VENTURE CAPITAL, CROWDFUNDING, AND INITIAL COIN OFFERING:

The interconnectedness of entrepreneurial financing channels in Europe

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ABSTRACT OF
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**Objectives**

The main objective of this study is to examine the potential relationship between the more recent funding mechanisms – crowdfunding and initial coin offering, in this case – and the traditional ones – venture capital, in this case. Towards this goal, the study will review the current state of literature and conduct correlation analyses of the three aforementioned mechanisms.

**Summary**

This paper reviewed the literature in entrepreneurship financing and found a clear gap in researches for the interaction between different funding mechanisms. Based on the findings in this literature review, the paper conducted correlational analyses of three time-series, representing the amount raised via three channels: venture capital, crowdfunding, and initial coin offering. To prepare for these analyses, measures have been taken to produce stationarity from these non-stationary time-series. Both the differencing for stationarity and the correlation analyses allowed for interesting observations.

**Conclusions**

This led to three main insights: (1) all the time-series exhibit strong rising trend and some seasonality, (2) amount raised via crowdfunding has a slight negative correlation with that via venture capital, and (3) there is no statistically significant relationship between venture capital and ICO.

**Key words:** venture capital, crowdfunding, initial coin offering, European, econometrics, stationarity

***See:*** http://web.lib.aalto.fi/en/helevoc/pdf/

**Language:** English

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## 1 INTRODUCTION

### 1.1 Background

The startup world has been shaken recently with the developments of two new funding methods: crowdfunding and initial coin offering (ICO). Although crowdfunding have been around quite a long time, the ongoing discussion in the United States regarding regulations of crowdfunding platforms (especially equity crowdfunding) has spurred mountains of interests on both sides of the table. Initial coin offering, on the other hand, has only just now appeared – thanks to the advancement and popularization of blockchain as a technology and cryptocurrency as a method of payment.

The sentiment around these two funding channels is quite divided. Some claim they are the long-overdue disruptive renovation of the finance industry and the economy. As funding channels, they let a tsunami of capital wash over the (arguably) stagnant entrepreneur ecosystem. As investment channels, they let the public partake in the potential ginormous upside of startups – some of which (Uber and AirBnB, for example) have become one of the world's largest companies. On the contrary side, some claim crowdfunding and ICO are just easy exploitation of unsophisticated retail investors – pointing to the many scams and frauds that have unfortunately happened as platforms emerge like mushrooms after rain. Some startups are still disappointed with the crowd's biases in due diligence, saying that we are merely trading one evil for another. The discussion has yet to die down and remains very much vibrant.

Among this discussion, one question seems to always crop up: if these new funding channels are so innovative, would they pose any challenge to the already-dwindling venture capital industry? This paper aims to answer that question – partially at least.

## 1.2 Research Question

More specifically, this paper investigates the effects of entrepreneurial financing alternatives on venture capital funding in Europe. From there, the paper will build on existing literature and discuss whether the relationships between all the investment channels have changed, and if yes, how. Specifically, the questions that this paper aims to answer are:

1. Is there a positive or negative correlation between the total funding amount of alternative methods and the traditional methods (venture capital and angel investment)?
2. Are these correlations affected by forces other than the investment decision itself, especially macroeconomics forces like inflation, capital growth, etc.?
3. How have the players – founders and investors – recently reacted to these changes? Have there been shifts in negotiation behavior, investment decisions, and cooperation between players?

## 1.3 Research Objectives

To answer those questions, there are three main objectives to fulfill. They are

1. Review the literature on venture capital, crowdfunding, and ICO;
2. Form hypotheses about the relationships between the channels;
3. Explore the correlation between funding amounts of all investment channels over time.

# 2 LITERATURE REVIEW

Although crowdfunding has developed at least since the start of Kickstarter in 2009 and ICO has appeared for almost 3 years, the literature has yet to cover the interrelationship between these new forms of entrepreneurial funding and the traditional form that is venture capital investment. Research on each financing channels have grown rapidly, but not the research on the combination of them and the interaction thereof.

Henceforth, this paper will approach the literature review section by (1) outlining the industry sentiment on this relationship, (2) reviewing the most recent literature review on the industry from Drover et al. (2017), (3) conducting a literature review of entrepreneurship financing through these interactive lenses, and finally (4) consolidating all that information into a conceptual framework that will form the foundation of the thesis.

## 2.1 News Outlets' and Investors' Discussion

There is discrepancy between the adoption of newer funding channels in Europe and that in the USA. However, the investment climate seems to share a few themes regarding this new interaction, as expressed through the media.

For the most part, investors, founders, and pundits alike believe that there is at least a small degree of competition between the novel fundraising methods and the traditional ones. Crowdfunding is said to compete with venture capital the most in the financing of an early-stage venture. In 2015, on a global scale, crowdfunding is reported to have invested $34 billion in new products, whereas in the same year, venture capital only contributed $30 billion. Where venture capital tends to ignore due to focus on past performance or tight-knitted network, crowdfunding has filled the gap, providing a much-needed source of cashflow to kickstart the ventures.

Initial coin offerings (abbreviated as ICO or ICOs from here on) also threaten venture capitalists to a certain degree. Because some startup founders and retail investors believe that large financial institutions have unfairly taken advantage of new ventures, ICOs provide a necessary way to move some of the power back to the founders. Founders, via ICOs, can now fundraise without much control from large equity stakeholders. Contradictorily, this lack of structure also exposes both entrepreneurial ventures and retail investors to frauds or investment bubbles.

However, this does not negate the potential for cooperation between venture capital, crowdfunding, and initial coin offering. Quite the contrary, some of the venture capital firms have embraced this new wave. According to a research by Beauhurst, professional investors have contributed to 16% of investment to startups on equity crowdfunding platforms in 2016. Crowdcube predicts that the number of deals in cooperation between professional and retail investors have quadrupled from 2015 to

2017. Notably, Downing Ventures, a large venture capital firm in the UK, has launched their own crowdfunding platform named Downing Crowd, and has seen some signals of success.

The same embracement can also be seen in the ICO landscape. Venture capital firms have paid more attention to startups focusing in blockchain and cryptocurrency (Friedlmaier, Tumasjan, and Welpe, 2017). Other firms have launched with a sole concentration into cryptocurrency, such as Blockchain Capital in the United States and HyperChain Capital in Singapore. ICOs provide the venture capital industry with liquidity that traditional equity investing cannot – investors can realize the profits within a few days instead of waiting from 5 to 10 years in the traditional case. Reasonably, many investors expect equal volatility risk on the losing side of this equation too.

Others are reluctant to make a strong stance on whether there is competition between the newer and the older channels of entrepreneurial financing. However, they acknowledge an ongoing trend for more transparency in startup investment which will transfer power from investors to founders. The industry has also seen more legitimacy for crowdfunding and ICOs, both in Europe – as per regulations A, B, and C, and in the US – as per the adoption of crowdfunding into law by the JOBS Act of 2012 and 2014 and by the SEC's recent notices regarding ICOs.

Although only one conclusion can be made from these media developments – that is, newer methods have alerted traditional institutions about the need for transparency and efficiency in startup investment, they have also incentivized academia to investigate the dynamics further.

## 2.2 Critique on Existing Literature Review

### 2.2.1 Venture capital

Most of research on entrepreneurial financing appears in the valuable and recent literature review by Drover et al. (2017), aptly named "A Review and Road Map of Entrepreneurial Equity Financing Research".

The authors thoroughly searched for research within venture capital (VC), corporate venture capital (CVC), and alternative investment channels via both Internet portals and professional journals. The search resulted in 418 such articles, which the authors further classified into VC, CVC, and angel research, on three levels of analysis – the *individual* level, *organization* level, and the *market* level. The timeframe of the review spanned from 1980 to 2003 and from 2004 to 2016. According to the authors, this subdivision allowed for more in-depth consideration of investment trend taking place only after the 2000s.

Research on VC in the 1980-2003 period comprised mostly of descriptive analysis of venture capital: process, actors, and foundational frameworks. Already in this period, there had already been linkages between venture capital and economic growth, and between venture capital and venture success that stemmed from factors other than financial support.

In the 2004-2016 period, academia investigated venture capital in more details. Many important findings emerged in this period. In general, venture capitalists consider many data points in their investment decision. In this environment with asymmetry of information, venture capitalists seem to hold more negotiating power – as shown by their ability to control deal terms via various parameters, such as investment allocation, investment vehicle, monitoring mechanisms, and so on. On the flip side, entrepreneurs also pursue investors who are more ethical and prestigious, but pressing financial needs still prevail. On a macro level, venture capital experience at least some influence from the political climate, governmental incentives, and institutional support.

The authors also make important suggestions for further research within venture financing. Regarding equity crowdfunding, after expressing agreement and appreciation of current research on the ownership dispersion inherent in this financing mechanism, the authors then recommend academia to place an emphasis on studying investment in a virtual setting and in a more socialized environment. The difference due to virtualization and socialization between venture capital and equity crowdfunding may not be great, as VC firms have been adopting syndication and virtual tools in their own processes.

Regarding the interconnectedness of these investment mechanisms, the authors acknowledge a gap in the literature, in writing:

> *"(…) Shifting research designs and theoretical perspectives from an isolated focus on one mechanism to considering the interrelated or simultaneous presence of others stands as an important shift going forward."*

As the authors observed, these emerging funding channels will shift negotiating power away from venture capitalists into retail investors and founders. This may imply that there is inherent competition between equity crowdfunding and VC. Nevertheless, all these funding mechanisms can also complement each other, each residing in a segment of the investment space and adding values to both the founders (by providing necessary funding) and the investors (by providing extra signals).

It is worthwhile to notice that although the researchers have comprehensively outlined the history of venture capital, there is a lack of review on equity crowdfunding or ICO research to support the proposals made for future research – this is reasonable, considering the initial goal of the review and the inherent lack of research in these emerging channels. There is also a difficulty in finding all the articles within a category – for example, all research about venture capital from 2004 to 2016 on a market level of analysis – as the centralized tabularization of categories only sample the most prominent studies. Nonetheless, the review provides clear value by consolidating important findings in the academia and identifying important research gaps.

### 2.2.2 Crowdfunding

A search for existing literature reviews on crowdfunding return three valuable works: Moritz and Block (2014), Short, J. et al. (2017), and McKenny, A. et al. (2017). Each of these works provides unique value and complements each other to create a more wholesome understanding of the current state of research in this area. A short summary and critique on these works is henceforth necessary.

Most notably, all these researches recognize four sub-categories of crowdfunding: donations-based, reward-based, lending-based, and equity-based. All agrees that earlier studies tend to investigate the motivations and determinants of crowdfunding as a financing mechanism. The determinants of success and the motivations of capital providers in crowdfunding are also similar to those in venture capital – the key difference being less geographical and gender biases in the former case. This points to a certain consensus in the literature that may be necessary for further developments.

Moritz and Block (2014) continued to divide the literature into three, according to the subject of study: capital seekers, capital providers, and intermediaries. Capital seekers have five major reasons for their crowdfunding decision: finance, networks, affirmation, replication of past success, and product awareness. Notably, crowdfunding closes the financing gap in the early stage of a venture, and thus provide further confirmation to the hypothesis that while there is a certain degree of competition between crowdfunding and venture capital, the former only serves the demand unfulfilled by the latter. However, Moritz and Block comment that the crowdfunding studies up to 2014 have been primitive and lack robust empirical evidence.

Short, J. et al. (2017) reaffirms the value of some works that Moritz and Block (2014) reviewed, such as Mollick (2014), Mollick and Nanda (2014), Belleflamme et al. (2014), and Lin and Viswanathan (2015). However, Short, J. et al.'s review is less comprehensive and serves more as an introduction of more recent but valuable and interesting researches in the space. For example, Drover et al. (2015) – also appearing in the recent literature review by Drover et al. (2017) – proposes that angel investment and crowdfunding success both serve as a certification signal to later investment when evaluating capital seekers. Other such interesting examples are the researches done by Calic and Mosakowsky (2016) and Davis et al. (2017), in concluding that sustainability and creativity, respectively, are important signals used in campaign evaluation by capital providers. Short, J. et al. (2017) then prominently feature 5 more recent articles that explore the relationships between crowdfunding success and factors such as geographical clustering, serial venturing, innovating, and signaling. From this perspective, the review does answer some of the questions posed by Moritz and Block (2014).

McKenny, A. et al. (2017) again contains element of a literature review but acts more like a survey of expert opinions on research gap regarding crowdfunding. Like Short, J. et al. (2017), McKenny, A. et al. (2017) reaffirms the value of research done by Mollick (2014) and Belleflamme et al. (2014), but also complement that with other researches by Agrawal, Catalini, and Goldfarb (2014) and Zhang and Liu (2012) – both of which are mentioned in Drover et al. (2017). More importantly, McKenny, A. et al.

(2017) poses four main questions to the academia in this area – along with some of the newer works that have moved to answer these questions:

- What are the characteristics of crowdfunding investors?
- What are the reasons for, results of, and contexts of crowdfunding?
- **What is the relationship of crowdfunding to other methods of entrepreneurial financing?**
- What are the determinants of crowdfunding success?

These questions once again coincide with the questions posed by the other works.

However, all these three documents seem to lack a strong discussion of how crowdfunding relates to the other financing mechanisms, especially financing via venture capital. In terms of comprehensiveness, the study done by Drover et al. (2017) appears to have more breadth with the inclusion of more than 400 articles and more depth by considering works from 1980 up to 2016. Granted, research on crowdfunding as it currently is has only begun in the most recent years, but crowdfunding as a mechanism has been researched for much longer – via similar models such as syndication of venture capital firm or behavior of investors in hedge funds.

## 2.3 Own Literature Review

In consideration of all these existing research, it may be necessary to re-investigate the definition of each of these financing channels for new ventures (especially of initial coin offerings) to set a more concrete foundation for the later parts of this thesis. In addition, this reviewing will open the main hypotheses that will be explored by the thesis.

### 2.3.1 Venture capital

"Venture capital" has morphed since its alleged birth in the 1980s. Its definition, as such, has also undergone many changes – which researches have tried to outline.

As have been observed quite fittingly by Drover et al. (2017), the timeline for VC can be divided into two main sections: before year 2000, and after year 2000. The general difference of these two periods in venture capital is the trend towards more founder-friendly structure from the investing firms. This trend is confirmed by A, B, and C.

“Founder-friendly” usually means more favorable transactional terms, more mentorship and close support, along with access to a wide network of resources, both in terms of human capital and future sources of funding or revenue.

Within the limits of this paper, the definition will focus more on the later, more recent developments of VC. Nonetheless, VC firms still maintain their basic operational principle: they raise large amounts of money through sovereign funds, funds of funds, and other institutional investors (making them the VC funds’ “limited partners” or “LPs”), then invest this aggregate funding to startups that they deem highly potential through their own process of due diligence. Historical data shows that this due diligence filters out most of startups companies, and thus put funding in the hands of only a chosen few (Gompers & Lerner, 2000). The VC firms charge a small percentage of the total fund in “management fee” and a percentage of the upside when portfolio startups successfully undergo an exit – usually an IPO or an acquisition by a larger corporate.

Venture capital as a source of finding has encouraged entrepreneurship tremendously since the 1980s. Investigations into the relationship between VC and economic development, such as that done by Timmons and Bygrave (1986), Kortum and Lerner (1998), or Samila and Sorenson (2011) have shown a positive correlation. More specifically, Samila and Sorenson (2011) propose that the presence of VC firms creates a “safety net” for budding entrepreneurs who predict a need for financing.

This support has grown at an even quicker pace in the recent years. On the surface, VC investment has moved from a later-stage focus to earlier stages (Hellmann & Thiele, 2015). In developed countries where regulatory frameworks facilitate the market, Cumming, Schmidt, and Walz (2010) have observed more venture capital entry. In emerging economies where informal networks may sometimes replace lackluster regulatory or institutional infrastructure, VC has also seen quick-paced growth (Ahlstrom & Bruton, 2006).

As stated above, VC, especially from the year 2000 onwards, provides not only financial support, but also mentorship and network support. Research from the pre-2000 era supports this. Timmons and Bygrave (1986) highlights the importance of venture capitalists’ ongoing input to the founders in improving the startup’s survival &

eventual success. For example, Yael et al (2007) shows that better networked VC firms perform better than others – which implies that the support VC firms provide is mutually beneficial and meaningful to both the investors and the founders.

However, there are certain key findings that describe venture capital's ineffectiveness as a source of funding and the dynamics between venture capitalists and founders. First, venture capital places the control away from the founders. Venture capital firms reject most of the funding requests from entrepreneurs. From a data survey by Fundable (2013), "only 0.91 percent of startups are funded by angel investors, while a measly 0.05 percent are funded by VCs." An informal number from Andreessen Horowitz – one of the top "founder-friendly" firms in the US – shows that of the 3000 inbound funding requests, the firm only accepts 15 to 30 – a 99% rejection rate! (Entrepreneur, 2014). Cosh et al. (2009) gave a less severe rejection rate of 46% – not much more hopeful, however. On the other hand, venture capitalists have a variety of risk-mitigation terms at their disposal – which can be renegotiated even after a signed contract (Tian, 2011; Kaplan & Strömberg, 2004).

Second, venture capital lacks transparency. The lack of transparency is also one of the obstacle for entrepreneurs in terms negotiation. The structure of deals varies (Tian, 2011; Kaplan & Strömberg), 2004, therefore unpredictable for entrepreneurs. Some of the contractual mechanisms that VC firms can use are pro-rata investment rights, convertible securities, and anti-dilution clauses – discussed in details by both the academia (Hellman, 2006) and by the movement towards founder-friendliness, spearheaded by books like Venture Deals by Brad Feld and VentureBlog (https://ventureblog.com) by Naval Ravikant (both are angel investors).

Third, venture capital performs sub-optimally. Despite the high rejection rate, VC firms seem to lack a logical or consistent set of criteria when evaluating startups (Goldfarb, 2014). As stated above, factors such as similarity in ethnicity, locality, and mindset between the investors and founders also play a role – all of which may pose a counterproductive bias to the investment portfolio.

With these findings in mind, venture capital may face certain challenges from other methods of entrepreneurship funding, such as crowdfunding or initial coin offering.

### 2.3.2 Crowdfunding

To investigate crowdfunding, we must first define "crowdfunding" within the scope of this research. There have been several researches trying to outline "crowdfunding" as an industry. Beaulieu et al. (2015), in an effort to formalize a framework for crowdfunding, suggested that there are three large types of exchange that backers (crowdfunding investors) can engage in: equity – in which the backers gain a stake in the business and may get profit from the venture's potential upside, debt – in which the investment will be repaid at a future point with interests, and appreciation – in which the backers gain nothing or small perks from the venture team. Gleasure and Feller (2016) largely agree, offering a two-by-two matrix that still divides crowdfunding into crowd patronage (products in return for funding), crowd charity (nothing in return), crowd equity (equity in return), and crowd lending (debt in return). Other papers also use this categorization, including "A Framework for European Crowdfunding" by De Buysere, Gajda, Kleverlaan, and Marom (2012).

In shorter terms, Schwienbacher and Larralde (2010) offer this definition:

> *"…Crowdfunding is the financing of a project or a venture by a group of individuals instead of professional parties"*

Mollick (2014) proposes a definition along the same line:

> *"The efforts by entrepreneurial individuals and groups … to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the Internet, without standard financial intermediaries."*

Within the scope of this research, we will use Mollick's definition, thus encompassing all the aforementioned types of crowdfunding.

There are certain key advantages that crowdfunding may have over venture capital. For example, crowdfunding shifts negotiation power towards founders. Mollick (2013), in his comparison between venture capital and crowdfunding, suggests that crowdfunders have less control over the deal terms with a project, compared to the various rights that venture capitalists possess.

More importantly, crowdfunding provides a much necessary financial source to founders who may have been ignored by venture capital or other institutional investors. More specifically, in Agrawal et al. (2011) – a research done about a fundraising campaign from Sellaband – distance was clearly wider from the funders to the fundraiser. Mollick (2013) agreed and observed that although crowdfunders judge fundraising projects using the same criteria as venture capitalists, the former also eases biases in geography and gender.

In addition, crowdfunding also encourages transparency from both the buy-side (the investment side) and the sell-side (the founders' side). On the buy-side, the investment intermediaries (the crowdfunding platforms, such as Kickstarter or Republic) are vastly improving their KYC-AML process (Know-Your-Customer and Anti-Money-Laundering, respectively), both in the United States and Europe. On the sell-side, regulations are also moving to protect investors from fraud by fundraisers. In fact, the discussion of such regulations has spurred many research in the United States, notably in the book "The Economics of Crowdfunding" (Bradford, 2018). Across the ocean, focus and concrete steps have been put into prevention of fraud on both side by the European Securities and Markets Authority (ESMA) (De Buysere et al., 2012). On the theoretical side, Haas and Blohm (2017) proposes a comprehensive configuration of crowdfunding platforms to mitigate financial risk on both sides while still maintaining profitability.

However, crowdfunding also faces certain drawbacks. First, crowdfunding is still young compared to venture capital. As mentioned above, the regulations surrounding crowdfunding are still rapidly evolving, resulting in a degree of unpredictability for investors and fundraisers. Many investors are not as sophisticated, and thus are subjected to scams (Abrams, 2017). Many fundraisers lack a formalized strategy to tap into their crowds (Giudici, Guerini, & Rossi-Lamastra, 2013; Hekman & Brussee, 2013; Hu, Li, & Shi, 2014).

Second, there has been little to no research on the performance of crowdfunded ventures, although researches on if and how the ventures are successfully funded are abundant. A material number of crowdfunding campaigns – equity or non-equity – do not fulfill their promises with investors and supporters. In fact, although more than 90% of the funded projects survived longer than 1 year with profitability, 37% of projects exceed their budget and many others are delayed for various reasons (Mollick and Kuppuswamy, 2014).

Taking all this into account, we can see the potential competition and/or complementation between crowdfunding and venture capital. However, the degree to which such relationships exist is open for debate and, consequently, further research.

### 2.3.3 Initial coin offering

Initial coin offering (or ICO) is an even younger channel of financing for entrepreneurial projects. Its emergence ties tightly to the blockchain – with many similar quirks.

A few definitions have been offered for ICOs. Tim Lea, in his article on the Financial Review (2017), described ICO as a process where a team creates a platform powered by cryptography – the "tokens" created in this platform are then traded to investors in return for funding in the form of other popular cryptocurrencies like Bitcoin or Ethereum. From the United States' Securities and Exchange Commission (2017) in their alert to investors:

> *Virtual coins or tokens are created and disseminated using distributed ledger or blockchain technology. Recently promoters have been selling virtual coins or tokens in ICOs. Purchasers may use fiat currency (e.g., U.S. dollars) or virtual currencies to buy these virtual coins or tokens. Promoters may tell purchasers that the capital raised from the sales will be used to fund development of a digital platform, software, or other projects and that the virtual tokens or coins may be used to access the platform, use the software, or otherwise participate in the project.*

Notably, both give precautions of fraudulent behaviors and the illiquidity of tokens.

As has been described in the previous section "News Outlets' and Investors' Discussion", the amount and speed of finance that startups have raised via ICO largely eclipse venture capital and crowdfunding.

Previously, projects that fundraise via an ICO did not have to strictly abide by financing laws. However, more official or governmental task forces have appeared in hopes for a safer market. For example, the SEC, as stated above, has suggested that ICOs will be subjected to securities law requirements. The same development was also seen from the Ontario Securities Commission. The European Securities and Markets Authority (ESMA) has yet to issue such an announcement.

From the investors' perspective, tokens may represent gigantic returns comparable to cryptocurrency at its peak. Although there has been little data on the performance of token as an asset class on the market, investors seem to be optimistic when considering the state-of-the-art technology usually under development by projects that finance with ICOs.

Despite those benefits, as stated above, ICOs are risky investments – both due to a lack of regulations, the dependence on technology for enforcement of contracts, and the uncertainty in the market itself. (2016) investigated the risk measures of cryptocurrency, whose behavior are quite similar to that of tokens from ICOs. Remarkably, cryptocurrencies do not move together among each other or with the S&P500 market. This makes ICOs an attractive investment for portfolio diversification.

## 2.4 Conceptual Framework

Due to the lack of previous research of the same category, it may be reasonable that we review other theories in finance and economics to compare whether there exists competition between these newer entrepreneurial fundraising channels and the traditional ones.

The literature about the relationship between ETFs and index mutual funds may shed some light on the relationship among venture capital, crowdfunding, and ICO that we are investigating.

The introduction of ETFs attracted investors who value immediacy in their investments. More specifically, between an index fund and an ETF that tracks the same index, a small percentage of investors will shift their portfolio allocation from the index fund to the ETF. If this relationship is applicable in the case of venture capital and the two new methods of funding, we can expect some direct competition between the former and the latter, but not extreme competition.

In the research done by Agrawal, Catalini, and Goldfarb (2013), the researchers proposed that "crowdfunding capital may substitute for traditional sources of financing".

With this, the paper aims to verify two main hypotheses:

- H1: The rise of crowdfunding (as represented by the amount of crowdfunding raised) has had a negative effect on venture capital in Europe (as represented by the amount of venture capital raised).
- H2: The rise of ICO (as represented by the amount of ICO raised) has had a negative effect on venture capital in Europe (as represented by the amount of venture capital raised).

These two hypotheses are both alternatives to the null hypothesis H0: The rise of crowdfunding and ICO has had no effect on venture capital in Europe.

# 3 METHODOLOGY

The paper verifies this quantitatively via regression analysis of secondary data, or more specifically, of three time-series as follows:

1. The amount of venture capital raised
2. The amount of crowdfunding raised
3. The amount of ICO raised

## 3.1 Data gathering

The process of data gathering has been especially challenging for the two latter channels of entrepreneurial fundraising, considering their state of relative infancy. As such, data gathering has relied tremendously on availability, although quality of data (cleanliness, comprehensiveness, and authority) plays a vital role. In more details:

1. **The amount of venture capital raised** is from the PitchBook 2017 Annual European Venture Report, released on February 7, 2018. Pitchbook's data have been used in researches by Cumming and Johan (2012), Cumming and Schwienbacher (2016), and Cannice (2018), to name a few. This PitchBook 2017 report covers quarterly data from 2010 to 2017, in euros.

2. **The amount of crowdfunding raised** is from CrowdBerkeley – a database project from University of California – Berkeley's Haas School of Business. This database has been initially explored by Boada et al. (2015) at Berkeley and has also uncovered quite interesting results. The database covers fundraising amount in dollars from four donation and reward-based platforms KickStarter, IndieGogo, FundRazer, and RocketHub, and two loan-based platforms LendingClub and Kiva. The data in each of these platforms vary in their scope, but the analyzed summation include only the overlapping time-period to best ensure data integrity. The overlapping time-period starts from Q2 2009 to Q1 2014.
3. **The amount of ICO raised** is from TokenData – a platform that consolidates and updates ICO news and campaign statistics. Although this is one of the most comprehensive data sources available, the coverage ranges only from Q3 2015 to Q4 2017, all in dollars.

## 3.2 Stationarity and differencing of time-series data

A preliminary analysis shows that these time-series maintain a strong upward trend and seasonality on a yearly basis, as typical of economic activities across time. More specifically, the investigation of upward trend required a regression on the amount of fund raised over time. For seasonality, the author employed auto-correlation analysis of the three time-series.

In other words, these time-series do **not** maintain one key feature for meaningful regression analysis: stationarity. Therefore, the investigation into them should first and foremost eliminate these elements of trend and seasonality. This elimination process applied the classical multiplicative decomposition model in conjunction with moving averages and trend regression.

Notably, the numbers from ICO show seasonality to a much lesser degree – perhaps due to the lack of breadth. As such, the author considered both the deseasonalized and the not-deseasonalized data in the following regressions. Further details of this preliminary analysis and the differencing to eliminate trend and seasonality can be found in the appendix.

## 3.3 Correlation analysis

To identify the relationship that crowdfunding and ICO have on venture capital, three correlation analyses were run – all with the X variable being the quarterly amount of venture capital raised. The only difference between these three analyses is the Y variable:

- For crowdfunding: the Y variable is the aggregated amount of fund raised on the aforementioned platform during the overlapping periods
- For ICO:
  - One analysis used the **deseasonalized** and **detrended** ICO data as the Y variable
  - The other analysis used the **detrended-only** ICO data as the Y variable

Similarly, the details of these analyses will be listed in the appendix.

# 4 FINDINGS

## 4.1 Stationarity and differencing of time-series

Although this has already been briefly mentioned in the previous section, further exploration into this topic may still bring forth value. Generally, the finding is that as time-series of economic and financial activities, they all exhibit a certain degree of trend. However, it is worth noticing that the degree to which seasonality exists vary a lot between the three channels. More specifically:

- The autocorrelation function (ACF) plot for venture capital follows a strong pattern of decay – demonstrating an underlying trend for venture capital funding to increase over time. In addition, the plot also displays a small rising spike at lag 4 – meaning that there is a seasonality pattern every four quarter. The partial autocorrelation function (PACF) plot confirms this, although not according to statistical rigor, by showing a high PACF value at lag 4 – meaning that there is a high amount of autocorrelation at lag 4 that is not explained by lag 1, 2, or 3.

- The ACF plot for crowdfunding, similarly, follows a strong pattern of decay. However, unlike the ACF plot for venture capital's time series, the ACF plot for crowdfunding's time series does not show detectable changes at lag 4. The seasonality of crowdfunding, instead, can be seen from the PACF plot. Here, a statistically significant spike appears at lag 4 – implying the seasonal nature of crowdfunding with a cycle of four quarters.
- The ACF plot for ICO decays at an even more accelerated pace. Again, there is no strong signs of seasonality to be inferred from ICO's ACF plot. However, in a manner that is like neither venture capital or crowdfunding, ICO fundraising shows no significant spike at lag 4 in the PACF plot. The significant spike surprisingly lies at lag 3 – which results in the author's decision to analyze ICO's data with **and** without deseasonalization.

## 4.2 Relationship between venture capital and crowdfunding

The correlation analysis between fund raised in venture capital and that in crowdfunding consisted of two main parts:

- Correlation without any lag in crowdfunding data
- Correlation with lags in crowdfunding data – including analyses at lags of one, two, three, and four quarters.

In these analyses, Y variable is the amount of fund raised via crowdfunding, and X variable is that via venture capital. As stated above, all data are detrended and deseasonalized. This has the effect of equalizing the magnitude of data from both time series – canceling the need to convert between the two currencies used in the data. The analyses bore some interesting results.

First, when analyzed without any lag, the correlation coefficient is roughly -0.18, with a significant p-value of 0.0077. This shows that there is a slight negative relationship between fund raised in crowdfunding and that in venture capital.

Second, when analyzed with lags, the correlation coefficients are approximately -0.04 at lag 1 and 0.07 at lag 2, but the results are statistically insignificant – the p-values are 0.527431923 and 0.322894524 respectively. On the other hand, at lag 3 and 4, we can see the same slight negative relationship, with the coefficients lying at -0.14 and -0.11 and the p-values at 0.0279 and 0.0174 in that same order.

Third, when comparing R-squared and adjusted R-squared of the lag-included and lag-excluded analyses, lag-3 analysis shows less predictive power than the lag-excluded model. However, surprisingly, lag-4 analysis shows more predictive power than lag-excluded model.

In effect, the results are sufficient for a rejection of **H0** and acceptance of **H1** – crowdfunding does compete with venture capital, albeit only to a minor degree. More notably, the analyses also imply that the competition may have a delayed effect of up to one year – as shown by the analyses with lag. The potential reasons and implications of that this delayed effect will be discussed later.

## 4.3 Relationship between venture capital and ICO

The correlation analyses between venture capital and ICO maintain the same structure as that between venture capital and crowdfunding. The main changes are:

- The Y variables will be ICO time-series.
- One ICO time-series is only detrended (referred to as ICO(1) onwards)
- The other ICO time-series is both detrended and deseasonalized (referred to as ICO(2))
- There will be no analyses with lags due to the lack of breadth in the ICO data

For ICO(1), its correlation coefficient and p-value with venture capital are -0.08 and 0.7606 respectively. For ICO(2), those numbers are 0.05 and 0.8251. These results are statistically insignificant. Henceforth, **H0** cannot be rejected.

# 5 DISCUSSION

## 5.1 Stationarity and differencing of time series

From the autocorrelation and partial autocorrelation analyses, we find that funding data from all three channels show significant trend behavior. This remains consistent with foundational findings about the stationarity of economic data (Leybourne et al., 1996; Ghysels and Osborn, 2001).

However, the existence of seasonality in these time series is harder to pinpoint despite findings from previous researches in venture capital (Füss and Schweizer, 2012; Ou and Haynes, 2006; Cohen and Langberg, 2012) and other researches about seasonality in finance (Rozeff and Kinney Jr., 1976; Thaler and De Bondt, 1987; Zarowin, 1990). Of all three time-series, crowdfunding's seasonality in a cycle of 4 quarters is only shown lightly via ACF and PACF, whereas ICO's PACF shows strange a seasonal cycle of three quarters.

Also noticeable is the fact that post-differencing to achieve stationarity, venture capital investment resembles the pattern of a "random walk", whereas crowdfunding and ICO investment both show more erratic behavior. In more concrete terms, the plot for crowdfunding investment after differencing takes a dive around the end of 2009 but shot up two quarters later. Perhaps this oddity is due to flaws in the data, or perhaps it is due to some regulatory changes that have affected all the involved crowdfunding platforms.

The strange behavior in ICO's plot after differencing shows as a steep rising spike in Q3 and Q4 of 2017 – which may be explainable by the current attractiveness of cryptocurrency and blockchain to investors. Generally, the post-differencing data imply that even as market forces like inflation are removed, both crowdfunding and ICO are experience periods of strong growth. All these speculations, of course, should be investigated further to disprove or confirm.

## 5.2 Relationship between venture capital, crowdfunding, and ICO

As mentioned above, crowdfunding does have a slight negative effect on venture capital – this aligns with previous researches summarized in the literature review. However, this negative effect is minor – considering that the all data points have been equalized in terms of magnitude. In other words, in comparison with venture capital, the benefits and costs of crowdfunding exert comparable forces on the competitiveness of crowdfunding and venture capital.

Note also that the crowdfunding data in this paper do not include information about equity crowdfunding – which may be deemed a closer substitute for venture capital (from both investors' and founders' perspective). The limitation of crowdfunding data to only periods before 2014 causes failure to account for recent developments in regulation, venture outcomes, and media coverage.

On the flip side, the analyses are still statistically significant, not merely from low p-values, but also from high values of R-squared and adjusted R-squared. These analyses can explain up to 20% of variance in venture capital investment.

The analyses did not establish an interaction between ICO and venture capital due to high p-values. Although different news outlets and industry analysts have broached the competition between the two fundraising mechanisms, these analyses show that the data are insufficient to prove such a relationship.

The plots allow for some interesting observations nonetheless. From the unfiltered data, one may even say that venture capital investment has rocketed in the last quarter of 2017 despite the strong emergence of ICO. However, the filtered (after differencing) data show that since the appearance of initial coin offering in Q3 2015, developments in venture capital have been lackluster. This may imply that although both ICO and venture capital are expanding quickly in the current environment, ICO has slowed down venture capital's progress – provided that we remove trends and seasonality caused by macroeconomical forces. This is purely speculation from eyeing the existing data, and further investigation is certainly needed to put this argument on more concrete ground.

## 5.3 Implications to theory

As a theoretical study, this paper provides the body of entrepreneurship literature with a quantitative perspective on the interaction between venture capital, crowdfunding, and ICO. Although the analyses are as primitive as naïve, they filled in the research gap in the literature body and start foundational work in this new unresearched area.

First, the analyses reveal a negative relationship between crowdfunding and venture capital. This may or may not be representative of new and old mechanisms of entrepreneurial fundraising, but this finding might provide some manner of trajectory for future research. For example, as the correlation between crowdfunding and venture capital is slightly negative, we may assume that the competitive forces between both is stronger than the cooperative ones. As such, further inquiry into the specific nature of these forces and the extent to which they interact or balance among each other may be of value.

Second, the assessment of seasonality and trend among the three methods of mechanisms may assist future research endeavors. Although it is hardly surprising that venture capital follows a four-quarter cycle, the possibility of such cycle applying to both crowdfunding and ICO poses interesting questions – considering that both rely on the crowd's buying power instead of institutional financiers. For example, how to verify the existence of such cycle in crowdfunding and ICO? What are the factors that create that four-quarter cycle?

The main challenges of this research also propose a direction forward for theoretical study. The lack of authoritative data on both crowdfunding and ICO – especially in the European area – encourages the academia to conduct more monitoring and recording of these activities. On the flip side, academia also need a method to deal with the lack of macroeconomical data from both ICO and blockchain as they dramatically evolve and mature.

## 5.4 Implications to practice

This paper offers a few insights to how different players in entrepreneurial financing may act or should act in this new environment. As there is a potential competitiveness between alternate funding methods and venture capital, how has investors and founders adapted? How should they change in the future? What can governments and regulators do to facilitate entrepreneurial financing in this context? All are viable questions that should be considered when these parties undergo strategic planning.

For example, venture capitalists as investors may stand to gain from understanding the comparative benefits that crowdfunding and ICO bring. Perhaps learning from and recreating these advantages will allow VC firms to position themselves more favorably among their competitors – both in the venture capital industry and in comparison to the newer mechanisms, not limited to crowdfunding and ICO. More interestingly, as some VC firms have already begun investment in blockchain and ICO, we may even see VC firms as they incorporate crowdfunding into their portfolio. On the organizational side, VC firms in syndication have already resembled crowdfunding characteristics – giving rise to the question: what can VC syndicates learn from the effective and efficient organization of crowdfunding platforms?

Founders now have an extra choice when deciding on their methods of financing. Because crowdfunding and ICO both requires more transparency from the companies, founders may have to rethink their approach to documenting business growth. During negotiation, the competition that crowdfunding and ICO present to venture capital will put founders at a moderately better edge over the investors. Other issues that may arise are those in compliance – e.g. how founders can stay true to the promises made when pitching to crowds, in strategy – e.g. if founders can use crowdfund as a new channel for acquiring competitors or for expanding reach to potential customers, and in organizational structure – e.g. how founders should allocate their equity across the many potential investors and the many phases of the business.

Governments face a different set of questions. Provided the latent competition between all these funding mechanisms, governments may have to devise policies so as to prevent unfair competition while also maintaining freedom for both investors and founders. In addition, other regulatory changes may be necessary to monitor and mitigate the downsides of seasonality or herd behavior in the crowd. If such downsides were existent and to be ignored by the government, both founders and investors stand to lose – capital for founders and returns for investors.

# 6 LIMITATIONS

This study carries clear limitations in terms of data and analysis methodology.

As there has been little data coverage in both crowdfunding and ICO, there exists no overlap that allows for cross-analysis among all three funding mechanisms. Instead, as shown in previous sections of this paper, only the relationship of one alternate funding method with venture capital can be analyzed. The limitation in data also prevents robust analytics of these time series. For example, both the ACF and the PACF models are restricted to within 10 lags – any higher number of lags would result in too small a sample. The data prove insufficient to be partitioned for verification of predictive power in linear correlational analysis. Also noteworthy is the lack of specific European data for crowdfunding and ICO – the usage of which in analysis may change the results noticeably, if not drastically. For this purpose, the paper assumes that international changes in crowdfunding and ICO also have substantial effects on European venture capital.

Furthermore, the methodologies for detrending and deseasonalizing are subjected to the author's rudimentary knowledge of the discipline. As such, although the results may be adequate for an exploratory study, they may not stand to statistical test of rigor. In addition, although ACF and PACF are both common methods to detect seasonality and trend, confirming the existence of such and drawing inferences from them require even stricter analytical models.

# 7 SUGGESTIONS FOR FURTHER RESEARCH

As acknowledged in the previous sections, there is necessity for more research to be done in the intersection between all funding mechanisms. Examples include more rigorous analysis of the seasonality and macroeconomic forces behind crowdfunding and ICO, of the competitiveness between crowdfunding, ICO, and venture capital, of the effects of different characteristics from each fundraising mechanism on the founders' eventual financing decision, and of the investors' decision on channels to invest in startups.

# 8 CONCLUSIONS

The paper set out to explore the relationship between the traditional funding channel of venture capital and the more recent ones, specifically, crowdfunding and ICO. As is proposed by the literature and the analytical results, there seem to be a minor but not neglectable negative correlation between crowdfunding and venture capital. No such inference can be drawn from the analysis between ICO and VC. As investment in startups become more accessible to both investors and founders, all the involved parties will be forced to realign internally to stay relevant and competitive. Regulatory changes may also be needed as preventative measures considering the outstanding pace at which newer funding channels are evolving.

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# 10 APPENDICES

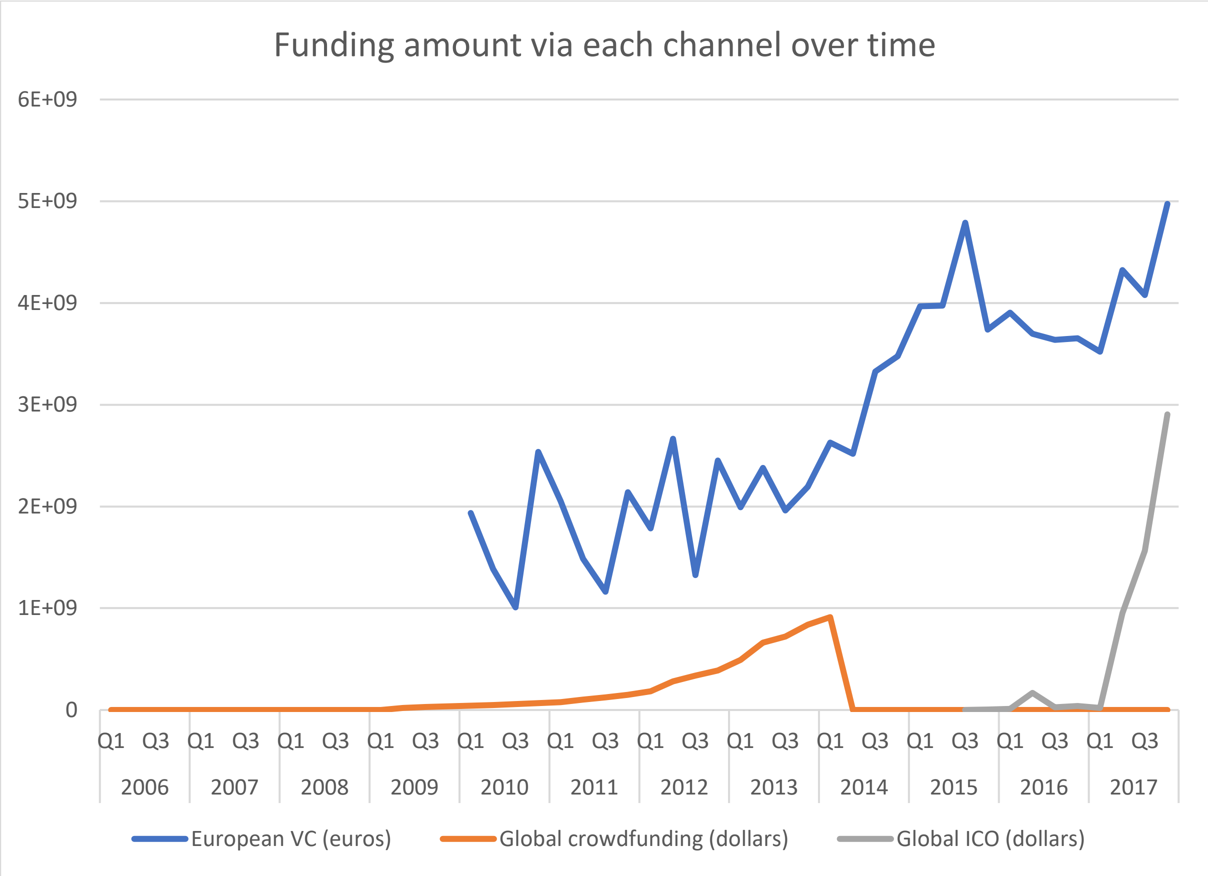


*Figure 1. Funding amount via each channel over time*

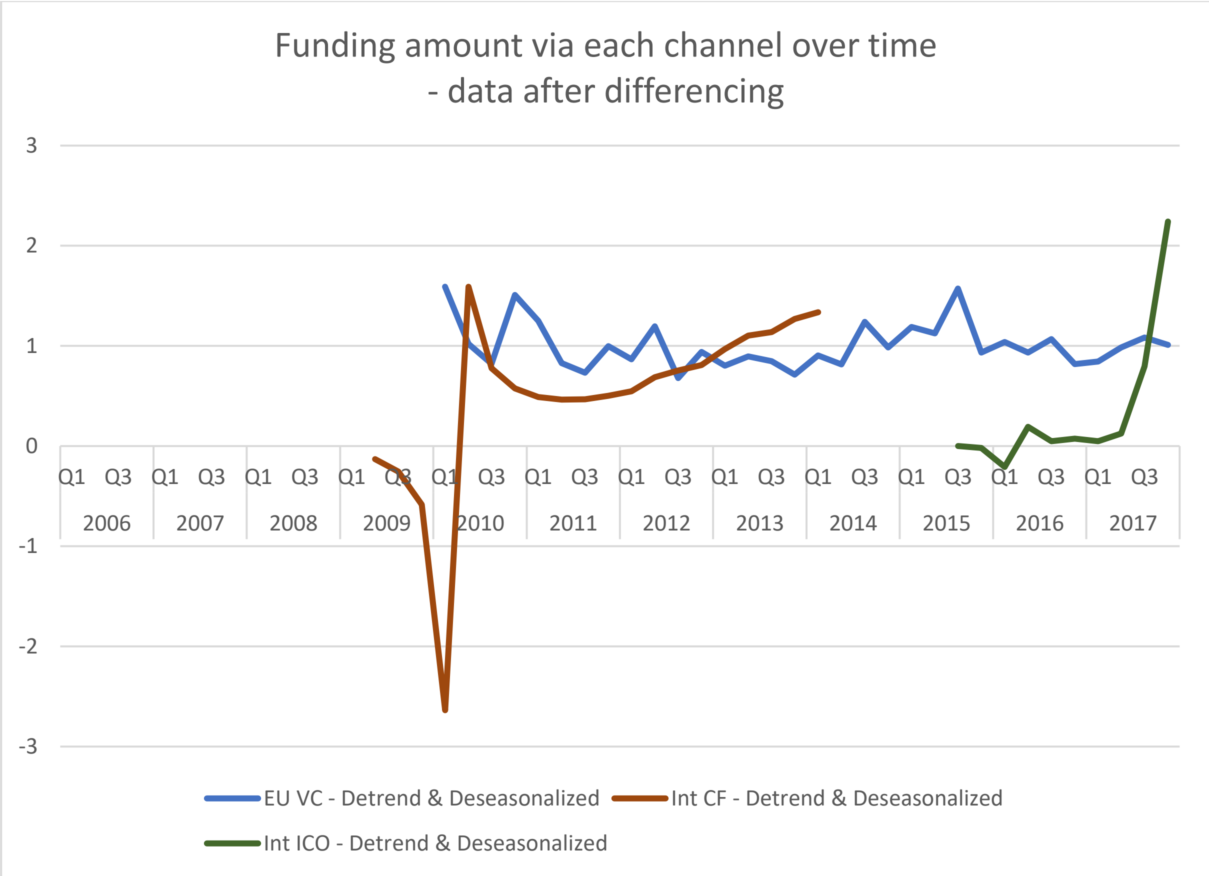


*Figure 2. Funding amount via each channel over time*

| CF and VC | Lag 0 | Lag 1 | Lag 2 | Lag 3 | Lag 4 |
|---|---|---|---|---|---|
| Correlation coefficient | -0.1808 | -0.0406 | 0.0661 | -0.1422 | -0.1130 |
| p-value | 0.0077 | 0.5274 | 0.3229 | 0.0279 | 0.0174 |
| R-squared | 0.3863 | 0.0291 | 0.0751 | 0.3427 | 0.4157 |
| Adj R-squared | 0.3863 | -0.0402 | 0.0040 | 0.2879 | 0.3625 |

*Figure 3. Crowdfunding (CF) and venture capital (VC) - Correlation statistics*

| ICO and VC | Detrended & Deseasonalized | Detrended only |
|---|---|---|
| Correlation coefficient | 0.0507 | -0.0794 |
| p-value | 0.8251 | 0.7606 |
| R-squared | 0.0153 | |
| Adj R-squared | -0.2660 | |

*Figure 4. Initial coin offering (ICO) and venture capital (VC) - Correlation statistics*

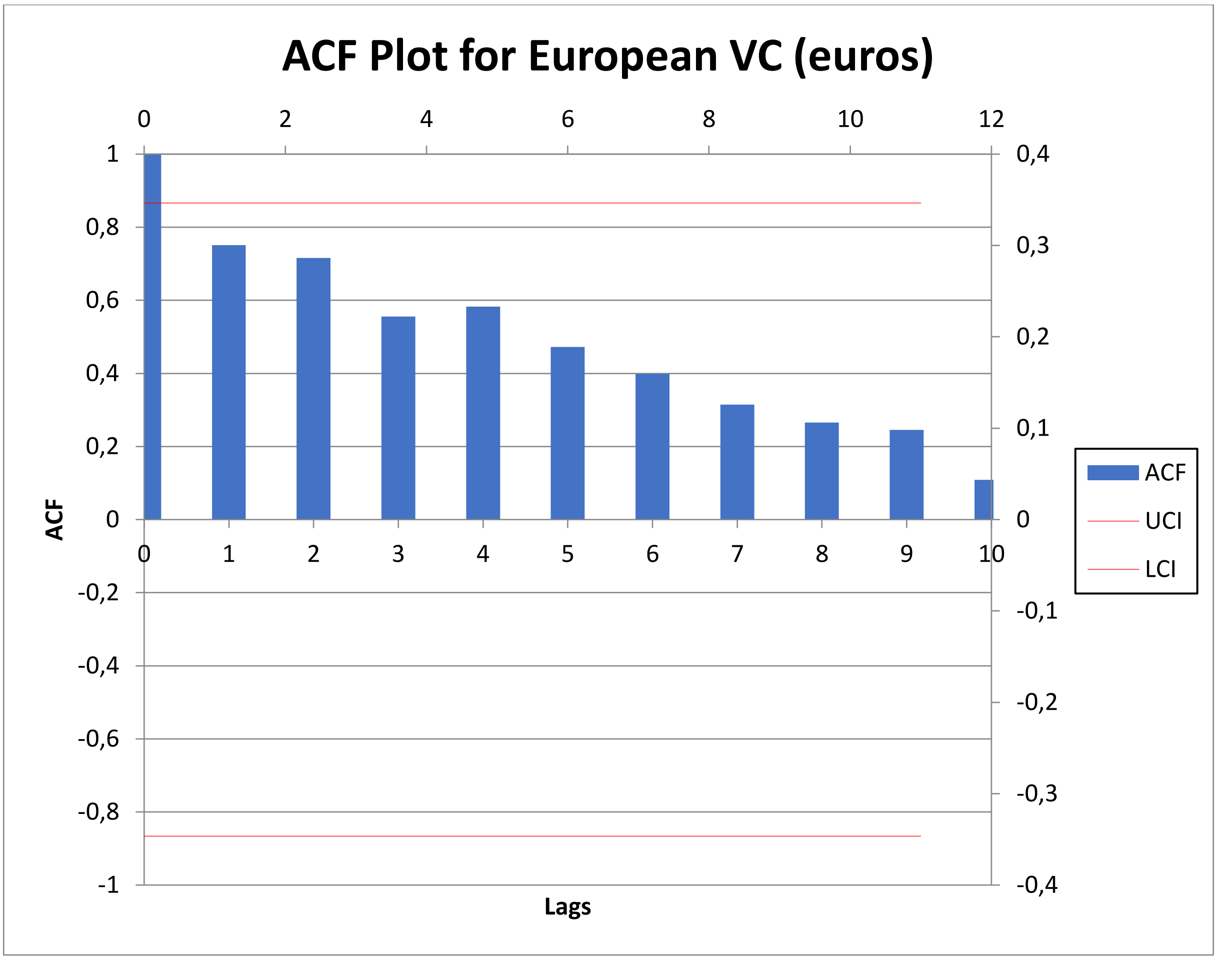


*Figure 5. ACF Plot for European VC (euros)*

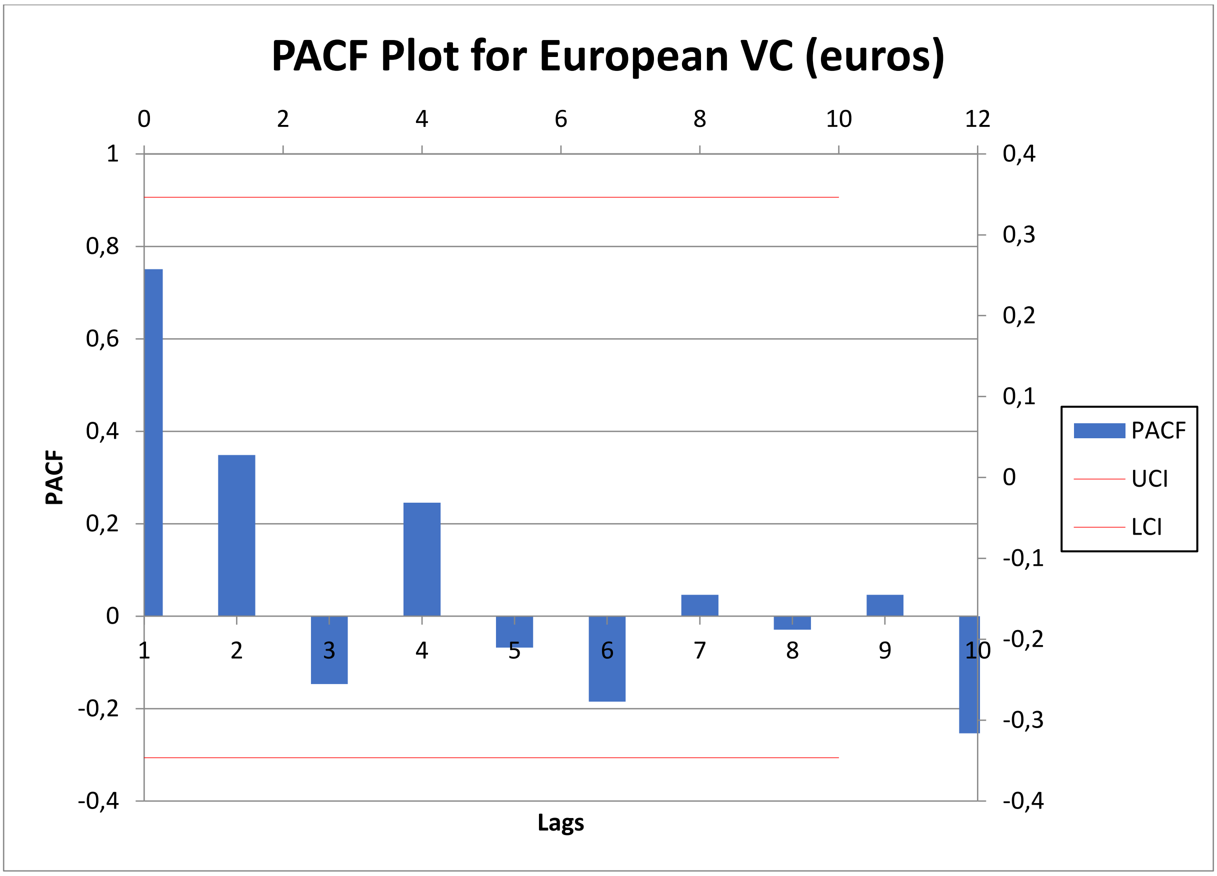


*Figure 6. PACF Plot for European VC (euros)*

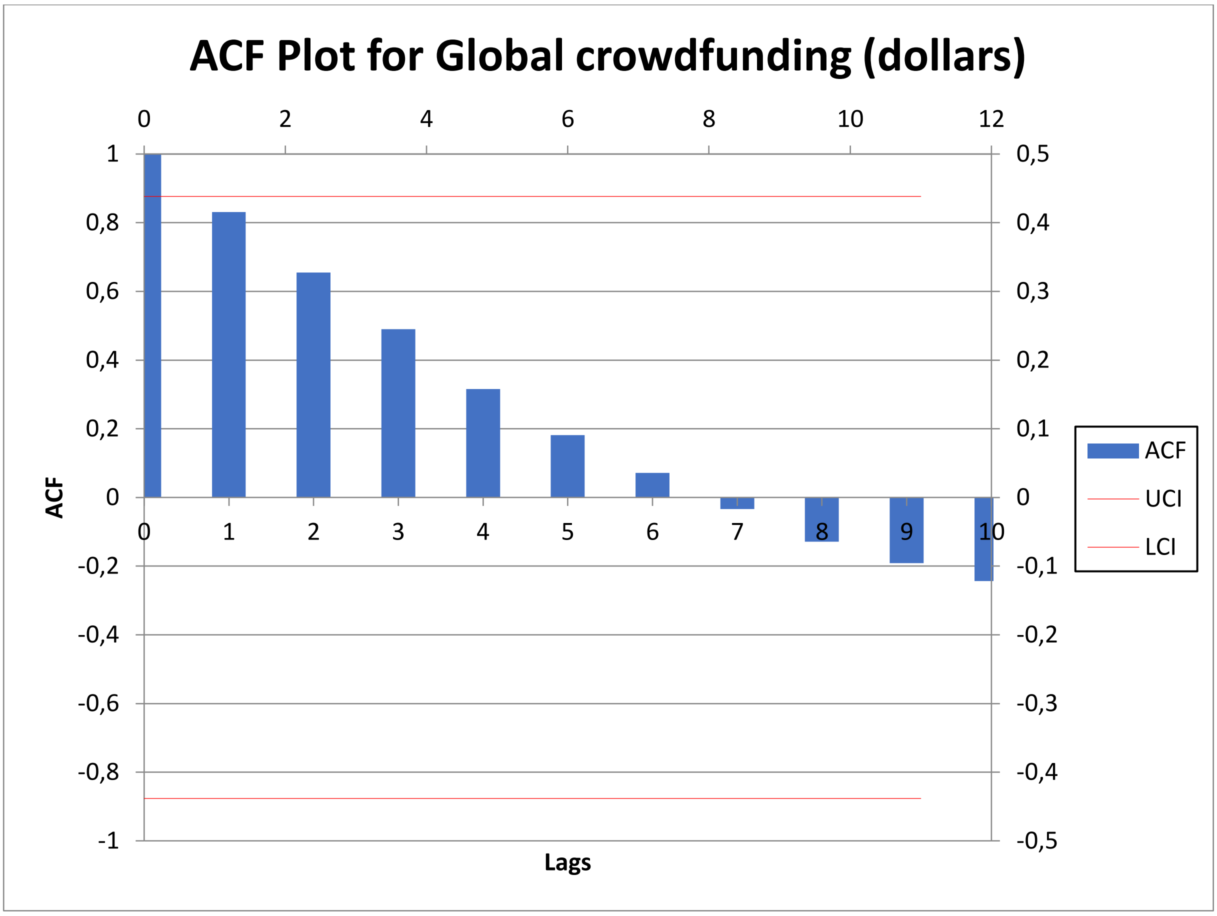


*Figure 7. ACF Plot for Global crowdfunding (dollars)*

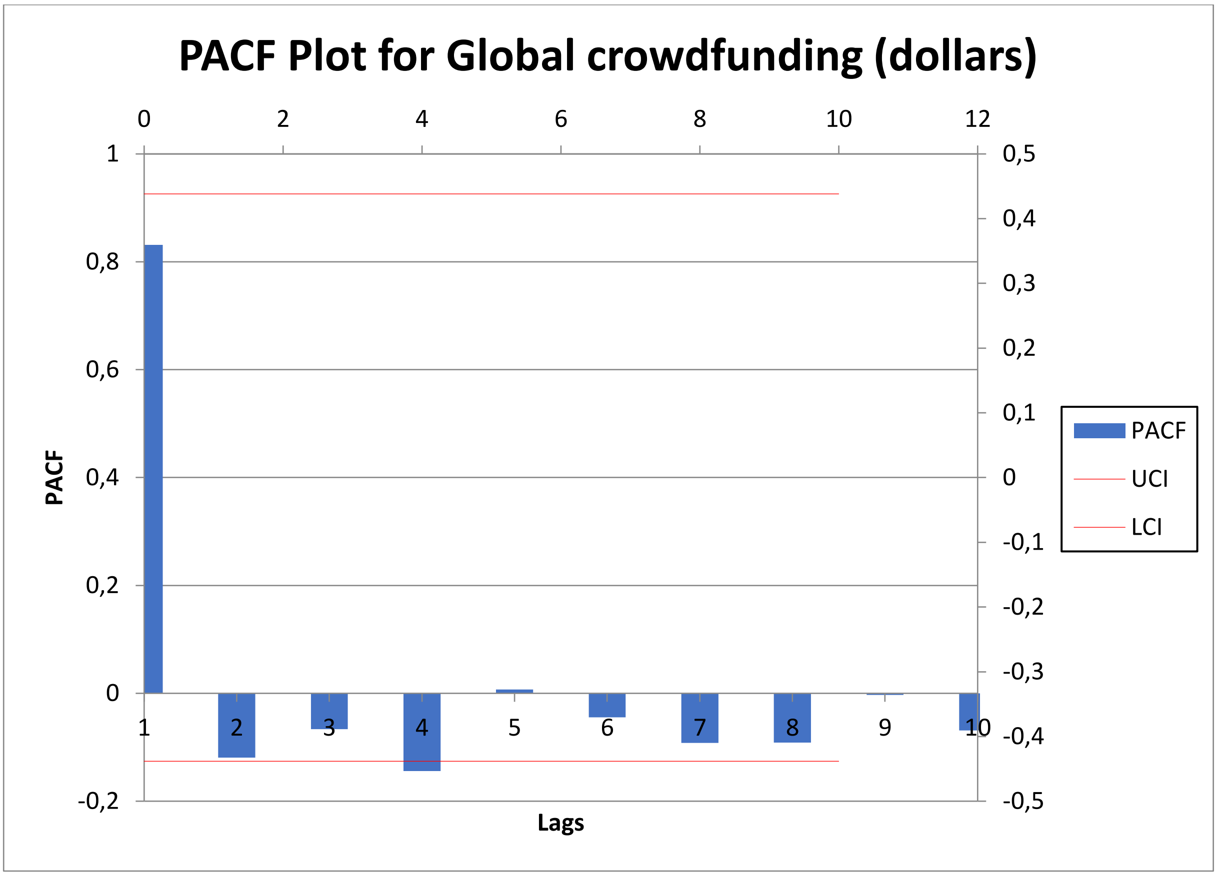


*Figure 8. PACF Plot for Global crowdfunding (dollars)*

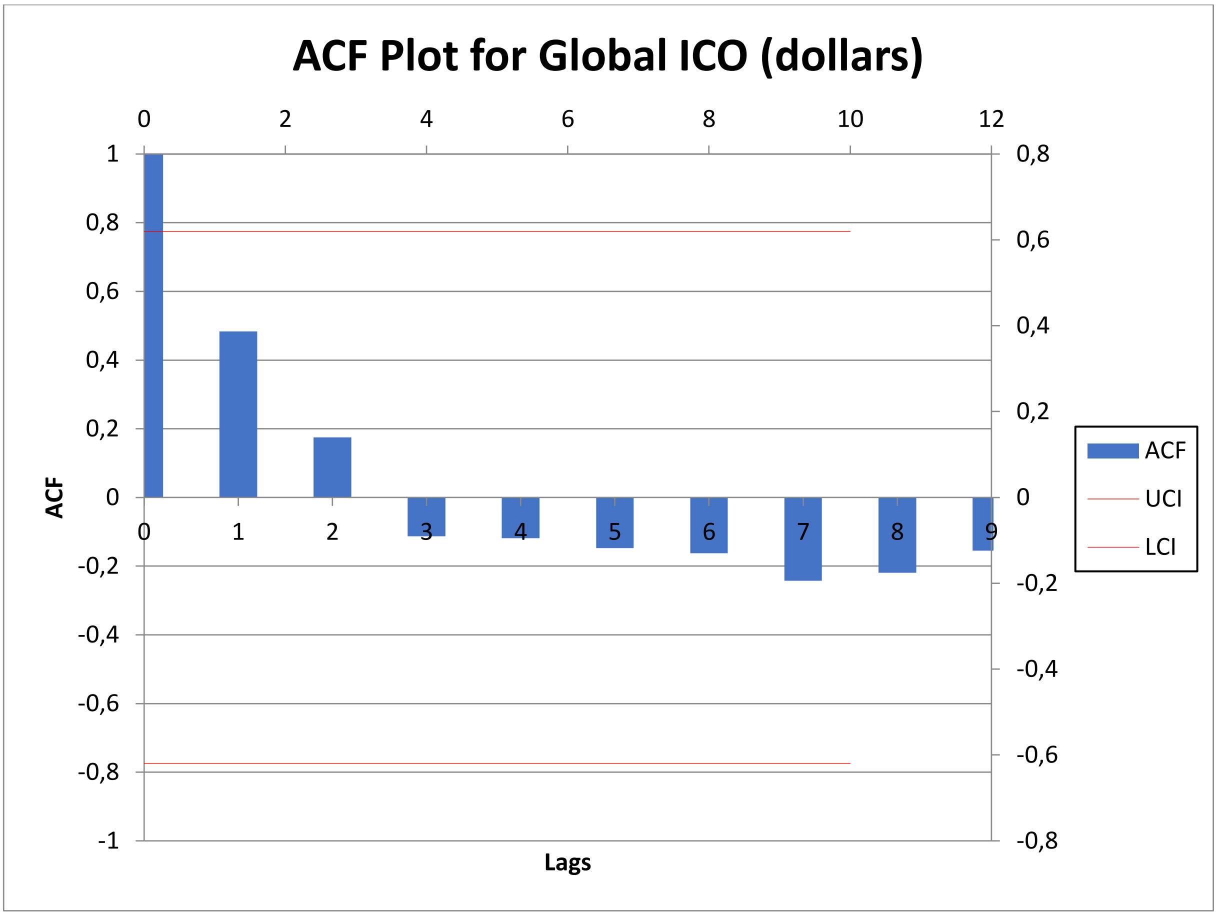


*Figure 9. ACF Plot for Global ICO (dollars)*

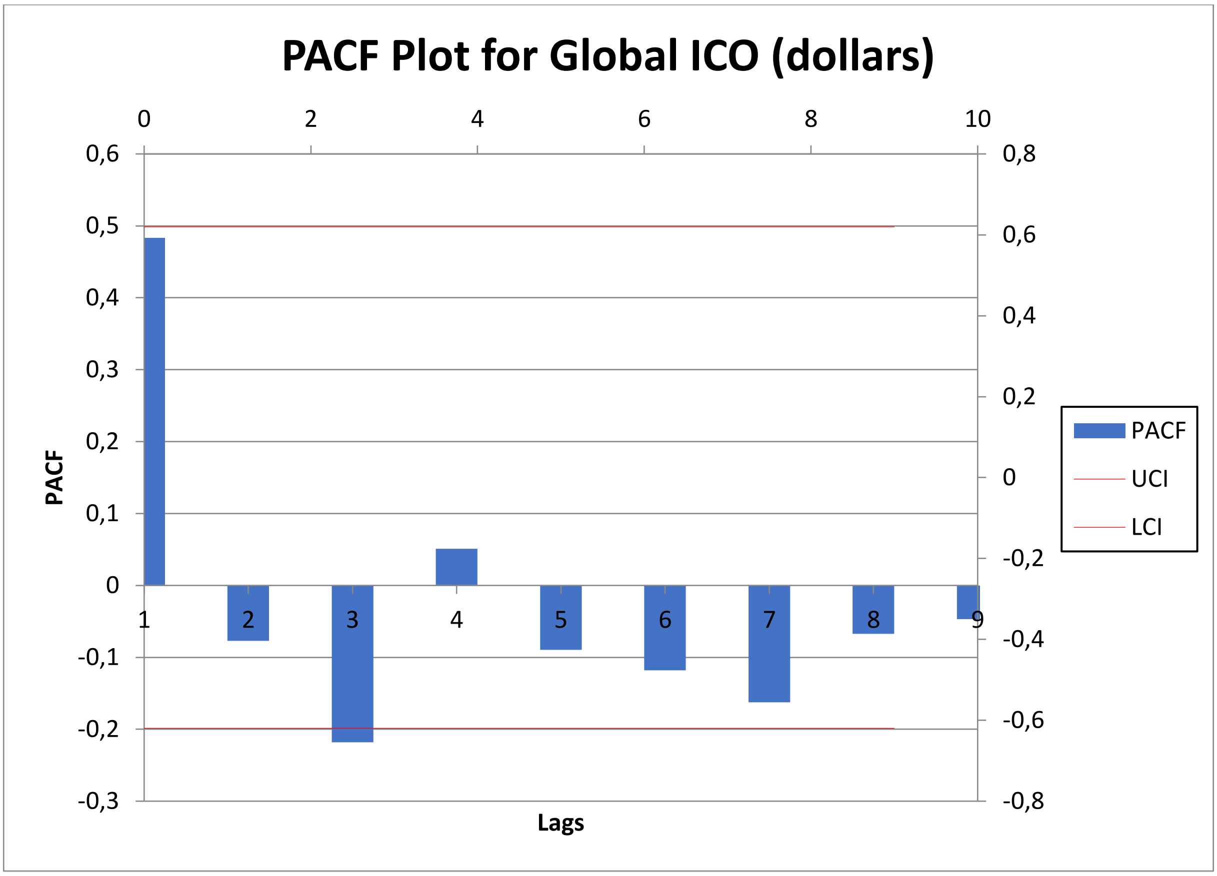


*Figure 10. PACF Plot for Global ICO (dollars)*