Journal of
Risk and Financial Management

MDPI

Review

Theories of Crowdfunding and Token Issues: A Review

Anton Miglo

Adam Smith Business School, College of Social Science, University of Glasgow, Gilmorehill Campus, West Quadrangle, Glasgow G12 8QQ, UK; anton.miglo@glasgow.ac.uk

Abstract: Entrepreneurial, innovative and small- and medium-sized firms experience difficulties with raising funds using traditional debt and equity. Consequently, they are constantly looking for new strategies of financing. The latest inventions are crowdfunding and token issues. In contrast to traditional ways of raising funds these innovations: (1) use modern technology (online transactions, blockchain, etc.) much more actively; (2) are usually quicker in reaching potential investors/funders; (3) use more active network benefits such as, for example, a large number of interactions between investors/funders and between funders and firms. These changes are so significant that some experts list them among the top business inventions of the 21st century. This article provides a review of the growing number of theoretical papers in the areas of crowdfunding and token issues, compares their findings with empirical evidence and discusses directions for future research. The research shows that a large gap exists between the theoretical literature and empirical literature.

Keywords: entrepreneurial finance; crowdfunding; token issues; initial coin offerings (ICOs); initial ex-change offerings (IEOs); security token issues (STOs)

JEL Classification: F30; G15; G18; G21; G24; G28; G32; G38; M13

Citation: Miglo, Anton. 2022. Theories of Crowdfunding and Token Issues: A Review. *Journal of Risk and Financial Management* 15: 218. https://doi.org/10.3390/jrfm15050218

Academic Editor: Paul P. Momtaz

Received: 5 March 2022
Accepted: 30 April 2022
Published: 13 May 2022

1. Introduction

Financing is crucial for entrepreneurial firms and innovative firms, as well as for small- and medium-sized businesses (see, for example, Hall 2009; Wilson 2015; Nicolò 2015; Capizzi and Carluccio 2016; Ceptureanu et al. 2017). Crowdfunding in its modern form (performed online) and token issues are the latest topics in this area. Crowdfunding is sometimes ranked/credited as one of the leading business/technology innovations of recent years.[1] As will be shown in this review, many theoretical ideas behind crowdfunding and token issues are quite similar, as for example, the idea of raising funds for new product development and gaining future customers at the same time.[2] In this review we will discuss these commonalities as well as the differences between these new phenomena.

Crowdfunding and token issues are highly growing areas of interest among practitioners and theorists (Ahlstrom et al. 2018; Masiak et al. 2020). The number of theoretical papers[3] is quickly growing, whereas the structure of these research areas and their main directions are not quite established yet. Both of these areas are parts of FinTech, which refers to various financial technologies used to automate processes in the financial sector (Alt et al. 2018; Das 2019; Horvat and Bobek 2020). Crowdfunding is a fundraising strategy that aims at getting support from a large number of investors/funders ("crowd"). There are four main types of crowdfunding: reward-based crowdfunding, equity-based crowdfunding, debt-based crowdfunding and donation-based crowdfunding. Under reward-based crowdfunding, funders receive some benefits usually related to future firm products/services, e.g., significant price discounts. Reward-based crowdfunding is offered in one of two models: KIA ("Keep-It-All") or AON ("All-Or-Nothing"). Under KIA, the firm keeps the total amount raised. Under AON, the firm sets a fundraising goal/target and keeps nothing if the target is not reached. The largest crowdfunding platform (Kickstarter) follows AON. Under equity-based crowdfunding, investors receive shares of the company. Debt-based

crowdfunding (also called P2P: peer-to-peer lending) involves requesting support and resources from other investors in exchange for interest. Under donation-based crowdfunding, funders support the firm's mission (usually related to social or environmental purposes) without getting any (direct) rewards.

Innovative companies can issue different types of tokens. These include ICOs (initial coin offerings), STOs (security token offerings), IEOs (initial exchange offerings) and NFTs (non-fungible tokens).[4] Under ICO, a firm pre-sells utility tokens which give their holders the right to purchase the company's product/service when it becomes available. Under STO, a firm raises capital by selling tokenised traditional securities (security tokens), e.g., equity where tokenholders obtain rights to the firm's profit. Security tokens are often regulated (Ante and Fiedler 2019). Under IEO, a firm raises funds by selling tokens with the help of an organised exchange;usually an exchange for cryptocurrencies such as Binance (Myalo (2019). The exchange is involved in promoting the firm's tokens.[5] Unlike traditional cryptoassets, NFTs typically cannot be traded on an interchangeable basis since they are unique and non-divisible. They are often used in trading, for example, pieces of arts.[6]

The analysis shows that the five following ideas/topics dominate the theoretical literature on crowdfunding and token issues.

1. *Learning market demand*. Under demand uncertainty, crowdfunding and token issues help entrepreneurs receive valuable signals and learn information about potential interest/demand for new products/services (Strausz 2017; Chemla and Tinn 2019; Schwienbacher 2018; Catalini and Gans 2018; Ellman and Hurkens 2016). Learning can take different forms. Firms can learn from observing pre-orders under reward-based crowdfunding, by observing share price under equity-based crowdfunding, by observing the results of crowdfunding campaigns of their competitors, by receiving direct feedback from market participants, etc. Similar ideas exist with regard to token issues. Firms can learn by observing and analysing the demand for firm tokens, by observing the token secondary market price, etc.

2. *Signalling project quality*. The projects of innovative firms and small- and medium-sized firms are in most cases projects with a very high degree of uncertainty regarding their quality. Unlike large established firms, these firms or products do not have large media coverage or analyst coverage. In these conditions firms try to undertake some actions that can be interpreted as credible signals of their project's quality that should help them attract the maximal number of potential investors/funders (Miglo and Miglo 2019; Chakraborty and Swinney 2021; Sayedi and Baghaie 2017; Kim et al. 2018; Chod and Lyandres 2021). Firms can use different tools and ideas for signalling including an appropriate choice and design of their financing method. It includes the choice between traditional methods and new methods; the choice between different types of crowdfunding; the choice between different types of tokens; the choice of campaign targets; etc.

3. *Network benefits*. The crowdfunding process and token issues are very different from traditional methods of fundraising by entrepreneurial firms. Among others, these differences include the exchange of information/feedback between funders and between funders and firms; a feeling of "community value" from being a part of a large group of participants with similar motivations; the ability to help with mitigating/solving communication/coordination problems between participants; etc. Some theoretical papers focus on the analysis of these so-called "network benefits" of crowdfunding and token issues (Li and Mann 2018; Sockin and Xiong 2020; Bakos and Halaburda 2018; Cong et al. 2021).

4. *Mitigating moral hazard problems*. Some papers analyse the role of moral hazard in crowdfunding and token issues (Strausz 2017; Schwienbacher 2018; Chemla and Tinn 2019; Babich et al. 2019; Belavina et al. 2020; Garratt and van Oordt 2019). Moral hazard refers to situations where the actions of managers/entrepreneurs are not observable or non-verifiable by investors. Two types of moral hazard problems are dominating the theoretical literature on crowdfunding and token issues: one related to entrepreneurial costly effort and one related to the possible diversion of funds by an entrepreneur. As an example, note that under equity-based crowdfunding, the entrepreneur's share of the

company is less than 100% (in the spirit of Jensen and Meckling 1976) after funds are raised and, therefore, the entrepreneur's incentive may be different than it would be, for example, under reward-based crowdfunding.

5. *Role of behavioural biases*. Behavioural finance is one of the most recently developed and growing parts of finance research. It is based on the idea that in many situations, decision-makers are not fully rational. The reasons might be very different, including estimation mistakes, overconfidence, emotions, etc. A growing line of theoretical research on crowdfunding and token issues focuses on the analysis of the role of these biases (Fairchild et al. 2017; Belleflamme et al. 2013, 2014). For example, an overconfident entrepreneur can set a target of a crowdfunding campaign too high, which can ultimately affect the probability of project success.

As was mentioned previously, no paper has been specifically focused on reviewing the theoretical literature on crowdfunding and token issues. This determines the significance of the present research. Additionally, it is necessary to compare the theoretical and empirical literature to find gaps and misalignments. Thus, the aims and objectives of this article include the following: (1) to review the theoretical literature in the areas of crowdfunding and token issues; (2) to determine common approaches and common ideas and to determine which ideas have received high and low amounts of attention to identify under-researched areas; (3) to compare the results of theoretical papers with existing empirical papers, identify gaps and "grey" areas and ultimately suggest some ideas for future directions of research.

In terms of methodology used, probably the closest paper is one by Harris and Raviv (1991) that provides a review of theories of capital structure. The papers are selected mainly based on the criterion that they offer rigorous theoretical models (usually in the context of financing literature these include game-theoretic tools, contract theory tools, etc.). To search for articles the author used most of the academic search engines, including Google Scholar, Web of Science, SSRN, etc., using the words crowdfunding, token issues and other related terms. In addition, some general papers in the area of financing have also been included because their ideas can be applied to the areas of crowdfunding and token issues without specifically mentioning them. Finally, some working papers may have not being included because they seem to be in intermediate stages or have models from different areas, e.g., they have different kinds of econometric or quantitative models that are not suitable for this research (in some cases the frontier separating different types of models is not quite clear; thus, the author used his own judgement about whether to include a paper in this review). An important part of the analysis was to connect empirical papers and theoretical ones (these connections are summarised in Tables 1–2 and 5–8). Many of the empirical papers do not directly test existing theoretical models but their results seem to be consistent with the spirit of these models' predictions.

In terms of the review's organisation, it is structured according to the five main topics mentioned above. Each of these ideas has a separate section. Each section contains a simple micromodel illustrating some of the most important points. All other ideas are summarised in a separate section. Note that nowadays, most papers use more than one major factor of analysis unlike, for example, capital structure theory developments in the 1970–1990s when most papers had one major factor such as asymmetric information, moral hazard, etc.[7] Now it is usually a combination of several factors. Therefore, some papers will be mentioned in more than one section.

The rest of the paper is organised as follows. Section 2 reviews the literature related to the "learning market demand" idea. Section 3 analyses the signalling idea. Section 4 analyses network benefits. Section 5 focuses on moral hazard problems. Section 6 discusses the behavioural aspects of crowdfunding and token issues. Section 7 reviews other theories and Section 8 provides a summary and a conclusion.

2. Learning Market Demand

One of the most popular ideas of crowdfunding and token issues is that firms can use them to learn information ("crowd wisdom") about the market. This section dis-

cusses articles that have the element of "learning" in their models. Learning means that a firm/entrepreneur improves its information about market demand during the crowdfunding or token issue process (or some stages of the crowdfunding/token issue process) and uses it later.

The following model illustrates this point.[8] Consider a firm with an innovative product or service. The production is q. The expected spot market price is p. The firm can also use a crowdfunding campaign (the product price during the campaign is p_c). The firm should determine c and s, which are crowdfunding pre-sales and spot sales, respectively: $q = c + s$. The inverse demand function is $p = a - q = a - c - s$. We assume a no-arbitrage environment, i.e., in equilibrium $p_c = p$. However, if the firm uses crowdfunding, the funders expect to receive an extra-benefit (reward) β from the firm that reflects the cost of waiting. Additionally, the firm faces demand uncertainty: $a = a_h$ with probability μ; otherwise, $a = a_l$, $a_h > a_l$.

Without crowdfunding (i.e., $c = 0$), when selecting s, the firm maximises its expected profit from spot sales, which equals $\mu p_h s + (1-\mu) p_l s = \mu(a_h - s)s + (1-\mu)(a_l - s)s$. Here $p_h = a_h - s$ is the price when the demand is high and $p_l = a_l - s$ is the price when the demand is low. The solution is:

$$s = \frac{\mu a_h + (1-\mu) a_l}{2}$$

The firm's expected profit is

$$\frac{(\mu a_h + (1-\mu) a_l)^2}{4} \tag{1}$$

With crowdfunding (i.e., when $c > 0$), the firm gets to know the demand after the crowdfunding campaign because the firm can observe p_c, which reflects the true value of a. If after crowdfunding the firm realises that $a = a_h$, then the firm selects s to maximise $(a_h - c - s)s$.

The solution is:

$$s_h = \frac{a_h - c}{2}$$

Additionally:

$$p_h = a_h - c - s_h = \frac{a_h - c}{2}$$

Similarly, when $a = a_l$, we get $s_l = p_l = \frac{a_l - c}{2}$.

When preparing its crowdfunding campaign, the firm's expected profit equals

$$\begin{gathered} \mu(Ep_h(c + Es_h) - \beta c) + (1-\mu)(Ep_l(c + Es_l) - \beta c) = \mu(a_h - s)s + (1-\mu)(a_l - s)s = \\ \mu\left(\left(\frac{a_h - c}{2}\right)\left(\frac{a_h + c}{2}\right) - \beta c\right) + (1-\mu)\left(\left(\frac{a_l - c}{2}\right)\left(\frac{a_l + c}{2}\right) - \beta c\right) = \frac{\left(\mu a_h^2 + (1-\mu) a_l^2 - c^2\right)}{4} - \beta c \end{gathered} \tag{2}$$

Here Ep_h and Ep_l are price expectations for the scenario with high- and low-market demand, respectively. Given the no-arbitrage condition, these expectations should be equal to expected spot sale prices. The difference between (2) and (1) can be written as

$$\frac{\mu(1-\mu)(a_h - a_l)^2}{4} - \frac{c^2}{4} - \beta c \tag{3}$$

If c is sufficiently small, crowdfunding provides higher profit than spot sales alone. Indeed, consider an extreme case where $c = 0$. In this case (3) becomes $\frac{\mu(1-\mu)(a_h - a_l)^2}{4}$ which is strictly positive; therefore, by the continuity of profit functions in c, the same holds if c is sufficiently small. Thus, crowdfunding can create value for the firm.

Degree of uncertainty about market demand. If the difference between a_h and a_l increases, then the likelihood that (3) is positive increases. With regard to the value of μ, note that (1) is maximised when $\mu = 1/2$. This is the case when the level of uncertainty is highest,

i.e., high and low demand are equally likely. Both these points mean that the likelihood of crowdfunding increases when uncertainty regarding market demand increases.

Chemla and Tinn (2019) develop a model where crowdfunding (reward-based) helps firms receive valuable information about their projects. Crowdfunding allows them to learn about the total demand from a sample of consumers (funders). They predict that a higher degree of uncertainty is positively correlated with the benefits of reward-based crowdfunding. They present data that support their results based on the comparison of crowdfunding campaigns by technology firms (with a higher degree of demand uncertainty) and theatre firms. It is also consistent with the spirit of findings in Xu (2019).

Similar ideas can be used with regard to ICO analysis. Entrepreneurs learn information about market demand by observing the price of tokens issued during an ICO. One can argue that an ICO will be preferred to an STO if the degree of demand uncertainty is relatively large (Miglo 2021c). This is indirectly consistent with the spirit of Amsden and Schweizer (2018). Based on an analysis of 1009 projects between 2015 and 2017, Amsden and Schweizer (2018) argue that ICO projects are characterised by a very high degree of market uncertainty.

Schwienbacher (2018) studies risks related to crowdfunding. It includes the uncertainty of market demand. Reward-based crowdfunding provides valuable information. On the other hand, raising funds from traditional investors does not offer the same level of feedback, since usually their decisions are based on the expected overall profitability of the project and not on consumption. Schwienbacher (2018) also finds that crowdfunding is more likely when demand uncertainty is higher.

Project size. Equation (3) is positive only if c (the size of the crowdfunding campaign) is relatively small. This is intuitive since the firm is facing a trade-off between learning about market demand and paying benefits β to funders. If we assume that funds raised during a crowdfunding campaign should also cover some one-time investment costs, this result leads to the prediction that crowdfunding (reward-based crowdfunding) will be the preferred strategy for relatively small investment projects.

Chemla and Tinn (2019) predict that a smaller campaign size (they interpret it as a shorter campaign duration) is associated with a higher probability of crowdfunding success, and as such, is positively correlated with the attractiveness of crowdfunding that is consistent with the spirit of the above point. This is also consistent with empirical findings in Mollick (2014).

Ellman and Hurkens (2016) analyse the optimal design of an AON campaign when a firm faces consumers with high- and low-valuation of its product. The model predicts that crowdfunding campaigns should have a moderate size. In addition, crowdfunding is complimentary to traditional financing when fixed costs are large. The model also predicts that crowdfunding prices are lower than future spot sale prices.

Chen et al. (2018) consider a model where an entrepreneur designs a reward-based crowdfunding campaign that helps him and helps a venture capitalist (VC) as well learn information about demand. The project size is supposed to be sufficiently large; thus, VC participation is required. They find that entrepreneurs should use crowdfunding either when it is highly informative or when it is not informative at all. Otherwise, the benefits of crowdfunding cannot offset the risk of campaign failure. The authors also find that successful campaigns do not necessarily lead to VC funding.

In Catalini and Gans (2018), an ICO allows an entrepreneur to reveal consumer value via competition among potential buyers without the entrepreneur having to know, ex ante, consumer willingness to pay. This paper also predicts that initial funds raised are maximised by setting the growth in the supply of tokens to zero to encourage early investments.

Among other theoretical predictions, note the following. Sahm (2016) investigates a model of advance-purchase contracts (e.g., crowdfunding) and compares it with traditional financing. The model finds that advance-purchase arrangements are preferable for large-sized projects. Strausz (2017) argues that the extraction of information about market

demand has its drawbacks and that the entrepreneur should learn neither too much nor too little.

The main articles analysing the learning market demand idea, their predictions and empirical evidence are summarised in Table 1.

Table 1. Learning-based theories of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Schwienbacher (2018)	Crowdfunding is preferred to venture capital if demand uncertainty is high		
Chemla and Tinn (2019)	Higher uncertainty of demand increases profitability of crowdfunding; smaller campaigns (shorter duration campaigns) have higher probability of success; prices are smaller during crowdfunding compared to spot sales		Xu (2019), Mollick (2014), Chemla and Tinn (2019)
Miglo (2021c)	ICO is more likely than STO if demand uncertainty is higher		Amsden and Schweizer (2018)
Strausz (2017)	The amount of information learned by the firm during crowdfunding should not be too low or too high		
Ellman and Hurkens (2016)	Crowdfunding campaigns should have moderate size; prices are smaller during crowdfunding compared to spot sales; crowdfunding and traditional finance are complements when fixed costs are large and crowdfunding is a substitute for credit when fixed costs are small		Mollick and Kuppuswamy (2014)
Sahm (2016)	Large projects prefer crowdfunding compared to traditional financing		
Catalini and Gans (2018)	ICO helps reveal consumers' willingness to pay; ICO will be preferred to equity financing if the amount of required investment is not too large		
Chen et al. (2018)	Entrepreneurs should use crowdfunding either when it is highly informative or when it is not informative at all; successful campaigns do not guarantee subsequent VC funding		

3. Signalling Project Quality

Another important idea is that firms/entrepreneurs use crowdfunding or token issues to signal quality or other features of their projects. As was mentioned previously, entrepreneurial and innovative businesses and their projects often represent an "unread" book for market participants. Entrepreneurs try to mitigate informational problems either directly, by communicating to the public the description of their activities and new projects, or indirectly, by selecting actions which may have a favourable interpretation by potential investors.[9] This section discusses articles that have an element of "signalling" in their models that is usually based on firms selecting an appropriate financing/fundraising strategy.

To illustrate the idea, consider the following model. Consider a firm with an innovative product or service. Predicted sales of the product equal a. The cost of production equals c. There are two firms: a low-cost (high-quality) firm (L) and a high-cost (low-quality) firm (H). The cost of production is c_h for H and c_l for L; $c_h > c_l$. The firm does not have any initial resources. To finance the production of the product, firms can use reward-based crowdfunding or equity financing (including equity-based crowdfunding or traditional equity). Consider the perfect information scenario. Under reward-based crowdfunding the firm's profit is $a - c_i$. Under equity financing the firm's expected profit equals $(1 - \alpha)(a + M - c_i)$, where M is the amount of funds raised and α is a fraction of the firm's equity sold to investors. In order to assure that investors provide funds, the following

constraint must be satisfied: $\alpha(a + M - c_i) \geq M$. The solution is: $M = c_i$, $\alpha = c_i/a$. The firm's profit equals $a - c_i$. Note that both strategies can only work if $c_i < a$ and they have the same result for the firm (which is not surprising given a perfect market environment with symmetric information) (Modigliani and Miller 1958). Now consider asymmetric information.

Consider an equilibrium where H selects equity financing and L selects crowdfunding. H's profit equals $a - c_h$, the same as previously. If it decides to mimic L and selects reward-based crowdfunding, its payoff is the same $a - c_h$. Private information is related to the cost of production and not to the demand side; hence, it does not affect the outcome of reward-based crowdfunding. Firms will select their prices, as in the case with symmetric information, since the demand function is the same for any type of firm. Under reward-based crowdfunding, funders receive products and do not rely on any long-term firm profits. Under equity crowdfunding, investors/funders count on long-term profits of the firm (which are directly affected by firm costs) and it is reflected in the share price during the crowdfunding campaign. Therefore, if the low-quality (high-cost) firm uses equity-based crowdfunding it will not be mimicked by the high-quality firm. Indeed, L's equilibrium payoff is $a - c_l$. If L mimics H, then market participants think that this is type H. Note that in equilibrium $\alpha = c_h/a$ and $M = c_h$. L's payoff from mimicking H then equals $(1 - \alpha)(a + M - c_l) = \left(1 - \frac{c_h}{a}\right)(a + c_h - c_l)$. After simplifications we find that this is less than $a - c_l$ because $c_l < c_h$. Thus, L will not mimic H and such an equilibrium exists.

On the contrary an equilibrium an equilibrium where L selects equity financing and H selects crowdfunding does not exist because H will mimic L. Indeed, H's profit equals $a - c_h$. H's payoff from mimicking L equals (calculations are identical to these above) $\left(1 - \frac{c_l}{a}\right)(a + c_l - c_h)$. After simplifications we find that this is less than $a - c_h$ because $c_l < c_h$. Thus, H will mimick L and such an equilibrium does not exist.

Choice of financing strategy. The above analysis predicts that firms can use crowdfunding as a signal of quality. More specifically it predicts that asymmetric information favours reward-based crowdfunding. Miglo and Miglo (2019) analyse the firm choice between reward-based crowdfunding and equity-based crowdfunding and find that high-quality firms prefer reward-based crowdfunding as a signal. It would be interesting to apply similar ideas to the choice between ICO and equity financing under imperfect information. High-quality firms can use an ICO as a signal. The reason is that prices, production decisions and other parameters arising in equilibrium for a high-quality firm may not be suitable for a bad quality firm if the latter decides to mimic the high-quality firm. Note that Bourveau et al. (2018), De Jong et al. (2018), Ofir and Sadeh (2020) and Benedetti and Kostovetsky (2021) suggest that in order to be successful, an ICO should meet high quality standards, including the quality of "whitepapers" (technical documentation describing an ICO), good level of transparency, etc.

Fraction of equity retained by the entrepreneur. Our analysis implies that high-quality entrepreneurs will retain a higher fraction of equity in equilibrium compared to the low-quality type (reward-based crowdfunding does not reduce entrepreneurs' fraction of equity). To the best of our knowledge, this prediction has not been tested directly but is consistent with the spirit of Ahlers et al. (2015), Mollick (2014) and Vismara (2016): that the firm's financing choice can serve as a signal of firm quality, and also, that the entrepreneur's fraction of equity is associated with a higher quality. This idea can be extended to the case of token issues as well. Chod and Lyandres (2021) compare ICO with traditional equity-based financing (venture capital or VC), focusing on several factors including information asymmetry between entrepreneurs and investors. In their model, asymmetric information between firm and investors exists in the case of ICOs but not in the case of VCs. They show that ICOs can be by high-quality entrepreneurs who retain more tokens in their won possession (signalling by risk-bearing in the spirit of Leland and Pyle (1977)).

Some papers analyse signalling opportunities by selecting a different type of reward-based crowdfunding, namely, the choice between AON and KIA. They are mostly based on the main feature of AON, which is a condition that if a campaign target (threshold) is

not reached, the money is returned to funders/investors. This analysis also implies that when asymmetric information is important, high-quality projects prefer AON. Miglo and Miglo (2019) consider a model of the choice between reward-based crowdfunding (AON and KIA) and equity-based crowdfunding when private information concerns the product quality (and future demand for the product). It is shown that an efficient signalling in a one-period environment is impossible because a high-quality firm will always be mimicked by a low-quality firm. Then, the authors analyse a two-period environment. It is shown that under some conditions high-quality firms can use AON as a signal of quality. A low-quality firm may find it unprofitable to mimic this strategy as it will be taking more risk to achieve a threshold by deleting potential income, which can be costly in the second period. This prediction has not been directly tested but is consistent with the spirit of Cumming et al. (2019) that find that KIA campaigns are less successful in meeting their fundraising goals compared to AON. For example, the rate of success of campaigns on Kickstarter, which only uses AON, is higher than on Indiegogo.[10]

Some papers are focused on signalling opportunities related to a campaign target/threshold. To illustrate the idea, consider the following model. There are two firms: a low-quality firm (L) and a high-quality firm (H). The objective of each firm is to maximise the amount of funds collected during a crowdfunding campaign. Under perfect information about the firm's type, L can collect an amount a and H can collect b; $b > a$. Firms have two strategies: the first is AON (that as we know is characterised by a campaign target/threshold) and the second strategy is when a threshold is not established (for example, KIA, equity-based crowdfunding, traditional debt or equity, etc.). If AON is selected, there is a risk that funds will not be collected above an established threshold, in which case the campaign fails. This happens with probability $1 - p_1$ for type L and $1 - p_2$ for type H; $p_1 < p_2$. If the information is asymmetric, a separating equilibrium with H using strategy two does not exist. Indeed, if such an equilibrium exists, then H raises an amount b and L raises a (in a separating equilibrium, firm types are revealed to the public and the outcome is identical to the case with perfect information). However, in this case L mimics H because the market thinks that strategy two is selected by a high-quality type. Therefore, L will be able to raise an amount b. Since $b > a$, such an equilibrium does not exist. Now consider a separating equilibrium where H selects AON and L selects strategy two. The expected amount of funds raised for H is $p_2 * b$ and that of L is a. If L decides to mimic H and play AON, its expected payoff is $p_1 * b$ which can be smaller than a if $p_1 < a/b$. If H mimics L and selects strategy two, its payoff is a. This is smaller than $p_2 * b$ if $p_2 > a/b$. Thus, a separating equilibrium exists if

$$p_2 > a/b \text{ and } p_1 < a/b \tag{4}$$

which is possible because $p_1 < p_2$ and $a < b$.

Choice of threshold. Our analysis implies that high-quality firms can use AON to signal their quality. If (4) holds, then the threshold (assuming H selects b as a threshold) increases with firm quality. This is because mimicking will be unprofitable for a low-quality firm as it would imply a high risk of campaign failure. Chakraborty and Swinney (2021) consider a model where an entrepreneur has private information about its firm product quality. It is found that a large size campaign should be used by high-quality entrepreneurs. At the same time, Miglo and Miglo (2019) find that the relationship between a firm's quality and the campaign threshold is non-linear. They argue that the threshold should be neither very small nor very large. Note that Mollick (2014) and Cordova et al. (2015) find that larger targets do not lead to greater rates of success. Further research is required.

Signalling and the extent of asymmetric information (uncertainty about project quality). Equation (4) predicts that signalling opportunities exist when the extent of asymmetric information is large enough. Indeed, for any given value of p_1, the farther that p_2 is from p_1 means it is more likely that a separating equilibrium exists. Similarly for a given value of p_2, an equilibrium exists if p_1 is farther from p_2 or if p_1 is sufficiently small. Some empirical research suggests that it is very typical in crowdfunding for projects to attract

very low or negligibly small amounts of funds (see, for example, Mollick 2014; Cordova et al. 2015; Desjardins 2016). Therefore, the condition that p_1 should be sufficiently small is not unreasonable.

Among other papers, note the following. Hakenes and Schlegel (2014) analyse a model that compares traditional bank financing and debt-based crowdfunding. Compared with traditional loans, under crowdfunding good projects have more opportunities to receive funding. On the other hand, under crowdfunding entrepreneurs will establish low loan rates and low thresholds, which will generate too much information.

Kim et al. (2018) show that the amount of funds raised and the number of backers during the campaign have a nontrivial impact on the efficiency of crowdfunding. They present a model of funder behaviour on a crowdfunding platform and show that the campaign funding status and the number of funders-per-day positively affect the funder's utility. They then test their model and find that first, both signals have nontrivial impacts, and second, the funding status has a larger impact on the efficiency of outcomes.

Sayedi and Baghaie (2017) argue that both a small threshold and a high price should be used by the founders. Quite surprisingly, they also find that the lack of information about entrepreneurs leads to higher product qualities. Funders therefore benefit from an environment with asymmetric information and uncertainty.

In all the considered papers above, entrepreneurs send signals of their projects' qualities to potential investors or to the crowd. Some papers analyse a different type of signalling. Chen et al. (2018) consider a model where a reward-based crowdfunding campaign set up by an entrepreneur with a large innovative project serves as a signal of demand to a venture capitalist (VC). The participation of VCs is required for the entrepreneur because he needs a large number of investments followed by a crowdfunding campaign. Similarly, crowdfunding can be used by a firm to signal the quality of their firm to competitors (Miglo 2020). Low-quality firms would not necessarily mimic high-quality firms because this would imply a high cost of rewards.

The main articles analysing the signalling project quality idea, their predictions and empirical evidence are summarised in Table 2.

Table 2. Signalling theories of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Miglo and Miglo (2019)	High-quality firms use reward-based crowdfunding as a signal compared to equity-based crowdfunding; high-quality firms use AON as a signal compared to KIA; non-linear relationship exists between target and firm quality; reward-based crowdfunding campaigns have smaller size compared to equity-based crowdfunding; prices are higher and quantities are lower with crowdfunding		Cumming et al. (2019), Ahlers et al. (2015) and Mollick (2014), Cordova et al. (2015), Paakkarinen (2016), Tuo et al. (2020), Gabison (2015)
Chakraborty and Swinney (2021)	High-quality firms use higher campaign targets as a signal of quality		Devaraj and Patel (2016), Tuo et al. (2020)
Sayedi and Baghaie (2017)	A low campaign goal and a high pre-order price are positively correlated with quality; uninformativeness can be beneficial; high-quality producer's optimal strategy may be to opt out of the crowdfunding market		Koch and Siering (2019)
Hakenes and Schlegel (2014)	Target is too low and the interest rate is too low under debt-based crowdfunding		
Kim et al. (2018)	For AON projects funding status is a strong signal	Kim et al. (2018)	
Chen et al. (2018)	Entrepreneur chooses low target to signal quality to VC		
Chod and Lyandres (2021)	High-quality entrepreneurs retain more tokens during ICO		Davydiuk et al. (2019)

4. Network Benefits

Another line of research focuses on network benefits of crowdfunding and token issues. The following example illustrates the role of crowdfunding in overcoming coordination failure and equilibrium multiplicity. Suppose there are two prospective consumers/buyers of a firm product. Suppose the firm sells the product on the spot market and the price for the product is p. Each consumer gets a number of benefits v if buying the product and $v+s$ if and only if the other consumer also buys the product, where s is the network benefit (exchange of ideas, community sense, etc.). Hence, the matrix of payoffs (Table 3) is:

Table 3. Matrix of payoffs 1.

Player 1/Player 2	Buy	Not to Buy
buy	$v+s-p, v+s-p$	$v-p, 0$
not to buy	$0, v-p$	$0, 0$

There are two Nash equilibria in this (coordination) game, if

$$v < p < v+s \tag{5}$$

either both investors participate in the campaign, or neither join. The multiplicity of equilibria opens the door for social value loss.

Crowdfunding. If instead of using spot sales the firm presell the product using crowdfunding, potential buyers/funders can observe other funders' strategies (e.g., crowdfunding campaigns update information about the number of pre-sold items). In this case we can assume that the game becomes dynamic (and not strategic as described above). In this case the only equilibrium is one where both consumers participate. A similar idea can be applied to utility token issues.

Financing choice and the extent of community benefits. Crowdfunding or token issues are more likely for products with large community benefits. Indeed, if s is sufficiently large then entrepreneurs have large opportunities to create profits. Suppose that the cost of the product is c for the entrepreneur. In equilibrium, the entrepreneur's profit equals $2(p-c)$, where the maximal price that can be charged is $v+s-e$ and where e is a sufficiently small number. Thus, the entrepreneur's profit is $2(v+s-e-c)$. A higher s leads to higher profits for the entrepreneur. It is observed that tokens and crowdfunding are especially popular in sectors or segments of the market with large network benefits (Kromidha and Robson 2016; Brown Ross and Rowe 2019; Mourao et al. 2018; Drasch et al. 2020). Drasch et al. (2020) further argue that the network benefits of tokens should be weighted by tokenholders against the upside potential of future token value growth.

Production cost and the choice of financing. As follows from (5), coordination problems under crowdfunding would be avoided if the production cost of the firm is either very small or very high. Indeed, suppose that the cost per product is c. The product price should at least cover cost. If the cost is not sufficiently small and not very large, i.e., if, for example, $v+s > c > v$, then the only situation when the entrepreneur can make profit is $v < p < v+s$,which will imply equilibrium multiplicity. A similar situation can arise if the fixed cost of the campaign or crowdfunding fees are not sufficiently small.

Deb et al. (2019) study reward-based crowdfunding campaigns. In their model two types of funders exist: some of them want to consume the product ("buyers"), whereas others just want the firm to be successful. There is a coordination problem among buyers. The paper describes possible equilibria in the game and provides a comparative analysis of factors affecting the probability of campaign success. In addition, the paper suggests that projects that finish close to the deadline are usually driven by the second type of funders, whereas projects that finish early are primarily driven by the first type.

The ideas of coordination problems and multiplicity equilibria can be applied to token issues as well. Similar to a crowdfunding campaign, the benefits of ICO participants

depends on the degree of other agents' participation. Li and Mann (2018) present a model of ICO that has two features: on one hand, an ICO solves a coordination failure inherent in many platforms with network effects; and on the other hand, harness the "wisdom of the crowd" by aggregating dispersed information about platform quality. The model predicts that multiple stages of ICO (pre-sale of tokens, sales of tokens and launching a platform) is a part of optimal design. Multiple stages of ICO help mitigate coordination problems, but also help mitigate differences in private values of different agents. Agents with the highest values will move first and their actions will motivate users with lower valuations, etc. A universal ban on ICOs is not optimal. Additionally, the model is consistent with the point that an ICO can quickly attract a large number of investors.

Sockin and Xiong (2020) develop a model to analyse the determinants of the fundamental value of a token. They argue that the trading price and volume of the cryptocurrency help with aggregating private information about cryptocurrency fundamentals, and secondly, they also facilitate coordination in equilibrium. Bakos and Halaburda (2018) develop a model to investigate the use of tradable digital tokens to solve a coordination problem. They show that tokens have higher value if the platform succeeds and help with supporting equilibria favourable to the platform. They also argue that pure utility tokens have certain characteristics of equity because the buyers of tokens enjoy the future gains if the platform succeeds.

Among other ideas, note the following.

In Belleflamme et al. (2014), participants of crowdfunding campaigns enjoy community benefits. It is argued that equity-based crowdfunding should be preferred by large projects.

Catalini and Gans (2018) analyse a model that compares ICO and equity financing. In their model, tokens can mitigate coordination problems among participants in the presence of network effects.

Cong et al. (2021) provide a dynamic asset-pricing model of (crypto-)tokens on (blockchain-based) platforms. In their model, network benefits increase with the size of the platform. Large size means that more community benefits can be realised by users using the platform. They argue that the demand for tokens increases if technical progress is expected. In this case the token price is expected to grow and attract more users.

Some papers started to analyse a different type of network advantage of crowdfunding. Namely, it can also benefit firms operating in a competitive network with multiple producers. The following illustrates the idea. Consider a firm that can choose between selling its product on a spot market (value is v) and via crowdfunding ($v - \beta$). Buyers are rewarded a benefit β for waiting; $\beta < v$. There are four potential buyers. If sales include two stages (crowdfunding and spot sales) buyers are split 50–50 between the first and second stages. Without crowdfunding, the firm's expected profit is $4v$. With crowdfunding, the firm's expected profit equals $4v - 2\beta$. Since the former is greater than the latter, crowdfunding is useless under a monopoly (one firm).

Now consider the case with two firms. Suppose that if two firms are on the spot market, buyers are split 50–50 between firms. In stage one, the following situations can occur: both firms select spot sales (denote this strategy S); both firms select crowdfunding (denote this strategy CF); Firm 1 selects CF and Firm 2 selects S; or Firm 2 selects CF and Firm 1 selects S. If both firms select S, the equilibrium firms' profits are $\pi_1 = \pi_2 = 2v$. If both firms select CF, the equilibrium firms' profits are $\pi_1 = \pi_2 = 2v - \beta$. Indeed, in this case each firm gets two buyers: one of them pre-orders the product during crowdfunding. Now consider the case when one firm (suppose Firm 1) selects CF and Firm 2 selects S. During crowdfunding, Firm 1 pre-sells two goods and on the spot market 2 remaining buyers are split 50–50 between firms. Therefore, Firm 1's profit equals $3v - \beta$ and Firm 2's profit equals v.

Then the matrix of payoff (Table 4) will become:

Table 4. Matrix of payoffs 2.

Firm 1/Firm 2	S	CF
S	$2v, 2v$	$v, 3v-\beta$
CF	$3v-\beta, v$	$2v-\beta, 2v-\beta$

Since $v > \beta$, the only equilibrium is one where both firms use crowdfunding.

The main articles analysing the network benefit idea, their predictions and empirical evidence are summarised in Table 5.

Table 5. Network benefit theories of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Belleflamme et al. (2014)	Crowdfunding price is higher than sale price; equity-based crowdfunding projects are larger than reward-based crowdfunding projects; asymmetric information favors equity-based crowdfunding		
Catalini and Gans (2018)	Size of projects with ICO is smaller compared to traditional equity financing		
Li and Mann (2018)	Multi-period trade is preferred to one-stage trade; universal ban on ICO is not optimal; ICO can quickly attract a large number of investors		
Sockin and Xiong (2020)	A rising token price is positively correlated with higher fundamental in the high price equilibrium, whereas it is indicative of lower fundamental in the low price equilibrium; technical analysis may lead to erratic trading behavior		
Bakos and Halaburda (2018)	ICO is preferred to traditional financing if the firm has capital constraint		
Cong et al. (2021)	A weaker network effect implies a more aggressive token issue		
Deb et al. (2019)	The distribution of campaign completion times is U-shaped; projects that fail often fail with only a small amount raised; tend to drop off sharply after a campaign meets its funding goal, whereas purchases continue	Deb et al. (2019)	
Drasch et al. (2020)	Two-sided incentives for platform participants: on one hand, the increasing number of platform participants results in an increase of the token value during platform operation; on the other hand, this benefit can weigh against token price growth potential		Haffke and Fromberger (2018), Momtaz (2019)

A new/growing line of research is related to donation-based crowdfunding that uses coordination problem/network effect ideas. Argo et al. (2020) argue that the non-observability of other donors' contributions implies the uncertainty about the recipient's ability to collect the necessary amount of funds and/or private benefits, and that making a deciding contribution to the projects can improve the campaign outcome for donation-based crowdfunding. Cason and Zubrickas (2019) argue that the all-or nothing feature of

crowdfunding (refund bonuses) can also improve the coordination problems and ultimately can improve the outcome of donation-based crowdfunding.

In terms of future research, one can apply network ideas to analyse the choice between ICO and IEO. For many entrepreneurs this issue seems to be very important.[11] One can argue that an IEO will be preferred if the promotion effect of listing (which is related to accessing a larger network of potential investors) is sufficiently large and when investment size is relatively large.

5. Mitigating Moral Hazard Problems

Moral hazard refers to situations where the actions of managers/entrepreneurs are not observable and/or not verifiable by investors. Two types of moral hazards seem to be dominating the theoretical literature on crowdfunding and token issues: one is related to entrepreneurial costly effort (in the spirit of Jensen and Meckling (1976)) and the other one is related to the possible diversion of funds by the entrepreneur (in the spirit of Jensen (1986)).

5.1. Moral Hazard Related to Entrepreneur's Costly Effort

Under AON, the entrepreneur's payoff is risky; thus, when choosing his level of effort he is facing a trade-off between the marginal cost of effort (the entrepreneur bears 100% of the cost increase) and expected benefits, which are weighted by the risk of campaign failure. In these conditions, entrepreneurs of high-quality ventures will be providing more effort than those of low-quality ventures.

The following model illustrates this point. Consider a firm with an innovative product or service. The firm is run by an entrepreneur who can provide either a high or low level of effort during the campaign of raising funds. Let c be the cost of effort. If the effort is high ($c = e$), the firm can raise an amount of B with probability p_h, and 0 otherwise. If the effort is low ($c = 0$), the firm can raise A with probability p_l; $A < B$, $p_l < p_h$. We assume that both strategies have positive net-present value (NPV), i.e.,

$$p_h B > e \text{ and } A > 0 \tag{6}$$

(the latter implies that $p_l A > 0$). In addition, if the campaign is successful, it will be the second period of production during which the firm will generate a profit $X + x$, where x depends on the crowdfunding campaign threshold. If the company sets a high threshold during the campaign, it can generate more profits in the second period since it creates more trust in the firm (and its product). The firm has three strategies: KIA; AON with threshold A and AON with threshold B. We assume that $x = b$ if the threshold was B and $x = a$ if the threshold was A; $a < b$. Additionally, $x = 0$ in the case of KIA.

The firm's expected payoff under KIA is

$$p_h B + X - e \tag{7}$$

if the effort is high and

$$p_l A + X \tag{8}$$

if the effort is low. The firm's expected payoff under AON and threshold A is

$$p_h(B + X + a) - e \tag{9}$$

if the effort is high and

$$p_l(A + X + a) \tag{10}$$

if the effort is low. Finally, under AON with a threshold B the profit is

$$p_h(B + X + b) - e \tag{11}$$

if the effort is high and 0 if the effort is low (a high threshold will not be reached if the effort is low). Equation (6) implies that (11) is positive, and therefore, there is no sense to set a high threshold and undertake low effort because in this case the entrepreneur's payoff is zero. Next, note that (11) is greater than (9). It implies that there is no sense to undertake a high amount of effort and set a low threshold.

Two cases are possible. First, consider $p_h B - p_l A > e$. This implies that (7) is greater than (8). It means that a high effort under KIA is better than a low effort. It also means that (11) is greater than (10) because $A < B$, $p_l < p_h$ and $a < b$. Therefore, the choice for the entrepreneur is now between KIA with high effort and AON (threshold B) with high effort. If $p_h > X/(X+b)$, AON will be chosen, and vice versa.

Now consider $p_h B - p_l A < e$. Then in turn two cases are possible. First, consider $p_h(B+X+b) - e > p_l(A+X+a)$. Now the choice is between AON with high effort and threshold B and KIA with low effort. The former is preferred if

$$p_h(B+X+b) - e > p_l A + X \tag{12}$$

Second, consider $p_h(B+X+b) - e < p_l(A+X+a)$. Then the choice is between AON with low effort and threshold A and KIA with low effort. The former is preferred if $p_l > X/(X+a)$.

Probability of success and crowdfunding type. The main prediction of the above analysis is that the only case when the entrepreneur selects different levels of effort for different types of crowdfunding is one where he selects a high level of effort under AON (and a high threshold) and a low level of effort with KIA. Cumming et al. (2019) suggest that KIA campaigns are less successful in achieving their objectives, which is consistent with the spirit of the above results. For example, the expected probability of success on Kickstarter, which uses AON, is usually higher than that on Indiegogo.

Cost of effort and the extent of continuation benefits. The above choice (between AON with a high threshold and high level of effort and KIA with a low level of effort) depends on (18). As follows from (18), AON is more likely when the cost of effort is relatively low and the continuation effects are low, such as in the scenario when the firm does not benefit from a trust increase, i.e., the value of X. If X is high, then KIA is preferred. This is intuitive, since with KIA there is not a risk to discontinue the firm.

Schwienbacher (2018) analyses a model of choice between crowdfunding and venture capital that is based on moral hazard problems. Similar to the spirit of the analysis above, the paper finds that under AON the best strategies are either to have a large target and deliver a high level of effort or a small target and low effort. An entrepreneur prefers the former if the effort cost is relatively low or when the demand uncertainty is high. In addition, the entrepreneur prefers crowdfunding to venture capital if the effort cost is low or when the demand in a low-demand scenario is very small. This is because continuation happens under VC more often than under AON; however, this continuation may be inefficient in a low-demand scenario if the demand is very low in this case. Schwienbacher (2018) also argues that firms increase their crowdfunding target if the risk of project discontinuation increases. This takes place, for example, when there is a risk that the idea can be mimicked by competitors. The presence of professional investors (business angels, venture capitalists) reduces the entrepreneurs' incentives in crowdfunding. On the other hand, professional investors can reduce the entrepreneur's risk-taking, which in turn implies that crowdfunding is a complement rather than a substitute to existing investors.

Among other papers, note the following.

Babich et al. (2019) study an optimal financing strategy for a start-up that can include crowdfunding, venture capital (VC) and traditional debt. A moral hazard problem exists between an entrepreneur and a bank, and a double-sided moral hazard problem exists between the entrepreneur and VC (both sides are affected). Under crowdfunding, the entrepreneur should take into account the expected scenario after the campaign is finished, including future financing opportunities. In some cases, a successful campaign can reduce the firm's chances with VC because it can worsen moral hazard problems. For example,

it can be the case when the probability of project success is too high prior to bargaining with VC or when the amount of funds raised during the campaign is too large (overfunded project), which can exacerbate competition from banks and worsen the position of VC, and ultimately worsen the outcome of bargaining as well. The finding that VC can walk away after a successful crowdfunding campaign is consistent with Ryu et al. (2019). Babich et al. (2019) also suggest that the likelihood of negative effects from crowdfunding is high among projects with relatively low capital requirements.

Miglo and Miglo (2019) analyse the role of different market imperfections in crowdfunding, including the effect of moral hazard issues on pricing and production strategies. Under equity-based crowdfunding the fraction of shares retained by the entrepreneur is reduced (in the spirit of Jensen and Meckling (1976)). Miglo and Miglo (2019) suggest that prices can be higher and the quantity produced can be lower under equity-based crowdfunding compared to reward-based crowdfunding. This seems to be indirectly consistent with, for example, Paakkarinen (2016) in that equity-based crowdfunding may have fewer customers, but higher margins. In more general terms, moral hazard issues related to the entrepreneurial effort might be more important under equity-based crowdfunding (see, for example, Gabison (2015) and also Paakkarinen (2016) that noted that equity-based crowdfunding is more constricted in comparison to other forms of crowdfunding).

Moral hazard ideas related to entrepreneurial costly effort can also be applied to the analysis of token issues. Garratt and van Oordt (2019) study a model of ICO that includes entrepreneurial moral hazard. The model generates conditions when an ICO is preferred to traditional debt or venture capital. Garratt and van Oordt (2019) find that an ICO can be the only strategy that induces an optimal effort. This is because under an ICO, token value is not proportional to firm profit, and the effect of moral hazard is different from traditional equity financing or debt financing. In particular if the entrepreneur's effort leads to cost saving rather than revenue increase, an ICO does not create any distortions in terms of effort choice.

Miglo (2021c) studies the choice between utility tokens and STO under moral hazard and demand uncertainty. Security tokens can help with improving the incentive of firm partners, including professional blockchain participants that are involved in the project (website platform) development. Thus, STO will be preferred if the extent of moral hazard problems is larger than that related to the degree of uncertainty regarding market demand. Next, Miglo (2021c) includes utility tokens with profit rights into the basic model and demonstrates that this type of token dominates regular utility tokens (i.e., without profit rights) and security tokens. This is indirectly consistent with Adhami et al. (2018) that find higher returns for firms when tokens provide additional services including profit rights.

Chod et al. (2021) compare traditional equity financing and ICO in a model that includes entrepreneurial moral hazard since the entrepreneur's effort is costly. Their model also includes corporate governance considerations because it affects a potential hold-up problem related to the point that costs of participants joining the platform become sunk after being paid (for a model of choice between token issues and equity financing that includes entrepreneurial moral hazard see also Malinova and Park (2018) and Gryglewicz et al. (2021)).

The main articles analysing the moral hazard idea based on entrepreneurial costly effort, their predictions and empirical evidence are summarised in Table 6.

Table 6. Moral hazard-based theories of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Schwienbacher (2018)	Crowdfunding is complimentary to venture capital financing rather than substitute; entrepreneur prefers crowdfunding to venture capital if the effort cost is low or when the demand in low-demand scenario is very small; entrepreneur prefers crowdfunding to venture capital if the effort cost is low; high threshold and high effort is preferred to low threshold and low effort if effort cost is low		
Babich et al. (2019)	Successful crowdfunding campaign may not necessarily be beneficial for the firm; projects that may not be beneficial if crowdfunding succeeds are likely to be ones with relatedly low external capital required		Ryu et al. (2019)
Garratt and van Oordt (2019)	ICO is preferred to venture capital for projects with low gross-profit margins; low required amount of capital		
Miglo (2021c)	STO dominates ICO when the extent of moral hazard problems is large; Utility tokens with profit rights (hybrid tokens) dominate ICO and STO when both moral hazard and demand uncertainty are present		Adhami et al. (2018)
Chod et al. (2021)	Issuing tokens rather than equity mitigates effort under-provision; decentralised governance associated with tokenisation eliminates a potential holdup of platform users		

5.2. Moral Hazard Related to Funds Diversion

Another issue is that an entrepreneur may divert funds raised during crowdfunding campaigns or token issues. Several factors contribute to this phenomenon. One is weakness in bankruptcy laws related to crowdfunding. Secondly, since the nature of a crowdfunding campaign includes selling (or pre-selling) the products of the firm before the production process even starts,, the economic incentive to start production is weakened.

The following model illustrates this point. Consider a firm with an innovative product or service. The firm plans to make an investment I and then sell the product for two periods. The production is $q_t, t = 1, 2$. The cost per item equals c. In each period, the demand is $p_t = a - q_t$ If a firm uses crowdfunding, the funders (those who pre-order the product during period one) expect to receive an extra-benefit (reward) β from the firm. The firm is owned and run by an entrepreneur that is subject to moral hazard. At the end of period one, he is able to divert funds received during period one (crowdfunding stage). In this case the entrepreneur's profit equals aF, where F is the amount of funds raised during a crowdfunding campaign and a is the probability of not beign caught (a parameter that reflects the institutional strength).

Consider period two. When selecting p_2, the firm maximises its expected profit, which equals $(p_2 - c)q_2 = (p_2 - c)(a - p_2)$. The solution is:

$$p_2 = \frac{a + c}{2}$$

The firm's expected profit is

$$\frac{(a - c)^2}{4} \tag{13}$$

Without moral hazard problems, in period one, when selecting p_1, the firm maximises its expected profit, which equals $(p_1 - c - \beta)q_2 - I = (p_1 - c - \beta)(a - p_2) - I$. The solution is:

$$p_1 = \frac{a + c + \beta}{2}$$

The firm's expected profit is

$$\frac{(a - c - \beta)^2}{4} - I \tag{14}$$

The total amount funds raised during crowdfunding (period one) equals:

$$F = p_1 q_1 = \frac{a + c + \beta}{2} \frac{a - c - \beta}{2}$$

With moral hazard, the entrepreneur faces the following choice. If he continues with the project, the profit over two periods equals the sum of (13) and (14):

$$\frac{(a - c - \beta)^2}{4} - I + \frac{(a - c)^2}{4} \tag{15}$$

If he diverts funds, the profit equals

$$\alpha F = \alpha \frac{a + c + \beta}{2} \frac{a - c - \beta}{2} \tag{16}$$

If the following holds

$$\frac{(a - c - \beta)^2}{4} - I + \frac{(a - c)^2}{4} < \alpha \frac{a + c + \beta}{2} \frac{a - c - \beta}{2} \tag{17}$$

then (16) is greater than (15), and the entrepreneur has an incentive to divert funds. Funders will anticipate it and the campaign cannot be successful.

Investment size. The likelihood that (17) holds increases with I. It means that crowdfunding should be preferred if the amount of required investment is relatively small. Strausz (2017) analyses firm interactions with potential investors using the mechanism design approach. Crowdfunding improves the revelation of information about future demand for the firm's products. On the other hand, under crowdfunding there is a moral hazard problem related to the diversion of potential funds.

Campaign threshold. To explain the point, consider the case with $I = 0$, $\beta = 0$ and $\alpha = 1$. Then (17) holds if $c < a/3$. It demonstrates inefficiency. In an ideal world any project with $c < a$ should be undertaken. However, in the second-best world only highly efficient projects may survive. In terms of threshold, if the company sets a threshold below the minimal accepted by the market, it will not be accepted. Thus, a minimal threshold is: $F = p_1 q_1 = \frac{a+c}{2} \frac{a-c}{2}$. Note that it is negatively correlated with c, implying that high quality firms should have a higher threshold. The minimal acceptable threshold is $\frac{a+a/3}{2} \frac{a-a/3}{2} = \frac{a^2}{3}$. Chemla and Tinn (2019) argue that a larger crowdfunding campaign target mitigates the chance that funds will be diverted by the entrepreneur.

Regulation, transparency and the cost of crowdfunding. As follows from (17), if a increases the likelihood that (17) holds, it is more likely that crowdfunding should be selected. The same holds if β decreases. Strausz (2017) finds that efficiency is sustainable only if returns exceed investment costs by a significant margin reflecting the degree of moral hazard.

Ellman and Hurkens (2017) provide a simple example of a crowdfunding design that tolerates some fraud risk.

Belavina et al. (2020) analyse reward-based crowdfunding by using a model where entrepreneurs have the ability to run away with funders' investments and where a product description can be misleading. They show these effects can negatively affect the damage

created by each effect separately. The authors consider different mechanisms to mitigate these effects. One of their suggestions consists of forcing the entrepreneurs to stop the campaign once the campaign threshold is reached. Another suggestion, for example, involves escrowing any funds received after the target was reached.

Chod and Lyandres (2021) compare token financing with traditional equity financing. Their analysis includes agency problems. An entrepreneur may not invest the cash received during an ICO in the production process. Chod and Lyandres (2021) argue that ICOs should dominate equity for ventures developing information goods or services, i.e., those for which entrepreneurial effort is crucial, and/or those with relatively low payoff volatility. Among other papers on ICOs that assume that entrepreneurs have an ability to divert cash, note, for example, Gan et al. (2021).

We have not found any theory specifically related to NFTs, but as mentioned in Bao and Roubaud (2022) and Chalmers et al. (2022), a high level of risk related to fraudulent activities by entrepreneurs and moral hazard issues is an important part of the NFT agenda and empirical evidence; thus, more research is expected in this area.

The main articles analysing the moral hazard idea based on funds diversion, their predictions and empirical evidence are summarised in Table 7.

Table 7. Moral hazard-based theories (part 2) of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Strausz (2017)	Crowdfunding should be preferred if required investment is smaller than expected profit by a significant margin; deferred payments should be a part of optimal mechanism		
Ellman and Hurkens (2017)	Actively monitor entrepreneurs to compensate		
Belavina et al. (2020)	Two deferred-payment mechanisms should be a part of optimal mechanism		
	Firms prefer ICO to IEO if the extent of moral hazard issues is relatively small; IEO will be preferred if the investment size is relatively large, the extent of moral hazard problems faced by the firm is relatively large and the degree of investors' impatience is relatively small		ICO/STO Report (2020)
Chemla and Tinn (2019)	AON dominates KIA in mitigating moral hazard problems; higher than optimal threshold; many campaigns are overfunded		Mollick (2014), Cumming et al. (2019)
Chod and Lyandres (2021)	ICO dominates venture capital (VC) financing when VC investors are under-diversified, when the idiosyncratic component of venture risk is large enough, when the payoff distribution is sufficiently right-skewed and when the degree of information asymmetry between the entrepreneur and ICO investors is not too large		
Gan et al. (2021)	Agency costs of ICO are less important when product margins and demand characteristics improve, and are less severe under equity (rather than utility) token issuance; ICO raises more funds than reward-based crowdfunding, but is better suited for higher-margin products; the percentage of tokens sold is negatively correlated with post-ICO performance		Lyandres et al. (2020)

6. Behavioural Finance-Related Factors

This section reviews articles that incorporate behavioural finance in their models. One example is entrepreneurial overconfidence (see, e.g., Hayward et al. 2006; Everett and Fairchild 2015). One idea is that crowdfunding can mitigate inefficiencies due to entrepreneurial bias. The following example proves an illustration (based on Miglo (2021b)).[12] Consider an entrepreneurial firm that plans a crowdfunding campaign and knows the potential demand for its product. Under reward-based crowdfunding the firm should be able to determine an optimal price and quantity produced because the demand is known. Now suppose that the entrepreneur is overconfident and overestimates the demand. In this case the entrepreneur will offer a price which is higher than optimal, which will not only reduce the demand but also the firm's overall profit. Now consider equity-based crowdfunding. During the sale of shares, a rational entrepreneur (i.e., the entrepreneur that is not biased with regard to demand estimation) will expect some amount of cash that should be equal to the amount needed, from a rational entrepreneur's point of view, in order to produce the optimal quantity of the product. Now suppose that the entrepreneur is overconfident. In this case, during the sale of shares he will expect to receive a higher amount of cash. After observing the "real" amount, the entrepreneur will realise that the mistake was made in estimating the product demand and he will be able to make some adjustments during the production stage compared to his initial thoughts.

Fairchild et al. (2017) analyse a model of a choice between venture capital and crowdfunding. Venture capital provides "network benefits", whereas crowdfunding investors demonstrate emotional excitement when using a platform. In addition, the entrepreneur is overconfident (with regard to benefits of the venture capital network and the level of crowd excitement). Under venture capital financing, there is a moral hazard problem related to the choice of the venture capitalist's level of effort (in addition to the entrepreneur's own effort). The firm should weigh all of these factors in selecting the best strategy. For example, it is shown that a higher level of overconfidence usually benefits venture capital financing.

Belleflamme et al. (2013)[13] compared for-profit and non-profit firms when conducting a crowdfunding campaign. In non-profit firms, the managers' objective function is different from that of for-profit firms and includes a social factor. They argue that crowdfunding campaigns of non-profit-based firms are usually more successful than other firms. This is consistent with a more general idea that non-profit organisations may find it easier to attract money for initiatives that are of interest for the general community due to their reduced focus on profits.

In Belleflamme et al. (2014)[14], a firm is facing potential funders with different demand functions. A funder's surplus from buying the product is $v - p$, where p is the price and v is the funder's product valuation. The v is uniformly distributed between 0 and a. All backers with a v greater than p will buy the product, making the demand $q = a - p$. On the spot market, the remaining investors will buy if $v > p_s$, where p_s is the spot price. If $p_s \geq p$, no one will buy on the spot market because it would be optimal to order during crowdfunding. Therefore, the crowdfunding model becomes essentially just a spot market model (i.e., there is no special role for crowdfunding). The only way crowdfunding makes sense is in the case where $p_s < p$. However, this case contradicts the no-arbitrage condition for the equilibrium concept: why would consumers buy for a high price during crowdfunding? Belleflamme et al. (2014) argue that if the objective function of funders is modified and includes additional (e.g., social) benefits, the solution changes. Although some researchers support the significance of these benefits (see, for example, Schwartz 2015), others find that their role seems to be negligeable (for example, Cholakova and Clarysse 2015). Additionally, Belleflamme et al. (2014) predict that the crowdfunding price should be higher than the spot sale price, which is empirically controversial because for most campaigns the opposite is true.

Miglo (2021b) considers a model of the choice between the different types of crowdfunding, which contains elements of the asymmetric information approach and behavioural finance (overconfident entrepreneurs).[15] The paper finds that equity-based crowdfunding

is a more efficient tool of learning about market wisdom for an entrepreneur, which is consistent with Arkrot et al. (2017).

The main articles analysing the moral hazard idea based on funds diversion, their predictions and empirical evidence are summarised in Table 8.

Table 8. Behavioural finance-based theories of crowdfunding and token issues.

Paper	Predictions	Direct Tests	Indirect Evidence
Fairchild et al. (2017)	A higher level of overconfidence usually benefits venture capital financing	Fairchild et al. (2017)	
Belleflamme et al. (2013)	Crowdfunding is preferred for small campaigns compared to traditional funding; non-profit firms can be more successful with crowdfunding than for-profit businesses	Belleflamme et al. (2013)	
Belleflamme et al. (2014)	Crowdfunding price is higher than spot price		
Miglo (2021b)	Equity-based crowdfunding can be more efficient than reward-based crowdfunding when entrepreneur is overconfident		Arkrot et al. (2017), Lin and Pursiainen (2018)

7. Other Theories of Crowdfunding and Token Issues

This section provides a review of articles which have not been covered previously. We also comment on other theories in related fields (e.g., capital structure theory) and discuss their connections to the theory of crowdfunding and token issues.

Kumar et al. (2020) study the trade-off between price discrimination abilities and the cost of financing constraints. They analyse the optimal design of crowdfunding contracts. Greater financing constraints reduce the ability of the firm to extract surplus but may increase production. Kumar et al. (2020) show when pre-sale price-discriminating contracts are implementable.

Brown et al. (2020) analyse a model of crowdfunding where investors can acquire some information about a project's quality. The entrepreneur gets a signal by observing fundraising amounts and then decides whether or not to undertake a risky project. There is a "non-investment threshold" that creates a "loser's blessing", i.e., the presence of the threshold encourages contributing without information by reducing the risk of investment in bad projects.

Cong and Xiao (2018) focus on investors' learning during the crowdfunding campaign. They consider AON using a classical model of information cascade. They find that a campaign target plays an important role in imitating preceding agents' rejections.

Chang (2016) considers a model where backers are assumed to cooperate in deciding whether to invest after observing a common signal about the value of the project. The firm will use crowdfunding in order to cover the difference between the project cost and other sources of funding.

Alaei et al. (2016) consider a model of crowdfunding in which funders arrive sequentially and decide whether to invest or not. Funders prefer not to invest if they think the campaign will not succeed. This can lead to cascades where a campaign fails to reach the threshold even when the product is socially efficient. The paper provides guidelines about how firms should design their campaigns in order to maximise the chances of success. Du et al. (2017) also consider a model where backers arrive sequentially at a crowdfunding project. They show that there exists a "cascade effect" on funders' contribu-

tions. Du et al. (2017) also conduct empirical analysis of their model. According to their data, the majority of projects fail to achieve their goals. They suggest different policies that can be used to mitigate this problem. They argue, e.g., that the optimal policy has a "cutoff-time" structure, and that the benefit of such a policy reaches its maximum in the middle of campaigns. Empirical analysis confirms their result.

Li (2018) studies a general contracting problem between investors and firms and the role of profit sharing in collecting the "wisdom of the crowd". It discusses specific implications of the security design and crowdfunding.

Zhang et al. (2017) develop a model of crowdfunding dynamics that maximises revenue for a given campaign. They show, for example, that under the optimal design, the success of campaigns decreases as the goal of a campaign increases, with a more pronounced effect for both very low and very high campaign goals. They also show that campaigns with high goals benefit from highly uncertain environments more than campaigns with low goals.

Hu et al. (2015) study the optimal product and pricing decisions for AON. When the buyers are sufficiently heterogeneous in their product valuations, the firm should offer different levels of product quality. If the firm uses crowdfunding, the quality gap between products can be reduced.

Lee and Parlour (2019) compare crowdfunding, ICO and traditional bank financing. ICO has a liquidity advantage over crowdfunding since tokens (claims for firm products) can be resold. The paper provides testable implications, e.g., it predicts that crowdfunding projects are less profitable than bank-financed projects.

Momtaz (2022) suggests a model that analyses pros and cons of ICO or decentralised finance (DeFi) as compared to financing with intermediaries (centralised financing) and argues that DeFi may imply large search frictions and that the presence of intermediaries in blockchain technology can help reduce these frictions.

Miglo (2022) compares crowdfunding and bank financing using learning market demand and moral hazard ideas. The former benefits crowdfunding, whereas the latter benefits bank financing. The paper finds that: large crowdfunding campaigns usually are less efficient in mitigating moral hazard problems than small campaigns and high-profit projects and projects with potentially large markets will tend to select bank financing, whereas largest-sized projects should select mixed financing where the firm uses a short crowdfunding campaign and a bank loan.

Among other theories, note the following. Myers and Majluf (1984) developed the pecking order theory. Equity is dominated by internal funds and debt in this theory. With regard to crowdfunding, we have not found any specific research utilising similar ideas, for example, of a choice between equity-based and debt-based crowdfunding. However, consistent with this idea, the volume of debt-based crowdfunding exceeds that of equity-based crowdfunding.

Other leading financing theories include the trade-off theory and life cycle theory. The trade-off theory suggests that capital structure reflects a trade-off between the tax benefits of debt and the expected costs of bankruptcy (see e.g., Kraus and Litzenberger 1973). Life cycle theory is based on the idea that firms in the development stage do not have a favourable track record (i.e., credit ratings) of borrowing (Diamond 1991) and are most likely to be turned down for credit when they need it the most. Mature firms use, in general, more debt than start-up firms. With regard to crowdfunding, it would be interesting to see if similar ideas apply, for example, to a choice between equity-based and debt-based crowdfunding.

Harris and Raviv (1988), Aghion and Bolton (1992) and Hart (1995) argue that firms issue debt as a tool of establishing an appropriate control structure. With regard to crowdfunding, we have not found any specific research utilising similar ideas, for example, of a choice between equity-based and other forms of crowdfunding or between STO (which gives control rights to investors) and ICO/IEO.

8. Discussion and Conclusions

Crowdfunding and token issues are among the latest innovations in the area of entrepreneurial financing, which is a very important area for small businesses, innovative businesses and start-up businesses that constantly face different kinds of problems. In contrast to traditional ways of raising funds, these innovations use modern technology much more actively; are usually quicker in reaching potential investors/funders and use more active network benefits such as, for example, a large number of interactions between investors/funders and between funders and firms. This article provides a review of the growing number of theoretical papers in the areas of crowdfunding and token issues, compares their findings with empirical evidence and discusses directions for future research.

Theories of crowdfunding and token issues are on the rise, but the structure of these fields is still not established clearly. Learning market demand, signalling project quality, using network benefits and mitigating moral hazard problems and behavioural biases seem to be the most popular lines of research. Our analysis shows the following. (1) A significant gap exists between theoretical and empirical articles on crowdfunding and token issues, similar to no other area of the entrepreneurial financing literature. Many of the theoretical papers lack empirical support. Furthermore, most of them have not been tested directly. Further convergence of the theoretical and empirical literature is expected. (2) Theoretical research on debt-based crowdfunding and donation-based crowdfunding is behind that on reward-based crowdfunding and equity-based crowdfunding. Therefore, more research is expected in the first two mentioned areas, especially given that by volume, debt-based crowdfunding is the most popular type of crowdfunding.[16] (3) Similarly, we found that the number of articles on ICOs significantly exceeds that on STOs, IEOs and NFTs. Thus, more research is expected in these areas in the near future. (4) Some issues seem to be ambiguous. For example, is a higher crowdfunding campaign target an ultimately better signal than a lower campaign target (as in Chakraborty and Swinney (2021)) or is the link between the target size and project quality not linear (as in Miglo and Miglo (2019))? Additionally, several empirical papers have analysed the role of asymmetric information in crowdfunding and token issues and possible ways which entrepreneurs can try to mitigate this problem (Kleinert and Volkmann 2019; Fisch and Momtaz 2020; Kleinert et al. 2020; Momtaz 2021b). Momtaz (2021a) suggests that a CEO's emotions play an important role in ICO valuations. These findings are interesting, but no theoretical papers have addressed them thus far. In addition, an interesting direction seems to be modelling connections between crowdfunding, bankruptcy and learning from campaign failure. Learning from failure as well as serial entrepreneurship are developing topics in entrepreneurship literature (see, e.g., He et al. 2020). Given that bankruptcy procedures for crowdfunded firms are not very well developed in practice, and given also, as we previously discussed, that one of the main ideas of crowdfunding for entrepreneurs is learning, it is interesting to see if crowdfunding is an efficient tool of learning from campaign failure (Greenberg and Gerber 2014). For moral hazard models, note the research is dominated by two forms of moral hazards, namely, entrepreneur's costly effort and possible fund diversion, although no explanation exists for why other types of moral hazards have not been explored. Similarly, an approach based on incomplete contract models that is quite popular in, for example, capital structure models dealing with entrepreneurial firms has yet to be explored (e.g., Aghion and Bolton 1992).

The limitations of this review include the focus on the ideas which are mostly similar to the ideas in the capital structure area developed in the last 40–50 years, including asymmetric information, moral hazard problems, behavioural finance, etc. Crowdfunding and token issues represent examples of financing strategies for firms that have a lot of new innovative features. Thus, new areas have been included in this review, e.g., network benefits, which are very relevant to both crowdfunding and token issues. Nonetheless, one might expect that unlike traditional financing, new ideas may be developed which are not necessarily based on using game theory or contract theory. They have not been a focus of

this review. Secondly, this review has not focused on NFTs to the same extent as other types of tokens. On one hand, they started to appear historically later than other types of tokens, and to the best of my knowledge, the research about NFTs mostly consists of empirical papers at the moment. However, some of the ideas developed regarding other types of tokens may probably be applied to NFTs as well; thus, it is a good area for future research.

For future research, as was previously mentioned, more research is expected in areas such as incomplete contracts, which have a lot of implications in capital structure theory (Chod et al. (2021) uses a model with a hold-up problem which is probably the closest one to the incomplete contracts literature). Donation-based crowdfunding has been explored seemingly less compared to other types of crowdfunding. Behavioural-based models should be more present (similar to other areas of finance, e.g., corporate finance, where behavioural finance has played an important role for the last 15–20 years). Additionally, a large gap exists between theoretical models and empirical research. It is a challenging problem to test new theoretical models. Data are often not easily observable, especially for entrepreneurial firms and small businesses. In some cases a survey can be used (see, e.g., Beck and Demirguc-Kunt 2006). The following represent some interesting examples. Belleflamme et al. (2013) developed a model of crowdfunding for non-profit firms and then tested it. Similarly, Chemla and Tinn (2019) developed a model of crowdfunding based on moral hazard and presented some data consistent with their model. It is also worth mentioning Lyandres et al. (2020) that provide some testing of results in Gan et al. (2021).

In addition, note that an interesting/important issue is the implementation of theoretical models in practice. Similarly to the traditional financing (capital structure) literature, most practical tests of theories are based on indirect confirmation of data consistency with model predictions rather than checking that developed models are directly applied by existing enterprises. This is an interesting direction for future research. More case studies and more surveys related to theoretical models and also related to the attitude of entrepreneurs regarding these theories are expected (similar to Graham and Harvey's (2001) survey of managers regarding theoretical concepts in corporate finance). The usage of specific models/theories in practice also depends on the structure/content of educational programs related to crowdfunding/token issues. These are relatively new topics for most programs and a time gap is expected before one can see some results here. Note though, that several papers provide examples of firms/industries that seem to be (indirectly) consistent with the suggested models. Note, for example, Chemla and Tinn (2019) with regard to technology firms; Chen et al. (2018) with regard to such firms as Scanadu, Formlabs etc.; Li and Mann (2018) with regard to Filecoin; etc.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Acknowledgments: I would like to thank professor Momtaz (the editor of the special issue) for his invitation and encouragement. Also many thanks to four anonymous referees, Jin Chen, Ramona Coia, Regina Connolly, Colin Mason, Bilal Maycid, Victor Miglo, Andrea Moro, Jason Pavunkovic, Zara Raza, Deema Refai, Melissa Toner, Silvio Vismara, Hans-Dieter Zimmermann, the seminar participants at the University of Sussex, National University of Ireland Galway, University of Twente, Ulster University, University of Greenwich and Westminster University for their helpful comments and editing assistance.

Conflicts of Interest: The author declares no conflict of interest.

Notes

1 See, e.g., http://www2.technologyreview.com/tr10/?year=2012 (accessed on 10 March 2022).

2 This applies to reward-based crowdfunding and utility token issues.

3 For a review of the literature on crowdfunding and tokens issues see, for example, Moritz and Block (2014), Mochkabadi and Volkmann (2020), Howell et al. (2020), Bao and Roubaud (2022) and Chalmers et al. (2022). Unlike these reviews, the present review is specifically focused on theoretical papers. In addition, Hoegen et al. (2018) focus on comparison of crowdfunding and traditional financing. See also Ahlers et al. (2015), Belleflamme et al. (2015), Estrin et al. (2018) and Miglo (2021a).

[4] Tönnissen et al. (2020) and Bachmann et al. (2021) provide a description of different business models/ideas related to firms that use tokens.

[5] ICO/STO Report (2020).

[6] Unlike ICOs, STOs and IEOs, NFTs usually are used for trading purposes. There are, however, some cases where they were used for raising funding (see, e.g., Cases of Stoner Cats and The Gimmicks https://www.lexology.com/library/detail.aspx?g=a2d91fc1-b441-4f6a-9b61-a9a4a14c68a5) (accessed on 10 March 2022).

[7] Crowdfunding and token issues are methods of raising funds for firms; thus, some of the ideas behind crowdfunding and token issues are related to capital structure theories. For a review of major capital structure theories see, among others, Harris and Raviv (1991) and Klein et al. (2002). Note that these theories usually focus on firm choice between traditional debt and equity. We discuss connections between traditional theories and their possible applications to crowdfunding and token issues in Section 7.

[8] In the spirit of Miglo (2020).

[9] The former has its limits, i.e., "actions speak louder than words". https://www.bookbrowse.com/expressions/detail/index.cfm/expression_number/151/actions-speak-louder-than-words. See also Grinblatt and Titman (2001) and Miglo (2021a).

[10] See, for example: http://crowdfunding.cmf-fmc.ca/facts_and_stats/how-likely-is-your-crowdfunding-campaign-to-succeed (accessed on 10 March 2022).

[11] See, for example, ICO/STO Report (2020) or https://appinventiv.com/blog/ieo-vs-ico/ (accessed on 10 March 2022).

[12] Based on Miglo (2021b).

[13] Their model is based on Belleflamme et al. (2010).

[14] See also Miglo (2021b).

[15] Lin and Pursiainen (2018) study the importance of overconfidence in an experimental setting.

[16] See, for example, https://www.statista.com/statistics/946668/global-crowdfunding-volume-worldwide-by-type/ (accessed on 10 March 2022).

References

Adhami, Saman, Giancarlo Giudici, and Stefano Martinazzi. 2018. Why do businesses go crypto? An empirical analysis of Initial Coin Offerings. *Journal of Economics and Business* 100: 64–75. [CrossRef]

Aghion, Philippe, and Patrick Bolton. 1992. An incomplete contracts approach to financial contracting. *Review of Economic Studies* 59: 473–94. [CrossRef]

Ahlers, Gerrit K. C., Douglas J. Cumming, Christina Guenther, and Denis Schweizer. 2015. Signaling in Equity Crowdfunding. *Entrepreneurship Theory and Practice* 39: 955–80. [CrossRef]

Ahlstrom, David, Douglas Cumming, and Silvio Vismara. 2018. New methods of entrepreneurial firm financing: Fintech, crowdfunding and corporate governance implications. *Corporate Governance—An International Review* 26: 310–13. [CrossRef]

Alaei, Saeed, Azarakhsh Malekian, and Mohamed Mostagir. 2016. A Dynamic Model of Crowdfunding. *Ross School of Business Paper No. 1307*. Available online: https://ssrn.com/abstract=2737748 (accessed on 18 January 2017).

Alt, Rainer, Roman Beck, and Martin T. Smits. 2018. FinTech and the transformation of the financial industry. *Electronic Markets* 28: 235–43. [CrossRef]

Amsden, Ryan, and Denis Schweizer. 2018. Are Blockchain Crowdsales the New "Gold Rush"? Success Determinants of Initial Coin Offerings. Working Paper. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3163849 (accessed on 13 December 2019).

Ante, Lennart, and Ingo Fiedler. 2019. Cheap Signals in Security Token Offerings (STOs). BRL Working Paper Series No. 1. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3356303 (accessed on 1 February 2020).

Argo, Nichole, David Klinowski, Tamar Krishnamurti, and Sarah Smith. 2020. The Completion Effect in Charitable Crowdfunding. *Journal of Economic Behavior and Organization* 172: 17–32. [CrossRef]

Arkrot, William, Anton Unger, and Erik Åhlström. 2017. Crowdfunding from a Marketing Perspective. Thesis. Available online: http://www.diva-portal.org/smash/get/diva2:1106397/FULLTEXT01.pdf (accessed on 13 December 2018).

Babich, Volodymyr, Simone Marinesi, and Gerry Tsoukalas. 2019. Does Crowdfunding Benefit Entrepreneurs and Venture Capital Investors? *Manufacturing and Service Operations Management* 23: 508–24. [CrossRef]

Bachmann, Nina, Benedict Drasch, Gilbert Fridgen, Michael Miksch, Ferdinand Regner, Andre Schweizer, and Nils Urbach. 2021. Tarzan and chain: Exploring the ICO jungle and evaluating design archetypes. *Electronic Markets*. Available online: https://link.springer.com/article/10.1007/s12525-021-00463-6 (accessed on 10 March 2022).

Bakos, Yannis, and Hanna Halaburda. 2018. The Role of Cryptographic Tokens and ICOs in Fostering Platform Adoption. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3207777 (accessed on 19 May 2021).

Bao, Hong, and David Roubaud. 2022. Recent Development in Fintech: Non-Fungible Token. *FinTech* 1: 44–46. [CrossRef]

Beck, Thorsten, and Ash Demirguc-Kunt. 2006. Small and mediumsize enterprises: Access to finance as a growth constraint. *Journal of Banking and Finance* 30: 2931–43. [CrossRef]

Belavina, Elena, Simone Marinesi, and Gerry Tsoukalas. 2020. Rethinking Crowdfunding Platform Design: Mechanisms to Deter Misconduct and Improve Efficiency 2020. *Management Science* 66: 4980–97. [CrossRef]

Belleflamme, Paul, Thomas Lambertz, and Armin Schwienbacher. 2010. Crowdfunding: An Industrial Organization Perspective. Paper presented at the Workshop Digital Business Models: Understanding Strategies, Paris, France, June 25–26; Available online: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.416.4643&rep=rep1&type=pdf (accessed on 10 January 2022).
Belleflamme, Paul, Thomas Lambertz, and Armin Schwienbacher. 2013. Individual Crowdfunding Practices. *Venture Capital: An International Journal of Entrepreneurial Finance* 15: 313–33. [CrossRef]
Belleflamme, Paul, Thomas Lambertz, and Armin Schwienbacher. 2014. Crowdfunding: Tapping the Right Crowd. *Journal of Business Venturing* 29: 585–609. [CrossRef]
Belleflamme, Paul, Nessrine Omrani, and Martin Peitz. 2015. The economics of crowdfunding platforms. *Information Economics and Policy* 33: 11–28. [CrossRef]
Benedetti, Hugo, and Leonard Kostovetsky. 2021. Digital tulips? Returns to investors in initial coin offerings. *Journal of Corporate Finance* 66: 101786. [CrossRef]
Bourveau, Thomas, Emmanuael De George, Atif Ellahie, and Daniele Macciocchi. 2018. Initial Coin Offerings: Early Evidence on the Role of Disclosure in the Unregulated Crypto Market. Working Paper. Available online: https://www.marshall.usc.edu/sites/default/files/2019-03/thomas_bourveau_icos.pdf (accessed on 10 March 2022).
Brown, David C., Shaun W. Davies, and Itay Goldstein. 2020. Financing Efficiency of Securities-Based Crowdfunding. *Review of Financial Studies* 33: 3975–4023. [CrossRef]
Brown Ross, Suzanne Mawson, and Alexander Rowe. 2019. Start-Ups, Entrepreneurial Networks and Equity Crowdfunding: A Processual Perspective. *Industrial Marketing Management* 80: 115–25. [CrossRef]
Capizzi, Vincenzo, and Emanuele M. Carluccio. 2016. Competitive Frontiers in Equity Crowdfunding: The Role of Venture Capitalists and Business Angels in the Early-Stage Financing Industry. In *Crowdfunding for SMEs. Palgrave Macmillan Studies in Banking and Financial Institutions*. Edited by Roberto Bottiglia and Flavio Pichler. London: Palgrave Macmillan.
Cason, Timothy, and Robertas Zubrickas. 2019. Donation-based crowdfunding with refund bonuses. *European Economic Review* 119: 452–71. [CrossRef]
Catalini, Christian, and Joshua S. Gans. 2018. Initial Coin Offerings and the Value of Crypto Tokens. NBER Working Paper 24418. Available online: https://www.nber.org/papers/w24418 (accessed on 10 March 2022).
Ceptureanu, Sebastian Ion, Eduard Ceptureanu, and Razvan Sassu. 2017. Financing of Romanian Non-governmental Organizations. *Management and Economics Review* 2: 68–77.
Chakraborty, Soudipta, and Robert Swinney. 2021. Signalling to the Crowd: Private Quality Information and Rewards-Based Crowdfunding. *Manufacturing and Service Operations Management* 23: 155–69. [CrossRef]
Chalmers, Dominic, Christian Fisch, Russell Matthews, William Quinn, and Jan Recker. 2022. Beyond the bubble: Will NFTs and digital proof of ownership empower creative industry entrepreneurs? *Journal of Business Venturing Insights* 17: e00309. [CrossRef]
Chang, Jen-Wen. 2016. The Economics of Crowdfunding. Available online: https://ssrn.com/abstract=2827354 (accessed on 13 July 2017).
Chemla, Gilles, and Katrin Tinn. 2019. Learning Through Crowdfunding. *Management Science*. [CrossRef]
Chen, Rachel R., Esther Gal-Or, and Paolo Roma. 2018. Reward-based crowdfunding campaigns: Informational value and access to venture capital. *Information Systems Research* 29: 679–97.
Chod, Jiri, and Evgeny Lyandres. 2021. A theory of ICOs: Diversification, agency, and information asymmetry. *Management Science* 67: 5969–6627. [CrossRef]
Chod, Jiri, Nikolaos Trichakis, and S. Alex Yang. 2021. Platform tokenization: Financing, governance, and moral hazard. *Management Science*. [CrossRef]
Cholakova, Magdalena, and Bart Clarysse. 2015. Does the Possibility to Make Equity Investments in Crowdfunding Projects Crowd Out Reward-Based Investments? *Entrepreneurship Theory and Practice* 39: 145–72. [CrossRef]
Cong, Lin William, Ye Li, and Neng Wang. 2021. Token-based platform finance. *Journal of Financial Economics* 144: 972–91. [CrossRef]
Cong, Lin William, and Yizhou Xiao. 2018. Up-Cascaded Wisdom of the Crowd. *SSRN Electronic Journal*. [CrossRef]
Cordova, Alessandro, Johanna Dolci, and Gianfranco Gianfrate. 2015. The Determinants of Crowdfunding Success: Evidence from Technology Projects'. *Procedia Social and Behavioral Sciences* 181: 115–24. [CrossRef]
Cumming, Douglas J., Gael Leboeuf, and Armin Schwienbacher. 2019. Crowdfunding Models: Keep-it-All versus All or Nothing. *Financial Management*. [CrossRef]
Das, Sanjiv R. 2019. The future of FinTech. *Financial Management* 48: 981–1007. [CrossRef]
Davydiuk, Tetiana, Deeksha Gupta, and Samuel Rosen. 2019. De-crypto-ing Signals in Initial Coin Offerings: Evidence of Rational Token Retention. Available online: http://entfin.org/wp-content/uploads/2021/06/De-crypto-ing-Signals-in-Initial-Coin-Offerings-Evidence-of-Rational-Token-Retention.pdf (accessed on 20 August 2021).
De Jong, Abe, Peter Roosenboom, and Tom van der Kolk. 2018. What Determines Success in Initial Coin Offerings? Available online: https://ssrn.com/abstract=3250035 (accessed on 21 July 2021).
Deb, Joyee, Aniko Oery, and Kevin R. Williams. 2019. Aiming for the Goal: Contribution Dynamics of Crowdfunding NBER Working Paper No. 25881. Available online: https://www.nber.org/papers/w25881 (accessed on 23 August 2020).
Desjardins, Jeff. 2016. 19 Weird Crowdfunding Campaigns That Failed Spectacularly. July 14. Available online: http://www.visualcapitalist.com/19-weird-crowdfundingcampaigns-failed/ (accessed on 10 January 2017).

Devaraj, Srikant, and Pankaj C. Patel. 2016. Influence of number of backers, goal amount, and project duration on meeting funding goals of crowdfunding projects. *Economics Bulletin* 36: 1242–49.
Diamond, Douglas W. 1991. Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt. *Journal of Political Economy* 99: 689–721. [CrossRef]
Drasch, Benedict, Gilbert Fridgen, Tobias Manner-Romberg, Fenja M. Nolting, and Sven Radszuwill. 2020. The token's secret: The two-faced financial incentive of the token economy. *Electronic Markets* 30: 557–67. [CrossRef]
Du, Longyuan, Ming Hu, and Jiahua Wu. 2017. Contingent Stimulus in Crowdfunding. Rotman School of Management Working Paper No. 2925962. Available online: https://ssrn.com/abstract=2925962 (accessed on 13 July 2018).
Ellman, Matthew, and Sjaak Hurkens. 2016. Optimal Crowdfunding Design. Barcelona Graduate School of Economics N871. Available online: https://ssrn.com/abstract=2709617 (accessed on 16 July 2017).
Ellman, Matthew, and Sjaak Hurkens. 2017. A Theory of Crowdfunding a Mechanism Design Approach with Demand Uncertainty and Moral Hazard: Comment. Available online: http://www.iae.csic.es/investigatorsMaterial/a1812160140sp40258.pdf (accessed on 15 December 2018).
Estrin, Saul, Daniel Gozman, and Susanna Khavul. 2018. The Evolution and Adoption of Equity Crowdfunding: Entrepreneur and Investor Entry Into a New Market. *Small Business Economics* 51: 425–39. [CrossRef]
Everett, Craig, and Richard Fairchild. 2015. A Theory of Entrepreneurial Overconfidence, Effort, and Firm Outcomes. *Journal of Entrepreneurial Finance* 17: 1–27. [CrossRef]
Fairchild, Richard, Weixi Liu, and Yang Yao. 2017. An Entrepreneur's Choice of Crowd Funding or Venture Capital Financing: The Effect of Entrepreneurial Overconfidence and CF-Investors' Passion. Working Paper. Available online: https://ssrn.com/abstract=2926980 (accessed on 15 December 2018).
Fisch, Christian, and Paul Momtaz. 2020. Institutional investors and post-ICO performance: An empirical analysis of investor returns in initial coin offerings (ICOs). *Journal of Corporate Finance* 64: 101679. [CrossRef]
Gabison, Garry. 2015. Understanding Crowdfunding and Its Regulations. Available online: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92482/lbna26992enn.pdf (accessed on 3 July 2017).
Gan, Rowena, Gerry Tsoukalas, and Serguei Netessine. 2021. Initial Coin Offerings, Speculation, and Asset Tokenization. *Management Science* 67: 914–31. [CrossRef]
Garratt, Rodney, and Maarten R. C. van Oordt. 2019. *Entrepreneurial Incentives and the Role of Initial Coin Offerings*. Staff Working Paper. Ottawa: Bank of Canada.
Graham, John R., and Campbell Harvey. 2001. The Theory and Practice of Corporate Finance: Evidence from the Field. *Journal of Financial Economics* 60: 187–243. [CrossRef]
Greenberg, Michael, and Elizabeth Gerber. 2014. Learning to fail: Experiencing public failure online through crowdfunding. Paper presented at the SIGCHI Conference on Human Factors in Computing Systems, Toronto, ON, Canada, April 26–May 1.
Grinblatt, Mark, and Sheridan Titman. 2001. *Financial Markets & Corporate Strategy*, 2nd ed. New York: McGraw-Hill Higher Education.
Gryglewicz, Sebastian, Simon Mayer, and Erwan Morellec. 2021. Optimal financing with tokens. *Journal of Financial Economics*.
Haffke, Lars, and Mathias Fromberger. 2018. ICO Market Report 2017. Performance analysis of initial coin offerings (presentation slides). *SSRN Electronic Journal*. [CrossRef]
Hakenes, Hendrik, and Friederike Schlegel. 2014. Exploiting the Financial Wisdom of the Crowd—Crowdfunding as a Tool to Aggregate Vague Information. Working Paper. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2475025 (accessed on 10 March 2022).
Hall, Bronwyn H. 2009. The financing of innovative firms. *EIB Papers* 14: 8–29. [CrossRef]
Harris, Milton, and Artur Raviv. 1988. Corporate control contests and capital structure. *Journal of Financial Economics* 20: 55–86. [CrossRef]
Harris, Milton, and Artur Raviv. 1991. The Theory of Capital Structure. *Journal of Finance* 46: 297–355. [CrossRef]
Hart, Oliver. 1995. *Firms, Contracts, and Financial Structure*. Oxford: Clarendon Press.
Hayward, Mathew, Dean Shepherd, and Dale Griffin. 2006. A Hubris Theory of Entrepreneurship. *Management Science* 52: 160–72. [CrossRef]
He, Hui, Yan Bai, and Xia Xiao. 2020. How Past Failure Predicts Subsequent Entrepreneurial Intention: A Comparative Study of Mainland China and Taiwan. *Sustainability* 12: 2331. [CrossRef]
Hoegen, Andreas, Dennis M. Steininger, and Daniel Veit. 2018. How do investors decide? An interdisciplinary review of decision-making in crowdfunding. *Electronic Markets* 28: 339–65. [CrossRef]
Horvat, Tatjana, and Vito Bobek. 2020. Two Modern Aspects of Intangible Assets—Protection on Blockchain and Funding through ICO. In *Managing Customer Experiences in an Omnichannel World: Melody of Online and Offline Environments in the Customer Journey*. Edited by Taskin Dirsehan. Bingley: Emerald Publishing Limited, pp. 287–303. [CrossRef]
Howell, Sabrina, Marina Niessner, and David Yermack. 2020. Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales. *The Review of Financial Studies* 33: 3925–74. [CrossRef]
Hu, Ming, Xi Li, and Mengze Shi. 2015. Product and pricing decisions in crowdfunding. *Marketing Science* 34: 331–45. [CrossRef]
ICO/STO Report. 2020. Available online: https://www.pwc.ch/en/insights/fs/6th-ico-sto-report.html (accessed on 10 January 2021).
Jensen, Michael C. 1986. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review* 76: 323–29.

Jensen, Michael C., and William H. Meckling. 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics* 3: 305–60. [CrossRef]
Kim, Jin-Hyuk, Peter Newberry, and Calvin Qiu. 2018. The Role of Information Signals in Determining Crowdfunding Outcomes. Available online: https://www.tse-fr.eu/sites/default/files/TSE/documents/ChaireJJL/Digital-Economics-Conference/Conference/kim_jin-hyuk.pdf (accessed on 3 August 2020).
Klein, Linda S., Thomas J. O'Brien, and Stephen R. Peters. 2002. Debt vs. Equity and Asymmetric Information: A Review. *The Financial Review* 37: 317–50. [CrossRef]
Kleinert, Simon, and Christine Volkmann. 2019. Equity crowdfunding and the role of investor discussion boards. *Venture Capital An International Journal of Entrepreneurial Finance* 21: 327–52. [CrossRef]
Kleinert, Simon, Christine Volkmann, and Marc Grünhagen. 2020. Third-party signals in equity crowdfunding: The role of prior financing. *Small Business Economics* 54: 341–65. [CrossRef]
Koch, Jascha-Alexander, and Michael Siering. 2019. The recipe of successful crowdfunding campaigns An analysis of crowdfunding success factors and their interrelations. *Electronic Markets* 29: 661–79. [CrossRef]
Kraus, Alan, and Robert Litzenberger. 1973. A State-preference Model of Optimal Financial Leverage. *Journal of Finance* 28: 911–22. [CrossRef]
Kromidha, Endrit, and Paul Robson. 2016. Social identity and signalling success factors in online crowdfunding. *Entrepreneurship and Regional Development* 28: 605629. [CrossRef]
Kumar, Praveen, Nisan Landberg, and David Zvilichovsky. 2020. Crowdfunding, Financing Constraints and Real Effects. *Management Science* 66: 3561–80. [CrossRef]
Lee, Jeongmin, and Christine A. Parlour. 2019. Consumers as Financiers: Crowdfunding, Initial Coin Offerings and Consumer Surplus. Working Paper. Available online: https://www.chapman.edu/research/institutes-and-centers/economic-science-institute/_files/ifree-papers-and-photos/parlour-lee-consumers-as-financiers-2019.pdf (accessed on 6 December 2020).
Leland, Hayne E., and David H. Pyle. 1977. Information asymmetries, financial structure, and financial Intermediation. *Journal of Finance* 32: 371–87. [CrossRef]
Li, Jiasun. 2018. Profit Sharing: A Contracting Solution to Harness the Wisdom of the Crowd. WFA, SFS Cavalcade. Available online: https://ssrn.com/abstract=2844335 (accessed on 5 December 2020).
Li, Jiasun, and William Mann. 2018. Initial Coin Offering and Platform Building. Working Paper. Available online: https://pdfs.semanticscholar.org/309e/f98741d5da2003df8317fd605e1ac83d6fb9.pdf (accessed on 6 July 2020).
Lin, Tse-Chun, and Vesa Pursiainen. 2018. Gender Differences in Crowdfunding—Entrepreneur Overconfidence and Campaign Outcomes. Working Paper. Available online: https://ssrn.com/abstract=3045050 (accessed on 13 November 2020).
Lyandres, Evgeny, Berardino Palazzo, and Daniel Rabetti. 2020. Do Tokens Behave like Securities? An Anatomy of Initial Coin Offerings. Working Paper. Available online: https://www.idc.ac.il/en/schools/business/annual-conference/Documents/2019-annual-conference/do-tokens-behave-like-securities-lyandres.pdf (accessed on 19 December 2020).
Malinova, Katya, and Andreas Park. 2018. Tokenomics: When Tokens Beat Equity. Available online: https://ssrn.com/abstract=3286825 (accessed on 3 December 2019).
Masiak, Christian, Joern H. Block, Tobias Masiak, Matthias Neuenkirch, and Katja N. Pielen. 2020. Initial coin offerings (ICOs): Market cycles and relationship with bitcoin and ether. *Small Business Economics* 55: 1113–30. [CrossRef]
Miglo, Anton. 2020. Crowdfunding in a Competitive Environment. *Journal of Risk and Financial Management* 13: 39. [CrossRef]
Miglo, Anton. 2021a. Crowdfunding: Definitions, foundations and framework. In *Crowdfunding in the Public Sector: Theory and Best Practices*. Edited by R. Lenart-Gansiniec and J. Chen. Series: Contributions to Finance and Accounting; Cham: Springer, pp. 1–19. ISBN 9783030778408. [CrossRef]
Miglo, Anton. 2021b. Crowdfunding Under Market Feedback, Asymmetric Information And Overconfident Entrepreneur. *Entrepreneurship Research Journal* 11: 20190018. [CrossRef]
Miglo, Anton. 2021c. STO vs. ICO: A Theory of Token Issues under Moral Hazard and Demand Uncertainty. *Journal of Risk and Financial Management* 14: 232. [CrossRef]
Miglo, Anton. 2022. Crowdfunding and Bank Financing: Substitutes or Complements? *Small Business Economics*, *Forthcoming*. [CrossRef]
Miglo, Anton, and Victor Miglo. 2019. Market Imperfections and Crowdfunding. *Small Business Economics* 53: 51–79. [CrossRef]
Mochkabadi, Kazem, and Christine Volkmann. 2020. Equity Crowdfunding: A Systematic Review of the Literature. *Small Business Economics* 54: 75–118. [CrossRef]
Modigliani, Franco, and Merton Miller. 1958. The Cost of Capital, Corporation Finance and the Theory of Investment. *American Economic Review* 48: 261–97.
Mollick, Ethan R. 2014. The Dynamics of Crowdfunding: An Exploratory Study. *Journal of Business Venturing* 29: 1–16. Available online: https://ssrn.com/abstract=2088298 (accessed on 13 July 2017). [CrossRef]
Mollick, Ethan R., and Venkat Kuppuswamy. 2014. After the Campaign: Outcomes of Crowdfunding. UNC Kenan-Flagler Research Paper No. 2376997. Available online: https://ssrn.com/abstract=2376997 (accessed on 15 August 2017).
Momtaz, Paul. 2019. The pricing and performance of Cryptocurrency. *The European Journal of Finance* 35: 1–14. [CrossRef]
Momtaz, Paul. 2021a. CEO Emotions and Firm Valuation in Initial Coin Offerings: An Artificial Emotional Intelligence Approach. *Strategic Management Journal* 42: 558–78. [CrossRef]

Momtaz, Paul. 2021b. Entrepreneurial Finance and Moral Hazard: Evidence from Token Offerings. *Journal of Business Venturing* 36: 106001. [CrossRef]
Momtaz, Paul. 2022. Decentralized Finance (DeFi) Markets for Start-Ups: Search Frictions, Intermediation, and Efficiency. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4020201 (accessed on 10 March 2022).
Moritz, Alexandra, and Joern Hendrich Block. 2014. Crowdfunding: A Literature Review and Research Directions. Available online: http://ssrn.com/abstract=2554444 (accessed on 13 December 2017).
Mourao, Paulo, Marco Silveira, and Rodrigo de Melo. 2018. Many Are Never Too Many: An Analysis of Crowdfunding Projects in Brazil. *International Journal of Financial Studies* 6: 95. [CrossRef]
Myalo, Alina. 2019. Comparative Analysis of ICO, DAOICO, IEO and STO. Case Study. *Finance Theory and Practice* 23: 6–25. [CrossRef]
Myers, Stewart C., and Nicholas S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13: 187–222. [CrossRef]
Nicolò, Domenico. 2015. Towards a theory on corporate reputation and survival of young firms. *Procedia Economics and Finance* 22: 296–303. [CrossRef]
Ofir, Moran, and Ido Sadeh. 2020. ICO vs IPO: Empirical Findings, Information Asymmetry and the Appropriate Regulatory Framework. *Vanderbilt Journal of Transnational Law* 53: 525–613. [CrossRef]
Paakkarinen, Pilvi. 2016. Success Factors in Reward based and Equity based Crowdfunding in Finland. Master's thesis, Aalto University, Otaniemi, Finland.
Ryu, Sunghan, Keongtae Kim, and Jungpil Hahn. 2019. The Effect of Crowdfunding Success on Subsequent Financing Outcomes of Start-ups. *Academy of Management Proceedings* 1: 17486. [CrossRef]
Sahm, Marco. 2016. Advance-Purchase Financing of Projects with Few Buyers. CESifo Working Paper Series No. 5560. Available online: https://ssrn.com/abstract=2691958 (accessed on 13 December 2019).
Sayedi, Amin, and Marjan Baghaie. 2017. Crowdfunding as a Marketing Tool. Available online: https://ssrn.com/abstract=2938183 (accessed on 10 January 2019).
Schwartz, Andrew. 2015. The Nonfinancial Returns of Crowdfunding. *Review of Banking and Financial Law* 34: 565–80.
Schwienbacher, Armin. 2018. Entrepreneurial Risk-taking in Crowdfunding Campaigns. *Small Business Economics* 51: 843–59. [CrossRef]
Sockin, Michael, and Wei Xiong. 2020. A Model of Cryptocurrencies NBER Working Paper No. 26816. Available online: https://www.nber.org/papers/w26816 (accessed on 6 December 2021).
Strausz, Roland. 2017. Crowdfunding, demand uncertainty, and moral hazard—A mechanism design approach. *American Economic Review* 107: 1430–76. [CrossRef]
Tönnissen, Stefan, Jan Heinrich Beinke, and Frank Teuteberg. 2020. Understanding token-based ecosystems—A taxonomy of blockchain-based business models of start-ups. *Electronic Markets* 30: 307–23.
Tuo, Gladys, Yi Feng, Solomon Sarpong, and Wenxin Wang. 2020. The Second Round Resource Acquisition of Entrepreneurial Crowdfunded Ventures: The Relevance of Campaign and Project Implementation Performance Outcomes. *Entrepreneurship Research Journal* 10: 1–21. [CrossRef]
Vismara, Silvio. 2016. Equity Retention and Social Network Theory in Equity Crowdfunding. *Small Business Economics* 46: 579–90. [CrossRef]
Wilson, Karen E. 2015. *Policy Lessons from Financing Innovative Firms*. OECD Science, Technology and Industry Policy Papers, No. 24. Paris: OECD Publishing. [CrossRef]
Xu, Ting. 2019. Learning from the Crowd: The Feedback Value of Crowdfunding. Working Paper. Available online: https://www.marshall.usc.edu/sites/default/files/2019-03/ting_xu_crowdfunding.pdf (accessed on 10 March 2022).
Zhang, Jiding, Sergei Savin, and Senthil Veeraraghavan. 2017. Revenue Management in Crowdfunding. Available online: https://ssrn.com/abstract=3065267 (accessed on 7 December 2019).