefficient (0.5788).

It is also important to note that like in the original model, the variables *unemp t-1*, *produc t-1* and *exp t-1* are always referring to the period before the *t* period of the dependent variable. It is relevant to use variables from a previous period because the last performance of these macroeconomic indicators impacts more the investment decision in the following period, rather than in the same period.

Taking into consideration that our model was a multiple linear regression, we though that it would be pertinent to make a multivariate analysis, testing the model for multicollinearity and autocorrelation. So, we started to test the multicollinearity, using the VIF (variance inflation factor) command on Stata program, and we obtained the following results:

Table 9: The estimated results after testing the model for multicollinearity.

Variables	Private VC Investment
pbt t	0.1942**
	(2.448)
pbt t-1	0.1062
	(1.358)
pbt t-2	0.1718**
	(2.208)
pbt t-3	0.0394
	(0.520)
unemp t-1	-0.3473***
	(-4.986)
produc t-1	0.2124***
	(3.232)
exp t-1	0.5788***
	(6.389)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.730
VIF	1.02-1.94

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Multicollinearity is nothing more than the existence of a correlation between regression predictors. The presence of multicollinearity can cause serious problems in the regression model, as the results may be biased, leading to incorrect conclusions (Daoud, 2018). Table 9 provides the values of the VIF, which sit between 1.02 and 1.94, so we concluded that there was no multicollinearity in our research model, once in the presence of multicollinearity the values of the VIF would be higher than 10 (Paul, 2006). Thus, we didn't need to correct the regression model.

In addition, as our model had a dataset of time series, we tested it for autocorrelation. The autocorrelation consists in the presence of a causal relationship between the current value of the same variable and its previous values (Smith, 2021). The method more frequently used to test the autocorrelation in a time series regression model is the Durbin-Watson test (Chen, 2016; Smith, 2021). The Durbin-Watson test (DW) varies between 0 and 4. As the value of the test is closer to 0, it indicates a higher positive correlation (Smith, 2021; Brooks, 2018). On the contrary, values sitting closer to 4 mean a higher negative correlation (Smith, 2021; Brooks, 2018). To conclude that slight evidence of correlation exists, the DW should be very close to 2. Table 10 provides the result we obtained after testing the model for autocorrelation.

Table 10: Result of the Durbin-Watson test.

Durbin-Watson	d-statistic	(8	;	72)	=	.9680505

Own elaboration, using Stata program as a support tool.

Through the value shown in table 10, we may conclude that our model presented a positive autocorrelation once the value of the Durbin-Warson test was 0.9680505. Thereby, we had to correct the model for autocorrelation. To correct the model, we applied the Cochrane-Orcutt procedure through the method of Prais-Winsten, using the *prais depvar [indepvars], corc* command on Stata, since this is considered a feasible form of dealing with autocorrelation (Brooks, 2018). This was the outcome we got:

Table 11: The estimated results after correcting the model for autocorrelation with Cochrane-Orcutt procedure.

Variables	Private VC Investment
pbtt	0.1755**
	(2.461)
pbtt_1	0.1275*
	(1.767)
pbtt_2	0.1817**
	(2.501)
pbtt_3	0.0738
	(1.070)
unempt_1	-0.3061**
	(-2.353)
product_1	0.2284***
	(4.637)
expt_1	0.5233***
	(3.554)
Constant	0.0449
	(0.354)
Observations	71
R-squared	0.565
Durbin-Watson-original	0.9681
Durbin-Watson-transformed	1.8730

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Table 11 makes it clear that by correcting the model using the Cochrane-Orcutt procedure, the Durbin-Watson test gets much closer to 2 rather than 0, given that the new value of the test is 1.8730. Thus, we can infer that there is small evidence of positive autocorrelation.

Regarding to other outcomes, the value of the R-squared decreased a bit after the correction, namely from 0.730 to 0.565. Additionally, after the correction the lagged variable *pbt t-1* started to have a significance level of 10% and the *unemp t-1* variable turned to a significance level of 5%. All the other variables continued with the same significance level, so none of our three hypotheses were rejected.

5.2. Interviews Results

With respect to the results of the interviews, we have already displayed, in the data section, the information that we acquired relatively to the first part of the interviews. That segment was about the characteristics of our sample. Now, we will present the results of the interviews that are the most relevant to us given the fact that the questions of the second and third part were actually related with the research topic. The following table (table 13) shows the general outcome of the interviews.

Table 12: The general outcomes of the interviews.

Questions & Answers	Number of VC players
What is the proportion of innovative firms in the VC fund in which you invest?	
100%	13
> 85%	3
other	2
Do you tendentially invest more in early-stage firms, or do you tend to invest in companies that are in a mature stage?	
seed and pre-seed	5
start-up and early-stage	4
later-stage and growth	6
private equity	2
Do the funds in which you invest have public investment? If so, what is the proportion of public investment?	
yes, = 65%	1
yes, 45 - 55 %	6
yes, < 45%	3
yes, various proportions (20 - 65%)	2
no	5
In the following lines, the interwiewees answered on a scale from 1 to 5 according to their degree of agreement with the statements:	
The involvement of public investment allowed you to participate in certain investments that otherwise you would not.	
4 or 5	11
3	1
1 or 2	6

Despite the inevitability of risk, the involvement of the State as an investor in venture capital gives you more confidence to invest.	
4 or 5	5
3	3
1 or 2	10
There should be a reinforcement of public support.	
4 or 5	15
3	1
1 or 2	2
There is no stability in public support, and it is inconstant and cyclical.	
4 or 5	16
3	1
1 or 2	1
There is still a very "risk averse" culture in Portugal, from both companies and investors.	
4 or 5	11
3	4
1 or 2	3
From here on, the interviewees answered openly once more:	
Has the crisis caused by the Covid-19 pandemic aggravate this "risk-averse" culture?	
yes	5
no	9
other	4
Were there any companies from the Venture Capital fund you managed or invested in that did not survive the crisis resulting from the Covid-19 pandemic?	
yes	6
no	12
Have you decreased your investment activity due to the Covid-19 pandemic?	
yes	4
no	8
other	5
Do you think that 2022 will be a year of normality?	
yes	9
no	7
other	2

Own elaboration.

It is relevant to note that the sum of the number of respondents in some questions is only seventeen rather than eighteen because two of the interviewees work for the same VC management company. So, taking into consideration that some of the questions were related with the company or the funds in which the interviewees are involved, the answers given by VC players from the same company were evidently equal. And so, it wouldn't make sense to consider the same answer twice. Nevertheless, since they have shown availability and interest in giving their contribution, we considered both testimonies for other questions, the ones that were more related with their personal perspective on the market. Although they belong to the same VC management company, they might still have different opinions about the topics covered in the interview. In fact, they did respond differently to those questions.

When questioned about the proportion of the innovative firms present in their funds, most of the interviewees responded that this proportion was of 100%. The exception were the five respondents who answered differently. They argued that the innovation of the firms was a precondition for the companies that make up their funds. This proves something that many authors defend, which is the fact that venture capital fosters the innovation of the firms (Faria & Barbosa, 2014). Such result demonstrates that these companies are not only of high worthiness (since they are innovative, venture capitalists believe more in their growth potential), but also by the fact that venture capitalists will always promote and support the innovation of their invested firms. They consider that this is essential for the success of their invested companies.

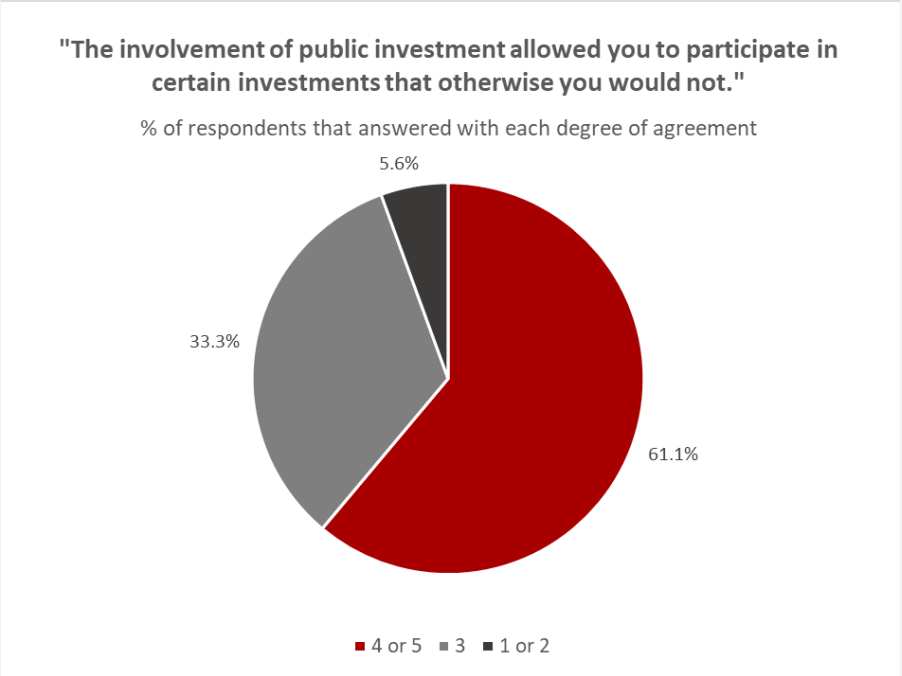
When we asked if they tendentially invest more in early-stage firms, or rather in companies in a more mature stage, nine VC players responded that they invest mainly in early-stage firms. Contrarily, eight interviewees invest mainly on a more advanced stage of development, as seen in table 13. Naturally, this does not mean that they only invest on a mature stage. These last eight respondents also have investments in early-stage firms, like seed, pre-seed, and start-up. Although our sample contains more investments in early-stage, we must not ignore the fact that six of the players we interviewed tend to operate more in later-stage and growth, which is quite significant.
The outcome of this particular question translates the reality in Portugal, as referred previously: the VC investments are made specially in companies more consolidated (CMVM, 2009). Overall, this could be explained by the fact that Portuguese investors

tend to be risk averse or have no financial availability for the great investments venture capital requires. This tendency is also common in Europe.

In relation to the existence or non-existence of public participation, thirteen of the eighteen interviewees reported the involvement of the public investment in their funds. A greater part of them has a proportion of public investment higher than 45%, which is a considerable percentage. Moreover, some of the respondents that currently don't have any sort of public participation in their funds, did have it at another time and some other who never had it do not discard the eventual possibility of a partnership with the State.

Some interviewees shared with us that sometimes it is not possible to take such partnership because the investments must meet several requirements. For example, the State could demand that the investment should be made in a specific region of the country, and they considered that such bureaucracy would significantly limit their frame of action. It is also interesting that most of the players who have a bigger tendency to invest in early-stage firms are also the ones that have a partnership with the public investor in their funds. This could be related with the fact that there is a market gap in the VC sector, and this is where the State has to act more (Colombo et al., 2016).

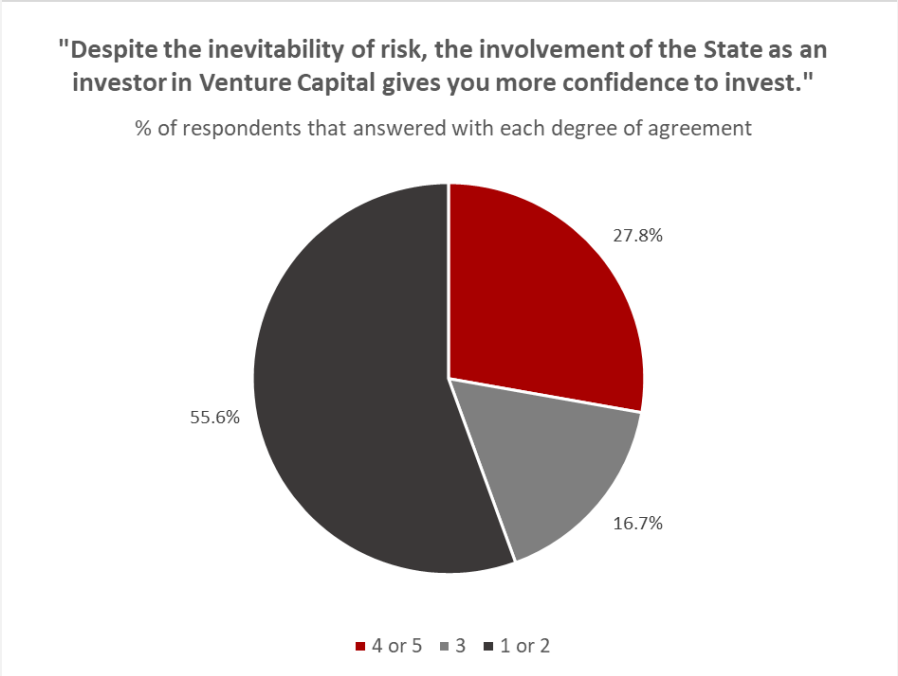
Later, as observed in table 13, the VC players were asked to answer to some statements about the Portuguese VC market, on a scale from 1 to 5 according to their degree of agreement with said statements. The first remark claimed that the involvement of the State as an investor allowed them to participate in certain investments that otherwise they would not. 61% of the interviewees responded with a 4 or a 5, meaning that more than half agrees with the statement, as it is observable in graph 2. Despite agreeing with it, some of the players found in this percentage, further explained that such claim would only make sense for the investments that were made in early-stage firms, because they considered that a market failure exists in this particular case.



Graph 2: % of respondents that answered with each degree of agreement to the first statement. (Own elaboration.)

Others stated that when the State takes part as an investor in the VC funds, that allows the increment of their "firepower". This means that the public participation makes the investment amount rise, which allows to invest in more firms. And, consequently, it mitigates the risk. It is also relevant to refer that one interviewee believes that the "government co-funding with PVCs is an ideal 'marriage' if the public investor has a passive participation". He considers that the 200M Co-investment fund is a good example.

Venture capital is a very risky form of investment and despite the inevitability of the risk, the majority of VC players does not feel that the involvement of the State as an investor transmits more confidence to invest. Ten of the interviewees responded with a 1 or 2 to this remark, according to graph 3. Nevertheless, five of them answered with a 4 or 5, recognizing that the presence of the State in the investments decreases the associated risk. One of the respondents told us that to some extent he feels more willing to invest when a good partnership between private and public venture capitalists is possible.

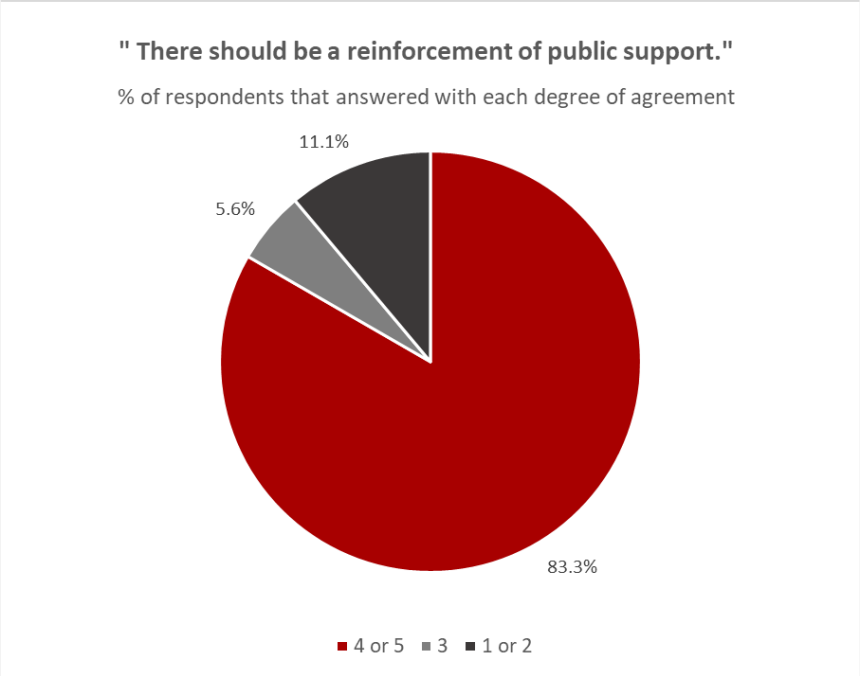


Graph 3: % of respondents that answered with each degree of agreement to the second statement. (Own elaboration.)

When it was suggested that there should be a reinforcement of public support, 83,3% of the VC players agreed with the claim, answering with a 4 or a 5, as noted in graph 4. The largest proportion of the interviewees claimed that the public investor has a preponderant role in the dynamization of venture capital in Portugal. They consider that there is a market failure, especially in the investments made in early-stage firms, and they believe that the State is the one who can help overcoming this gap in the market.

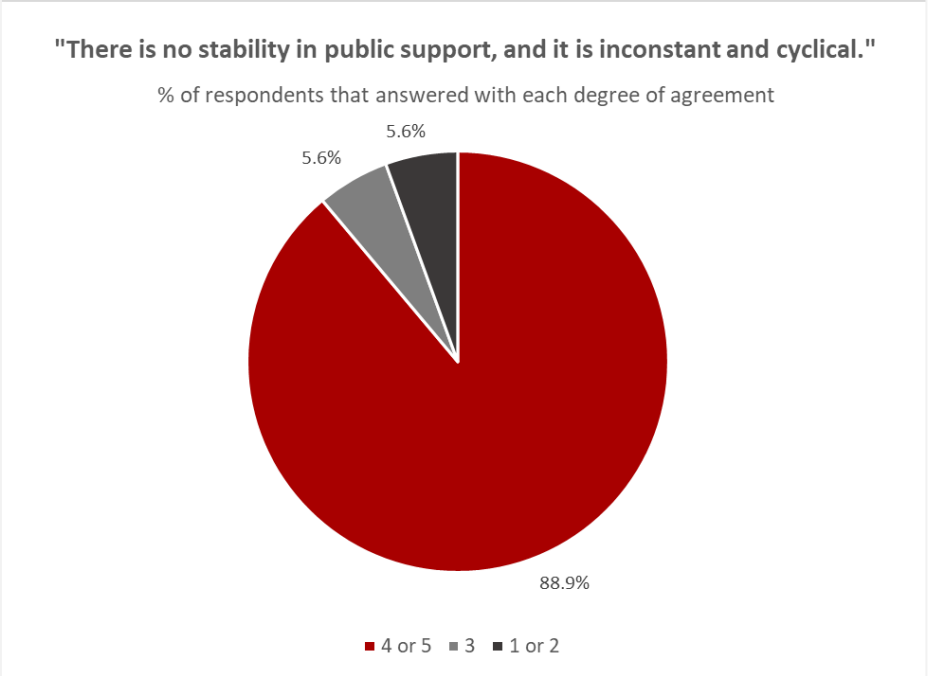
One of the venture capitalists interviewed said that "there should be a reinforcement where there is market failure, which is in the early-stage, because in private equity stages the investors have enough money available".

While some respondents highlighted the importance of the reinforcement relatively to the funding support, other emphasized its importance in relation to the efficiency and quality of the public support. These last ones stated that the support should be more agile and should promote more this alternative of financing.



Graph 4: % of respondents that answered with each degree of agreement to the third statement. (Own elaboration.)

Regarding to the statement about the lack of stability in public support, and about its inconstant and cyclical nature, most of the respondents confirmed that this is true, as it is possible to observe in graph 5. They argued that the public support is strongly related to the European Community Support framework, "when a new community framework starts, there is a lot of money to fund, but when it ends, there is no money anymore", as said by one of the players. The Portuguese State attempts to channel European support funding to the VC sector (Félix et al. 2009). Thus, sometimes venture capitalists cannot be sure when the public support will be back again once "it doesn't exist a clear time horizon". "Indeed, it is true because in 2013 the *Revitalizar* fund arose, and only now is a new fund emerging". Other aspects pointed out by the VC players were the necessity for a long-term policy and less delay in the support.

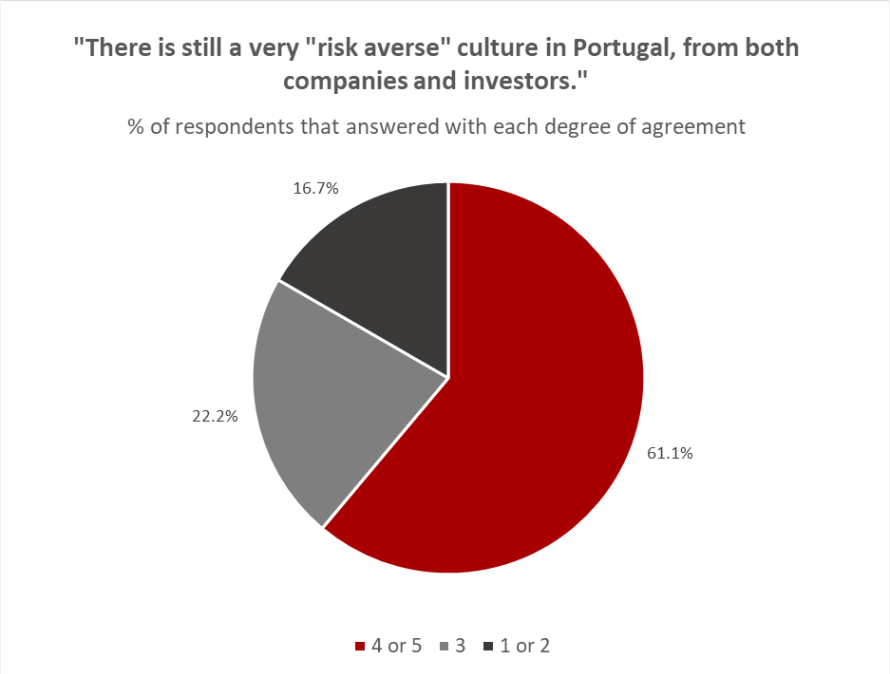


Graph 5: % of respondents that answered with each degree of agreement to the fourth statement. (Own elaboration.)

A theme that revealed itself to be quite controverse for some VC players was the perseverance of a "risk averse" culture present in Portugal. Some of the respondents affirmed that there was no truth to the statement and one of them even went as far as to consider it to be "a myth".

However, the majority of respondents mostly agreed with the claim, given the 61,1% of answers that were either 4 or 5, according to graph 6.

Overall, the VC players believe that the risk aversion is fading, but "there is still a long way to go" in the national scene. In conversation, one interviewee mentioned something pertinent which was the fact that the risk-averse culture seems to be more evident in entrepreneurs from Private Equity than from Venture Capital. This is justified by the fact that VC entrepreneurs are, in general, younger and "younger generations seem to be more open to risk".



Graph 6: % of respondents that answered with each degree of agreement to the fifth statement. (Own elaboration.)

Other arguments were given to justify such answers, firstly, the lack of liquidity. Taking into consideration that Portugal is one of the eurozone countries with the lowest purchasing power, ranking 16th in 2020 (Lusa, 2021), the Portuguese do not have as much money available to invest, for example. And, secondly, the low level of financial literacy. According to Lusa (2022), Portugal ranked last in the financial literacy ranking out of the 19 eurozone countries in 2020. This means that, in general, the Portuguese don't know how to invest their savings in financial instruments.

One interviewee made another observation, which was the fact that venture capital is an industry with little history in Portugal, and because of that it has few examples of success. It is also interesting that nine of the respondents believe that the crisis caused by the COVID-19 pandemic does not aggravate this "risk-averse" culture, and three of the respondents think that it only had an impact in the beginning.

In relation to the impact of COVID-19 in the Portuguese VC industry, five of the interviewees were part of companies that did not survive to the crisis resulting from the pandemic. Whereas others' companies suffered a lot, namely event planning companies and companies from the industry of tourism and hotels, which are businesses that require a great in-person contact. Nevertheless, many other said that they increased

their activity and found some investment opportunities due to the pandemic situation. The VC players that didn't decrease their investment activity invest specially in the technological sector, which was and continues to be essential in the fight against the pandemic. Overall, the financial crisis resulting from the COVID-19 pandemic impacted the VC sector in Portugal, which translated into a reduction in venture capital activity due to the context of uncertainty during the first semester of 2020 (CMVM, 2021). Nevertheless, as said by some of the respondents, during the second half of 2020 the venture capital industry began to recover, and this recovery continued into early 2021.

Finally, we asked the VC players about their future perspectives, to which we mainly obtained two common answers. The first of them was more prevalent on the interviews conducted before the 2022 Russian invasion of Ukraine, the latter was more common after the outbreak of the war. There is a clear change of perspective from the sample interviewed before the invasion to the sample interviewed after. The first part of the interviewees believed that 2022 would be a year of normality, and that the venture capital activity would continue to increase. However, the second part answered that the war brings a lot of uncertainty that results in not having a clear and objective vision of the future. One of the respondents even claimed that "the war in Europe will have more negative effects in the VC industry than the COVID-19 pandemic".

6. Conclusion, limitations, and suggestions for future investigation

The present dissertation studies the development of venture capital in Portugal since its emergence in 1986 through the establishment of the first management company and, further, investigates the role of the Portuguese public investor in the dynamization of this industry. To accomplish this investigation, we started by analyzing the evolution of this industry in the country. We managed to conclude that the market of venture capital in Portugal is a recent and small one, but it has been presenting a progressive growth throughout the years.

Despite its general growth tendency, the development of the sector suffered some oscillations mainly as a result of unfavorable macroeconomic contexts. The first one was the International Financial Crises, which made its impact in 2008, leading to a reduction in the VC activity. After a significant recovery, the Portuguese VC industry would once again suffer a negative effect in 2011 due to the Portuguese sovereign debt crisis. However, it eventually overcame yet another setback and continued to increase its activity, showing its importance for economic recovery in situations of crisis. More recently, the sector was impacted by the COVID-19 pandemic and the war in Ukraine. Both situations brought a lot of uncertainty, but, as said by one interviewee, "the Portuguese VC sector has shown itself to be resilient".

Certainly, the development of the VC industry has not only been affected by macroeconomic situations, in fact, it has also been influenced by the Portuguese culture, the dimension of the country and the level of financial literacy of the Portuguese people. Nonetheless, the industry has been presenting a growth tendency over time and the Portuguese government is committed to give support to this market, following the steps of other governments around the world (Buzzacchi et al., 2013; Soleimani Dahaj & Cozzarin, 2019). There are two ways of public support. On one hand, the promotion through the launch of some investment programs: Portugal Tech – 2018, Portugal Growth – 2020, and Portugal Blue – 2020. On the other hand, the public direct co-funding realized through various governmental agencies of venture capital funds (Félix et al., 2009), like quasi equity, *Revitalizar Funds* and FINOVA.

Regarding to the methodology applied in this dissertation, we opted for both a quantitative and a qualitative approach. We started to apply and adapt the model of

Kraemer-Eis et al. (2016) once they intended to study the impact of the European Investment Fund's participation in the VC ecosystem. In addition, we conducted interviews to about twenty Portuguese VC players in order to obtain their testimonies and to achieve more precise and strong conclusions. Although quantitative methodologies are more common in finance, for us it also made sense to apply a qualitative method with an epistemological orientation of the interpretivism, since the Portuguese VC market still only has a few years of existence. We believed that the interviewees could bring additional information, complementing the numerical outcomes.

Relatively to the model results, it was possible to infer that the public VC investment at time *t*, which was our main explanatory variable, had a positive influence in the dependent variable with a 5% significance level. We were also able to verify that the public VC investment does not only have impact in the private VC investment at time *t*, but also at time *t-2*. Such result reinforces our initial expectation that the public investor attracts other potential investors, which in turns are private investors, making the venture capital industry grow. Thus, these first outcomes support our first research hypothesis. In relation to other explanatory variables, the unemployment rate negatively influences the private VC investment with 1% significance level, supporting our second research hypothesis, as we expected initially. Finally, in regard to the productivity and exports, we concluded that both variables had a positive impact in the dependent variable at 1% significance level, as we previously expected, sustaining our third research hypothesis.

Overall, through the results of the interviews, we concluded that the degree of innovation of the firms is a pre-condition for the VC players and that the development stages that they mostly invest in is in early-stage, but a considerable part of the sample invests in later-stage and growth as well, which is something that represents the tendency in Portugal. In general, the public investment represents a significant proportion of our sample's funds. Seven of the interviewees had a proportion of public investment in their funds higher than 45%. In relation to the public support, we could infer a general idea from the VC players, which was the fact that they consider that there is a market gap in venture capital, namely in early-stage companies. They believe that this gap can only be overcome with a good partnership between private and public

venture capitalists. They also pointed out that the quality and efficiency of this support should be improved due to the limitations caused by the bureaucracy and the delays.

Regarding the impact of COVID-19 on venture capital activity, overall, the testimony we received was that the pandemic had a negative effect, but only in the beginning. The industry quickly adapted to the new reality and even new investment opportunities emerged. In terms of future perspectives, we had two main answers. The first, common in interviews made before the invasion of Ukraine, claimed that 2022 was going to be a year of normality and that the sector was going to continue to grow. However, after the outbreak of the war, the interviewees had a completely different perspective. They were very uncertain about the future trend of the VC industry.

The results of both methodologies coincide, and it is possible to relate them. Therefore, our main research question was answered by the results of the two methodologies. The results of the model prove that the first hypothesis is true, which is further supported by the results of the interviews that indicate that the State as an investor has a preponderant role in the dynamization and development of this sector in the country. Furthermore, we can relate the results regarding exports and productivity. We saw that if these macroeconomic indicators perform well, they make the market more attractive to investors. Thus, and considering that during the interviews the VC players gave great importance to the innovation of companies, we can say that high levels of productivity may be related to greater efficiency as a result of the innovation adopted by companies.

In conclusion, it is important to mention some limitations felt throughout the research. The first one had to do with the fact that there is little information available about the venture capital industry in Portugal. This is mainly due to its recency in the country. It was also for this reason that we sought to develop this research, in order to bring a contribution to the state-of-the-art by addressing a topic not yet explored in this industry in Portugal. Additionally, we felt a limitation in the number of observations when implementing the quantitative methodology, once again due to the fact that this industry is still recent not presenting relevant data before the year 2000. We could only consider data from that year on. Despite this, we believe that the interviews enabled us to overcome these limitations and that the study was pertinent to understand where

the focus should be to make this sector grow and help the Portuguese economy be fruitful, as it did with other economies.

Therefore, and as a recommendation for future research, it is of highest importance to continue this study and to do it with more observations in order to infer more robust conclusions about the impact of public support in boosting venture capital in Portugal. Equally crucial is to determine more clearly which other variables have equal influence in the development and attractiveness of this industry. Finally, it would likewise be interesting to study a question that has already been raised by Brander et al. (2015) which is to investigate whether Portuguese companies that are funded by a mixed VC structure (public and private) are more successful than other Portuguese companies.

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Appendices

Appendix 1 - Interview Structure

1. Gender? Female _ Male _
2. How old are you?
3. For how many years have you been working in the venture capital industry?
4. To whom do you perform your duties? (Who do you work for?)
5. What duties do you perform in that organization?
6. What was the reason that led you to enter in the venture capital market?
7. What is the proportion of innovative firms in the VC fund in which you invest?
8. Do you tendentially invest more in early-stage firms, or do you tend to invest in companies that are in a mature stage?
9. In average, how much do you invest annually?
10. What is the average ticket of investment per company?
11. Do the funds in which you invest have public investment? If so, what is the proportion of public investment?

In the following lines, answer on a scale from 1 to 5 according to your degree of agreement with the statements, in accordance with the caption. In addition, please, justify your answer.

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

12. The involvement of public investment allowed you to participate in certain investments that otherwise you would not.
13. Despite the inevitability of risk, the involvement of the State as an investor in venture capital gives you more confidence to invest.
14. There should be a reinforcement of public support.
15. There is no stability in public support, and it is inconstant and cyclical.
16. There is still a very "risk averse" culture in Portugal, from both companies and investors.

(From here on, answer openly once more)

17. Has the crisis caused by the COVID-19 pandemic aggravate this "risk-averse" culture?

18. Were there any companies from the venture capital fund you managed or invested in that did not survive the crisis resulting from the COVID-19 pandemic?

19. Have you decreased your investment activity due to the COVID-19 pandemic?

20. Do you think that 2022 will be a year of normality?

Appendix 2 - Descriptive statistics of all variables tested.

Variable	Obs	Mean	Std.Dev.	Min	Max
pvt t	72	1.03e+07	1.23e+07	0	6.34e+07
pbt t	72	4780631	8475024	0	4.72e+07
pbt t-1	72	4544891	8366466	0	4.72e+07
pbt t-2	72	4432400	8372450	0	4.72e+07
pbt t-3	72	4173113	8212911	0	4.72e+07
unemp t-1	72	9.695833	3.232208	5.6	17.5
produc t-1	72	.2039861	2.56566	-10.9467	13.50224
exp t-1	72	34.93453	6.135577	26.41332	43.92148
dinv t-1	72	2.097222	3.820736	-12.7	17.3
educ t-1	72	1.522054	2.607278	-4.848748	7.655786
gdp t-1	72	.5264992	2.444975	-13.54885	12.83555

Own elaboration, using Stata program as a support tool.

Appendix 3 - Correlation matrix of all variables tested.

	pbt t	*pbt t-1*	*pbt t-2*	*pbt t-3*	*unemp t-1*	*produ t-1*	*exp t-1*
pbt t	1.0000						
	72						
pbt t-1	0.3837*	1.0000					
	0.0009						
	72	72					
pbt t-2	0.4028*	0.3836*	1.0000				
	0.0005	0.0009					
	72	72	72				
pbt t-3	0.3059*	0.3838*	0.3842*	1.0000			
	0.0090	0.0009	0.0009				
	72	72	72	72			
unemp t-1	0.1823	0.1851	0.2106	0.1464	1.0000		
	0.1253	0.1195	0.0758	0.2197			
	72	72	72	72	72		
produc t-1	0.0566	-0.0914	-0.0430	-0.0510	0.0123	1.0000	
	0.6369	0.4450	0.7199	0.6705	0.9186		
	72	72	72	72	72	72	
exp t-1	0.5290*	0.4852*	0.4701*	0.4487*	0.3549*	0.0075	1.0000
	0.0000	0.0000	0.0000	0.0001	0.0022	0.9504	
	72	72	72	72	72	72	72

Own elaboration, using Stata program as a support tool.

Appendix 4 – Estimated results of the first variables combination test.

Variables	Private VC Investment
pbt t	0.2346***
	(2.907)
unemp t-1	-0.3315***
	(-4.521)
produc t-1	0.2044*
	(1.711)
exp t-1	0.6995***
	(8.031)
dinv t-1	-0.0806
	(-1.129)
educ t-1	0.1303*
	(1.821)
gdp t-1	-0.0048
	(-0.040)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.708

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 5 - Estimated results of the second variables combination test.

Variables	Private VC Investment
pbt t	0.2534***
	(3.113)
unemp t-1	-0.3313***
	(-4.440)
produc t-1	0.1671
	(1.395)
exp t-1	0.6803***
	(7.732)
dinv t-1	-0.0474
	(-0.674)
gdp t-1	0.0283
	(0.235)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.693

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 6 - Estimated results of the third variables combination test.

Variables	Private VC Investment
pbt t	0.3583***
	(3.756)
pbt t-1	0.2352**
	(2.422)
pbt t-2	0.2198**
	(2.126)
pbt t-3	0.1588
	(1.652)
unemp t-1	-0.2148**
	(-2.490)
produc t-1	0.0871
	(0.587)
dinv t-1	-0.0601
	(-0.705)
gdp t-1	0.1726
	(1.141)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.570

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 7 - Estimated results of the fourth variables combination test.

Variables	Private VC Investment
pbt t	0.3577***
	(3.740)
pbt t-1	0.2236**
	(2.309)
pbt t-2	0.2589**
	(2.648)
pbt t-3	0.1410
	(1.483)
unemp t-1	-0.2276**
	(-2.654)
produc t-1	0.2270***
	(2.711)
dinv t-1	-0.0608
	(-0.712)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.561

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 8 - Estimated results of the fifth variables combination test.

Variables	Private VC Investment
pbt t	0.1943**
	(2.421)
pbt t-1	0.1063
	(1.332)
pbt t-2	0.1716**
	(2.088)
pbt t-3	0.0396
	(0.506)
unemp t-1	-0.3472***
	(-4.857)
produc t-1	0.2115*
	(1.772)
exp t-1	0.5786***
	(6.172)
gdp t-1	0.0012
	(0.009)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.730

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 9 - Estimated results of the sixth variables combination test.

Variables	Private VC Investment
pbt t	0.1747**
	(2.188)
pbt t-1	0.0895
	(1.129)
pbt t-2	0.1859**
	(2.274)
pbt t-3	0.0232
	(0.297)
unemp t-1	-0.3475***
	(-4.916)
produc t-1	0.2578**
	(2.143)
exp t-1	0.6028***
	(6.417)
dinv t-1	-0.0611
	(-0.882)
educ t-1	0.1303*
	(1.877)
gdpt_1	-0.0445
	(-0.359)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.745

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.

Appendix 10 - Estimated results of the seventh variables combination test.

Variables	Private VC Investment
pbt t	0.1933**
	(2.392)
pbt t-1	0.1067
	(1.328)
pbt t-2	0.1695**
	(2.044)
pbt t-3	0.0359
	(0.452)
unemp t-1	-0.3454***
	(-4.789)
produc t-1	0.2115*
	(1.760)
exp t-1	0.5756***
	(6.080)
dinv t-1	-0.0273
	(-0.400)
gdp t-1	0.0017
	(0.014)
Constant	-0.0000
	(-0.000)
Observations	72
R-squared	0.730

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own elaboration, using Stata program as a support tool.