Cryptocurrency Rewards and Crowdsourcing Task Success

Shan Meng
Xi'an Jiaotong University, China
mengsh3@stu.xjtu.edu.cn

Xia Zhao
University of Georgia, USA
xia.zhao@uga.edu

Xi Zhao
Xi'an Jiaotong University, China
zhaoxi1@mail.xjtu.edu.cn

Abstract

Crowdsourcing task success depends on the contributions of developers. How to identify capable developers and motivate them to actively contribute to a task is a challenging issue. This study investigates how the use of cryptocurrency rewards, i.e., the choices of stablecoins and unstablecoins affects the crowdsourcing task success, and how the relationship depends on task difficulty. Based on 3858 crowdsourcing tasks, we find that the use of unstablecoins reduces the number of participating contributors and extends the time period of having the first contributor, but has no significant effect on the likelihood of task success. In addition, task difficulty alleviates the negative effect of the unstablecoins on the number of participants. Our study potentially provides important implications for the use of cryptocurrency tokens as task rewards.

Keywords: Crowdsourcing, Cryptocurrency, Token, Reward uncertainty, Task difficulty

1. Introduction

Crowdsourcing has been increasingly used by individuals or organizations to motivate crowds to contribute their resources, such as time, money, wisdom, and effort (Estellés-Arolas & González-Ladrón-De-Guevara, 2012). Through crowdsourcing, crowds are gradually transformed into value co-creators of products and services (Gao et al., 2021). With the advances of Information Communication Technology (ICT), many online crowdsourcing platforms emerge, for example, Amazon's Mechanical Turk (mTurk) and Topcoder. Online crowdsourcing platforms provide a common place for information exchange and problem-solving between crowdsourcing funders and contributors at low costs (Deng et al., 2016). A key challenge in crowdsourcing governance is how to effectively identify contributors and motivate them to engage in crowdsourcing tasks (Pedersen et al., 2013). Rewards have been long used to motivate individuals in different contexts such as crowdfunding (Gerber & Hui, 2013) and crowdsourcing. In crowdsourcing, the literature has examined the reward magnitude (Liu et al., 2020), reward structure (Q. Wang et al., 2019), reward forms such as goods prizes, monetary rewards (Hua et al., 2020), and others (Lee et al., 2018). As cryptocurrency has risen to be media of exchange, emerging crowdsourcing platforms adopt cryptocurrency as the reward token. However, the understanding of how the use of cryptocurrency affects task success is still limited. This study aims to fill the gap.

Cryptocurrency is considered a financial asset (Corbet et al., 2018, 2019). It assumes the role of "money" in the blockchain ecosystem. Based on price stability, cryptocurrency can be grouped into two sets (Wei & Dukes, 2021), stablecoins and unstablecoins. Stablecoins are cryptocurrencies with prices pegging to reference assets such as fiat money or exchange-traded commodities. Unstablecoins, in contrast, are the set of untethered and unbacked cryptocurrencies. Unstablecoins have relatively high price volatility compared with stablecoins. For tasks rewarding unstablecoins, the compensation is uncertain because the reward values fluctuate over time. Our study focuses on reward uncertainty caused by the use of unstablecoins and examines how it affects contributors' participation and task success in the context of crowdsourcing.

In addition to such reward uncertainty, contributors have to face task difficulty (Liu et al., 2020). On the crowdsourcing website, task funders often specify the required contributors' skill levels. The skill level requirement reflects the funders' assessment of the task difficulty. Contributors may assess the tasks and make their choices based on these task characteristics (Zheng et al., 2011). These task characteristics may affect the impact of reward uncertainty on the outcomes of the tasks. Thus, we aim to examine how task difficulty moderates the effect of reward uncertainty on contributors' participation and task outcomes in the context of crowdsourcing.

This study empirically examines the role of reward uncertainty in crowdsourcing. Specifically, we aim to answer two questions: (1) how the reward

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uncertainty affects contributors' participation and crowdsourcing task success; (2) how these relationships depend on task difficulty. We collect a data set of crowdsourcing tasks and cryptocurrency from multiple sources, including task, funder, and developer information from open source crowdsourcing platforms, and cryptocurrency information. Our data set consists of 3858 tasks with initiation dates from April 2018 to March 2022. The preliminary results show that reward uncertainty has a negative effect on the contributors' participation and a positive effect on the time period (i.e., longer time period) of having the first contributor. The negative relationship between reward uncertainty and the contributors' participation is weakened for more technically difficult tasks. Interestingly, using unstablecoins has no significant effect on the likelihood of task success.

Our research contributes to the growing literature on crowdsourcing and cryptocurrency. First, this research investigates the effectiveness of using tokens with uncertain values, i.e., cryptocurrency, as reward. We identify the differentiated effects between stablecoins and unstablecoins. Second, we show how the reward uncertainty interacts with task difficulty in affecting contributors' participating and contributing incentives in the crowdsourcing context. The study helps gain insight into the use of cryptocurrency in the digital economy.

2. Background and related work

Crowdsourcing allows organizations and individuals to tap into the pool of contributors to create new ideas and develop new products. Extant literature on crowdsourcing has examined topics such as project format including contests (Jin et al., 2021; Lu & Cho, 2018) and micro-task (Chen et al., 2021), crowdsourcing parameter choices (Jian et al., 2019; Koh, 2019; Q. Wang et al., 2019), interaction during crowdsourcing (Atanasov et al., 2017; Jiang & Wang, 2020; Lu & Cho, 2018), project type (L. Wang et al., 2019), and contributors' engagement (Camacho et al., 2019; Deng et al., 2016; Nishikawa et al., 2017). Rewards have been used as an important mechanism to encourage participation in crowdsourcing (Boudreau et al., 2011; Jeppesen & Lakhani, 2010). Liu et al. (2020) found an inverted-U shape relationship between award size and crowd size. Liu et al. (2014) investigated the effect of different incentives and found that a higher reward induces significantly more and high-quality submission. Wang et al. (2019) concentrate on the structure of reward and investigate the multiple-winner award rules. However, prior literature pays little attention to how the reward characteristics affect crowdsourcing.

A prominent feature of crowdsourcing tasks is uncertainty, such as the uncertainty of evaluation criteria, the uncertainty of funders' behavior (Jian et al., 2019), and the uncertainty of competing contributors' capability. Studies on contributors' responses to such uncertain factors are very limited. In this study, we focus on contributors' decisions when facing reward uncertainty in a crowdsourcing context. Uncertain rewards are defined as rewards with multiple potential values with either known or unknown probabilities (Shen et al., 2015). On the one hand, participants may be motivated by possibly very high payoffs or just enjoy the positive feelings stimulated by uncertainty (Wilson et al., 2005). On the other hand, the expected utility theory and prospect theory suggests risk-averse participants may prefer tasks with certain rewards (Gneezy et al., 2006). Shen et al. (2015) show that when people pay more attention to the process of pursuing rewards than the results, they will invest more effort, time, and money to improve the quality with uncertain rewards than certain rewards. Gong et al. (2021) find that uncertain rewards in the form of lotteries attract more backers for crowdfunding projects but reduce the probability of reaching the funding goal. The literature has examined other types of uncertainties such as problem uncertainty (Boudreau et al., 2011), competition uncertainty (Hong et al., 2016), and task uncertainty (Jian et al., 2019). However, it is still unclear how uncertain rewards affect contributors' participation and task success.

Cryptocurrency has gained tremendous attention in recent years. There is an emerging body of literature examining cryptocurrency. Ilk et al. (2021) assess the stability of using Bitcoin to pay for transaction fees. Griffin & Shams (2020) examine the relationship between the price of a stablecoin, Tether, and the price of an unstablecoin, Bitcoin. Tsoukalas & Falk (2020) investigate token-weighted voting for crowdsourcing information. Liu et al. (2022) evaluate and compare different risk factors in predicting cryptocurrency return. These studies focus on their market efficiency and market performance, whereas this study considers the use of cryptocurrency in crowdsourcing.

Based on the degree of price volatility, cryptocurrency can be grouped into two sets: stablecoins and unstablecoins (Wei & Dukes, 2021). A prior study compares stablecoins and unstablecoins in terms of fundamental factors such as privacy, financial influence, and so on (Li & Whinston, 2020). As far as we know, our study is among the first to examine and compare stablecoins and unstablecoins as incentive rewards. In this study, we frame the unstablecoins as an uncertain reward and the stablecoins as a certain reward and explore how the use of cryptocurrency affects the contributors' participation and crowdsourcing tasks' success.

Tasks on a crowdsourcing platform are differentiated in the level of difficulty (Liu et al., 2020). Task difficulty affects task contributors' engagement and task success. Extant studies focus on examining the direct effects of task difficulty on contributors' engagement and performance (Mazzola et al., 2018). However, task difficulty may interact with task rewards in influencing contributors' engagement, performance, and thus task success. Therefore, we complement this gap by examining the effect of task difficulty on the relationship between reward uncertainty and contributor participation as well as task success in the context of crowdsourcing.

3. Hypotheses development

A major difference between stablecoins and unstablecoins is price volatility. Compared with stablecoins, unstablecoins entail a higher level of reward uncertainty. Rewarding unstablecoins may attract contributors who are willing to tolerate the risk and uncertainty (Nyqvist et al., 2018). In addition, reward uncertainty could stimulate positive feelings and attract contributors who enjoy risks (Gong et al., 2021). However, the bubble (Wei & Dukes, 2021) and scandal(Griffin & Shams, 2020) of cryptocurrency may weaken or even reverse this feeling beyond risk tolerance. From the lens of prospect theory (Tversky & Kahneman, 1992) and expected utility theory (Grant & Van Zandt, 2007), risk-averse individuals may prefer a certain reward over uncertain ones. As a result, the developers may take a longer time to make participation decisions and prefer not to participate in the tasks. Therefore we hypothesize:

H1: Crowdsourcing Tasks rewarding unstablecoins have fewer contributors compared to those rewarding stablecoins with equal values.

H2: Crowdsourcing Tasks rewarding unstablecoins have a longer response time compared to those rewarding stablecoins with equal values.

Contributors facing potential loss and risk associated with uncertain rewards may limit their efforts and time on the tasks. With fewer participating contributors, less effort and shorter time for the task, crowdsourcing tasks rewarding unstablecoins have a lower likelihood of success. Therefore, we hypothesize:

H3: Using uncertain rewards reduces the likelihood of task success.

Crowdsourcing tasks vary in their difficulty. Many factors contribute to task difficulty, such as the breadth and depth of knowledge required for the task. Difficult tasks are more challenging for contributors to complete and receive rewards. Because of loss aversion, people may overestimate their efforts and potential losses in difficult tasks failure (Kahneman & Tversky, 1979). Thus, their perceived reward uncertainty may be higher for a more difficult task. Difficult tasks may intimidate mediocre contributors from participating but retain those with a challenging spirit. It serves as a filter to screen contributors. Therefore, we expect that the resultant contributors are more capable and technical savvy. To summarize, task difficulty may weaken the effect of reward uncertainty. Hence, we hypothesize that:

H4: The negative relationship between reward uncertainty and the number of contributors is weaker when the task difficulty increases.

H5: The positive relationship between reward uncertainty and the time period of having the first contributor is weaker when the task difficulty increases.

H6: The negative relationship between reward uncertainty and task success is weaker when task difficulty increases.

4. Research context and Data

To test the hypotheses proposed above, we collect and compile a data set from different sources including an open source crowdsourcing platform and cryptocurrency websites.

4.1. Crowdsourcing Platforms

We collect our data from an open source crowdsourcing platform for blockchain projects. It was launched to reduce the pressure of labor shortage for open-source blockchain projects and promote the development of blockchain projects and blockchain ecology. Cryptocurrency tokens are used as rewards to motivate contribution efforts to digital public goods like open-source protocols and decentralized blockchains.

The open source crowdsourcing platform is connected to GitHub projects, which helps to track important tasks in Github repository. The project funder initiates a task by first creating issues in the project's GitHub repository to provide contextual knowledge for the active resolution of issues. The issues include bug solving, document translation, feature development, ideas solicitation, and so on. The webpage of the task specifies the issue's URL of the GitHub page, the project type (indicating whether one or multiple contributors work for the task), required experience level (including beginner, intermediate and advanced), and reward details (the species of cryptocurrencies as well as its quantity and corresponding USD value). Contributors participate in the issues by clicking the apply link if the participation requires approval or start working on it directly if approval is not required. The submitted contribution will be reviewed by the funder and the contributors will receive the reward if the funder is satisfied with the submission.

4.2. Cryptocurrency as a reward

Cryptocurrency was first introduced as an incentive to motivate miners to work for open-source blockchains, like Bitcoin and Ethereum. The open source crowdsourcing platform allows task funders to use cryptocurrency to incentivize contributors. A variety of stablecoins and unstablecoins are used as an incentive in this context. Stablecoins peg to fiat currencies (mostly US dollars) through a stabilization mechanism by their issuers. For example, Tether, the stablecoin with the largest market value, is claimed to be backed by US dollars with a ratio of 1 to 1, and its historical performance showed that it almost fulfilled its promise. The set of unstablecoins is a collection of other cryptocurrencies with a price stability mechanism. Ethereum (ETH) is a typical unstablecoin with a price of US $1 per token when launched in 2015 and a peak of US $4,800 in 2021. Due to the volatile nature of cryptocurrency, the value of the cryptocurrency reward change over time. This provides us a context to explore the effects of uncertain rewards on contributors and crowdsourcing task performance.

4.3. Data and Variables

We collect task data, including rewarding cryptocurrencies with value in USD, task types, task description, required experience level, event detail, feature or not, permission type, task duration, project types which indicate one or multiple contributors work at the same time, and contributors' behavior data, including contributors' application time, starting work time, submission time, and time of being paid. We also collect cryptocurrency data, including cryptocurrency type (whether it is a stablecoin or unstablecoin), daily price, daily trading volume, daily market capitalization, and cryptocurrency market daily trading volume, and daily market capitalization. After excluding the test tasks and preprocessing, we finally obtain 3,858 tasks with initiating dates between April 1, 2018, and March 22, 2022. Table 1 shows variable description and Table 2 reports descriptive statistics.

Table 1. Variable Description

Variable	Definition and Measure
Success	An indicator of whether the task state is done and existing paid contributors.
Participant	The number of unique contributors who participated in a task.
Response-Time	Log the time interval (hours) for the first contributors participating in the task.
Unstablecoin	An indicator of whether the task reward is the unstablecoin.
TaskType	A series of dummy variables of the task type, which are bug fixing, code review, design, documentation, feature, improvement, security, and others.
Description	Log the byte num of the task description.
Difficulty	The requirement of the contributor's level with 0 representing begin, 1 representing intermediate, and 2 representing advanced, indicating the difficulty of the task with 3 levels.
Event	An indicator with 1 representing the task joining a platform event, and 0 otherwise.
Feature	An indicator with 0 representing the task paid to promotion, and 0 otherwise.
Permission	An indicator with 1 representing the task will approve contributors and 0 otherwise.
Reward	Log the value in US dollars of reward when the task fund.
TaskLength	A series of dummy variables of the unit of time estimated to complete a task: hours, days, months.
Expire	An indicator of whether the task has a time limit within a year.
Completing Type	An indicator of whether the task is one contributor or multiple contributors at the same time.
Competing-Task	The number of tasks in the task fund day.
TokenVolume	Log the transaction volume in the past day in US dollars.
TokenExistday	The number of the day that cryptocurrency exists.
TokenMarket-cap	Log the market capitalization in the past day in US dollars.
FunderTasks	The number of tasks the funder has funded before
FunderParticipant	The number of tasks the funder has participated in before.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Unstablecoin	3858	0.339	0.473	0	1
Success	3858	0.468	0.499	0	1
Participant	3858	4.612	12.79	0	299
ResponseTime	3847	2.997	3.76	-4.79	10.12
Difficulty	3858	0.932	0.608	0	2
Description	3858	6.688	1.394	0	10.415
Event	3858	0.229	0.42	0	1
Feature	3858	0.013	0.113	0	1
Expire	3858	0.607	0.489	0	1
Reward	3858	5.266	2.323	-4.61	19.787
CompetingTask	3858	12.583	9.242	1	50
TokenExistday	3858	953.59	551.9	6.369	3247.3
FunderTasks	3858	62.739	113.9	0	701
FunderParticipant	3858	0.354	0.478	0	1
TokenVolume	3858	19.13	3.39	-0.62	26.478
TokenMarketcap	3858	21.172	2.944	12.46	27.771

5. The Empirical Study

5.1. Model Specification

To empirically examine the effect of reward uncertainty on crowdsourcing outcomes, we construct a task-level cross-sectional dataset. We consider three dependent variables:

1) *Participants*: the number of contributors participating in a crowdsourcing task. If the task requires the funder's approval, it is the number of developers who applied for participating in the task. Otherwise, it is the number of developers who worked on the task,
2) *Success*: a dummy variable with 1 indicating the task succeeded and 0 otherwise. We define a crowdsourcing task succeeded if the status of the task is "done" and already paid to contributors.
3) *ResponseTime*: the time interval between the task fund and the first contributor participating.

A potential issue with the analysis is that the funder selects a specific cryptocurrency as a reward for a task. In order to control for this self-selection bias and obtain a balanced data set for analysis, we consider the use of unstablecoins as the treatment and divide the tasks into the control group and treatment group. We use propensity score matching (PSM) with logit regression and nearest neighbor matching (NNM) to match the tasks based on the task characteristics.

5.1.1. The effect of reward uncertainty. We first investigate the effect of cryptocurrency type on *Participants* using the fixed-effects regression model. The key independent variable is *Unstablecoin*, an indicator of whether the task reward uses unstablecoins.

$$Participants_j = \beta_0 + \beta_1 Unstablecoin_j + \beta_2 \mathbf{Task_j} + \beta_3 \boldsymbol{Funder_j} + \beta_4 \boldsymbol{Cryptocurrency_j} + \eta_j + t_j + \varepsilon_j \quad (1)$$

In model (1), j indexes tasks. Variable $Participants_j$ is the number of contributors participating in the task. To account for other confounding factors related to the dependent variable, we included a series of control variables: (1) $\boldsymbol{Task_j}$ is a vector of task-related variables including *Description, Difficulty, Event, Feature, Permission, Reward, TaskLength, Expire, CompletingType,* and *CompetingTask*; (2) $\boldsymbol{Funder_j}$ is a vector of funder-related variables including *FunderTasks, Fucontriexp*; (3) $\boldsymbol{Cryptocurrency_j}$ is a vector of cryptocurrency-related variables including *TokenVolume, TokenExistday, and TokenMarketcap*. β_i are the coefficients of the variables respectively. We also control for time effects by including t_j, and time-invariant but tasks related factors by including task category fixed effects η_j.

For *ResponseTime*, owing to the nature of "time to event", we use the hazard rate model. In survival analysis, we select a semi-parametric Cox-proportional hazard model and treat the variable *Participants*=0 as the "failure" event (Helsen & Schmittlein, 1993; Singh et al., 2021; Yang et al., 2020), and is shown next.

$$h_j(\mathrm{t}/\mathbf{X}) = \lambda_0(t).\exp\{\beta_1 Unstablecoin_j + \beta_2 \mathbf{Task_j} + \beta_3 \boldsymbol{Funder_j} + \beta_4 \boldsymbol{Cryptocurrency_j} + \eta_j + t_j\} \quad (2)$$

where, $h_i(\mathrm{t}/\mathbf{X})$ is the hazard of dominance for the ith component at hour t, given a set of covariates **X**. **X** includes $Unstablecoin$ and all control variables; $\lambda_0(t)$ is a baseline hazard that is a function of time.

Similarly to model (1), because the dependent variable *Success* is a dichotomous variable, we use the logistic regression model with fixed effect to estimate model (3) (Desai & Madsen, 2021; Gambardella et al., 2015):

$$logit(Success_j) = \beta_0 + \beta_1 Unstablecoin_j + \beta_2 \mathbf{Task_j} + \beta_3 \boldsymbol{Funder_j} + \beta_4 \boldsymbol{Cryptocurrency_j} + \eta_j + t_j \quad (3)$$

5.1.2. The moderating effects of task difficulty. To test the moderating effect of task difficulty, we further investigate how the relationship between reward uncertainty and crowdsourcing outcomes varies with task difficulty. We add an interaction term into model (1), model (2) and model (3) like：

$$Participants_j = \beta_0 + \beta_1 Unstablecoin_j + \beta_2 Unstablecoin_j \cdot Difficulty_j + \beta_3 \boldsymbol{Control_j} + \eta_j + t_j + \varepsilon_j \quad (4)$$

$$h_j(\mathrm{t}/\mathbf{X}) = \lambda_0(t).\exp\{\beta_1 Unstablecoin_j + \beta_2 Unstablecoin_j \cdot Difficulty_j + \beta_3 \boldsymbol{Control_j} + \eta_j + t_j\} \quad (5)$$

$$logit(\mathrm{Success}_j) = \beta_0 + \beta_1 Unstablecoin_j + \beta_2 Unstablecoin_j \cdot Difficulty_j + \beta_3 \boldsymbol{Control_j} + \eta_j + t_j \quad (6)$$

where $\boldsymbol{Control_j}$ is a vector of control variables including $Difficulty$ in model (1), model (2) and model (3) respectively.

5.2. Result

Since the number of tasks rewarding unstablecoins in the treatment group is much higher than the number of tasks rewarding stablecoins in the control group, we first conduct a stratified random sampling method based on completing type to reduce the number of treated tasks for PSM. Then we use propensity score matching with task variables including *Event, Expire, Feature, Reward, CompletingType, Permission, TaskType*. We finally obtain 1,542 tasks after sampling and PSM.

Table 3 reports the estimation results using the 1,542 samples after PSM. For the number of participants, the coefficient of *Unstablecoin* in columns (1) is negative and significant (β= -1.768, p<0.01). Specifically, compared to the tasks rewarding stablecoins, the number of contributors participating in the tasks rewarding unstablecoins is reduced by 1.768, supporting H1. For the time period of having the first contributor, the coefficient of *Unstablecoins* is significant in column (3) (β= -0.612, p<0.01), and the hazard ratio is 0.542 which is less than 1, suggesting that it takes a longer time for the first contributor to participate in the task with unstablecoins, supporting H2. For the likelihood of task success, the coefficients of *Unstablecoin* in columns (5) is not significant, which not supports H3.

Table 3. Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	SM	SM	clogit	clogit
	DV= Participants	DV= Participants	DV= Response Time	DV= Response Time	DV= Success	DV= Success
Unstablecoin	-1.768***	-3.265***	-0.612***	-0.651***	-0.166	-0.348
	(0.618)	(1.146)	(0.113)	(0.174)	(0.193)	(0.282)
Difficulty	-1.825***	-2.613***	-0.0192	-0.0366	-0.172	-0.274
	(0.403)	(0.684)	(0.0724)	(0.0878)	(0.132)	(0.183)
Unstablecoin× Difficulty		1.569**		0.0409		0.200
		(0.766)		(0.144)		(0.232)
_cons	-5.203	-4.519				
	(3.882)	(3.761)				
Controls	Yes	Yes	Yes	Yes	Yes	Yes
TaskType FEs	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	—	—	-5485.39	-5485.35	-484.1	-486.7
R^2	0.424	0.427	—	—	0.332	0.332

Note. Standard errors statistics in parentheses; FEs, fixed effects included; OLS, ordinary least squares regression; clogit, conditional logistic regression; SM, survival model with coefficients presented.

* *p < 0.10,* ** *p < 0.05,* *** *p < 0.01*

The estimation result of the moderating effect was shown in columns (2), (4), and (6). In column (2), the coefficient of the interaction between task difficulty and unstablecoin reward is significant and positive (β=1.569, p<0.05), which suggests that the negative relationship between the unstablecoins and the number of participants is weakened if the task is more difficult. The reduction of participating contributors is smaller for a more difficult task compared with a less difficult task, which supports H4. Columns (4) and (6) test the same interaction in impacting the time interval for the first contributors participating and the likelihood of success in the task, respectively. The coefficients of the interaction on the time period of having the first participant and task success are insignificant in columns (4) and (6). The relationship between unstablecoins and the time period of having the first participant and the relationship between unstablecoins and task success do not vary with the levels of task difficulty.

6. Discussion

6.1. Summary of findings

Our study examines how the use of cryptocurrency affects crowdsourcing task outcomes and identifies task characteristics that influence the relationship. Based on 1,542 crowdsourcing tasks, our empirical analysis shows that tasks rewarding unstablecoins have fewer participants and longer contributor participation time interval than tasks rewarding stablecoins. But rewarding unstablecoin has no significant effect on the likelihood of task success. The risk and uncertainty associated with unstablecoins thwart developers' participation in crowdsourcing tasks but improve the governance efficiency of task success. The funders manage fewer contributors but achieve the same likelihood of task success by rewarding unstablecoin.

Second, we find that the negative effect of the use of unstablecoin on the number of contributors' participation was alleviated when the task is more difficult. Difficult tasks require a higher level of skills. Contributors may self-select the tasks to join. The contributors joining the more difficult tasks are less sensitive to reward uncertainty or even prefer risk and uncertainty. Reward uncertainty does not decrease their participation passion or mitigate their engagement efforts. We do not observe a longer period of having first contributors or a lower likelihood of task success.

6.2. Contributions

Our study advances the literature in several aspects. First, we examine how reward uncertainty affects contributors' participation in crowdsourcing tasks and crowdsourcing task outcomes. We focus on the use of unstablecoins. The findings contribute to the growing crowdsourcing literature on reward design issues.

Second, we also enrich the crowdsourcing literature by investigating how task characteristics moderate the relationship between reward uncertainty and crowdsourcing task participation and outcomes. More specifically, we examine the moderating effect of task difficulty. Previous research found that task difficulty had no significant moderating effect on reward size on crowdsourcing contest crowd size(Liu et al., 2020), but we find that task difficulty had a significant moderating effect on reward uncertainty. More difficult attract fewer but retain more qualified and skilled participating contributors. The resultant participating contributors are less sensitive to risks because they are more educated and technologically competent to afford more uncertainties (Black et al., 2018). Although prior studies found that reward uncertainty has a positive impact on crowdfunding (Gong et al., 2021) and individuals' motivation (Shen et al., 2015), this study in contrast shows that it has a negative effect on crowdsourcing outcomes.

In addition, our study sheds light on the motivating effect of cryptocurrency as an incentive, contributing to the cryptocurrency literature. Prior research related to cryptocurrency has mostly focused on its financial properties, market bubbles (Wei & Dukes, 2021), investment returns (Mattke et al., 2021), and the social phenomena that it triggers, such as illegal behavior (Foley et al., 2019) and market manipulation (Griffin & Shams, 2020). Our research provides an in-depth understanding of how cryptocurrency motivates user participation in crowdsourcing tasks, filling gaps in the literature on its applications.

6.4. Limitations and future research

Our research has several limitations, which provide opportunities for future research. First, this study uses data from a single platform, which may limit the generalizability of results. Future research can consider examining other platforms to verify the effectiveness of using cryptocurrency as rewards. Second, the impact of cryptocurrency may vary depending on the types of tasks. Future research can explore how the effectiveness of using cryptocurrency as rewards depends on task types. Additionally, we only consider the effect of reward uncertainty on crowdsourcing tasks in aggregation. In the future, a comprehensive consideration from an individual contributor's perspective can also be carried out. These limitations create interesting opportunities for the effects of cryptocurrency in crowdsourcing platforms and other contexts for future research.

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