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Effects of Initial Coin Offering Characteristics on Cross-listing Returns

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Abstract: The lack of transparency in cryptocurrency markets means that investors must assess a project's quality on the basis of public information. This paper examines how initial coin offering (ICO) characteristics affect cross-listing returns, i.e. whether or not the available information is a valuable signal of quality. For this purpose, we analyze 250 cross-listings of 135 different tokens issued via ICOs and calculate abnormal returns for specific samples using event study methodology. We find that cross-listing returns are driven by success in terms of token performance and project funding, as well as by jurisdiction-specific characteristics like the extent of regulation and domestic market size. Other characteristics like the choice or change of blockchain infrastructure, token distribution across investors and the project team, campaign duration and whitepaper characteristics also seem to influence perceived project quality and thus cross-listing returns. The results provide insights for the literature on cross-listings, cryptocurrency markets and entrepreneurial finance in the form of ICOs. They also make it possible to interpret the information available on the market and enable investors, project teams and crypto currency exchanges to evaluate probable market reactions to cross-listings.

Keywords: ICO characteristics; Cryptocurrency exchanges; Blockchain; Ethereum; Event study; Token sales

1. Introduction

Traditional financial markets offer a large number of multipliers, ratios and asset pricing models that help with the valuation of a company and thus the prediction of its future price performance. Few such indicators, if any, exist on the cryptocurrency market. This is due on the one hand to the complexity of the market and the individual projects and, on the other hand, to the lack of disclosure obligations that would allow investors and customers to gain insights into company figures. It is therefore all the more important to evaluate the little information available and examine its suitability for the crypto currency market in order to achieve a higher level of transparency.

The complexity of this market is illustrated by the various ways in which cryptocurrency can be issued. The first cryptocurrency Bitcoin (Nakamoto 2008) was simply started as a decentralized computer protocol, with issuance occurring via an open mining mechanism. Users of the blockchain receive Bitcoins as a reward for solving an arithmetic problem. Today, additional forms of issuance include corporate issuance (e.g. a company simply distributes tokens, like a digital dollar), initial coin offerings (ICOs), security token offerings (STOs), airdrops, and initial exchange offerings (IEOs).

This study is only concerned with cryptocurrencies issued through ICOs, which are one of the most widespread forms of cryptocurrency issuance, not least because the issuance process is comparatively simple. They also face low regulatory requirements and offer investors instant access to secondary markets. Projects that conduct an ICO do not require their own blockchain but can create a digital token on an existing blockchain infrastructure using a smart contract, i.e. autonomously executed computer protocol. A sizable body of literature on ICOs has already investigated the influence of various ICO characteristics and market metrics on returns. These will be discussed in more detail in the course of this paper.

In the run-up to a cross-listing event, investors inform themselves about the project in question using the information that is available in the market. The aim of this work is to investigate the effects of different ICO characteristics, which are publicly known to the market, on the returns from cross-listing events of ICO tokens. In a broader context, we strive for a deeper understanding of how a project's properties affect its price structure on the cryptocurrency market. The results can shed some light on whether and how the market evaluates and proceeds available information such as return on investment (ROI) or ICO duration.

In Chapter 2, we provide a general overview of the existing literature on cross-listing events and ICO characteristics. Chapter 3 describes the data set, the methodology and ICO characteristics. Chapter 4 presents some descriptive statistics, while Chapter 5 is dedicated to the empirical results proper. Chapter 6 discusses the results, points out several limitations of the work and makes some suggestions for future research. Finally, Chapter 7 contains a brief conclusion.

2. Related literature and hypothesis development

There is already a wide field of research on ICOs, part of which deals with the influence of ICO characteristics on the effects of stock market listings and the associated development of returns. For example, Drobetz et al. (2019) investigate returns on the first day an ICO project is listed on a cryptocurrency exchange and identify market sentiment, competition and liquidity as influencing factors. Momtaz (2018) finds an influence of funding on the pricing of ICO projects, while Zhang et al. (2019) show that the readability of whitepapers influences first-day ICO returns. Benedetti and Kostovetsky (2019) and Momtaz (2019) find that initial exchange listings of cryptocurrencies yield positive abnormal returns. Benedetti (2019) and Ante (2019) examine the effects of cryptocurrency cross-listing and reveal similar results for returns. Ante and Meyer (2019) assess the market reaction to ICO cross-listings and the effects of specific cryptocurrency exchanges and liquidity metrics on the returns. They conclude that ICO cross-listings on average produce positive returns and thus represent a quality signal, and they identify a clear influence of exchanges and liquidity metrics on cross-listing returns.

2.1 Cross-listings

There is plenty of literature on cross-listings for stock markets, and some for cryptocurrencies. While on stock markets, cross-listings have been variously found to have positive price effects (Foerster and Karolyi 1999; D. P. Miller 1999) or no effects (Lau et al. 1994; Varela and Lee 1993), the results on cryptocurrency markets consistently show positive abnormal returns during cross-listing events (Ante 2019; Ante and Meyer 2019). In both fields, assets prices rise in anticipation of a cross-listing event (Ante 2019; Dharan and Ikenberry 1995). Similarly, negative drifts after cross-listing events have been found both in stock markets (Alexander and Janakiramanan 1988; Dharan and Ikenberry 1995) and in cryptocurrency markets (Ante 2019; Ante and Meyer 2019). However, findings for stock markets vary, as Foerster and Karolyi (1999) and Howe and Kelm (1987) identify negative effects on the days following listing events, while Miller (1999) and Jayaraman et al. (1993) do not.

Several theories may explain why a cross-listing should classify as a positive event and thus entail positive price effects. Bris et al. (2007) demonstrate that cross-listings are a quality signal. Other theories mention the degree of investor protection, access for new investors or market visibility as possible explanations for the positive effects of a cross-listing event. Bonding theory (Coffee 2002) states that listing a stock in a country with higher investor protection can raise company value. A listing on US markets seems to have a particularly positive impact (Doidge et al. 2004). Higher investor protection and extended disclosure requirements serve to reduce information asymmetries (M. H. Miller and Rock 1985), which makes submission to stricter regulation a signal of quality (Cantale 1996). Doidge et al. (2004) find a price premium for firms from home jurisdictions with weaker investor protection that recently cross-listed on a US market.

Cross-listing an asset also raises market visibility and attracts new investors (Bancel and Mittoo 2001; Mittoo 1992; Pagano et al. 2002). Baker et al. (2002) explain the positive returns of such events with lower capital costs due to increased visibility, and Merton (1987) argues the existing investors' expected returns decline as new investors are acquired during a cross-listing. Jayaraman et al. (1993) regard the newly-opened market as a cheaper form of corporate financing. Other findings suggest that the increase in liquidity thanks to a cross-listing attracts liquidity traders competing for order flow (Chowdhry and Nanda 1991). Increased liquidity as an effect of cross-listing is found both for stock markets (Foerster and Karolyi 1999a) and cryptocurrency markets (Benedetti 2019). You et al. (2013) however show that as the number of cross-listings increases, their positive effects decline.

2.2 ICO success

The introduction of blockchain technology (Nakamoto 2008) gave young companies a new form of financing. The mapping and transmission of digital assets via the blockchain is the cornerstone of this new form of start-up financing. Most ICO projects sell so-called utility tokens, which usually carry a specific benefit in the form of a service or product, similarly to a coupon or voucher (Ante et al. 2018). Thanks to the blockchain technology, the tokens can immediately be traded on secondary markets.

It is in the interest of projects to signal their quality to the market and thus successfully attract investors on both the primary and secondary markets. *Signaling theory* (Spence 1973) states that signals of quality can reduce asymmetric information and thus attenuate market uncertainty. To be effective, signals should be costly to imitate or be provided by trusted third parties (Fischer and

Reuber 2007; Sanders and Boivie 2004). Yet even cost-free signals can be effective in specific circumstances (Smith 1994). Still, signals should be structured so that misbehavior is not rewarded, or is even punished (Connelly et al. 2011). Ante and Fiedler (2019) find that cryptocurrency projects that issue security tokens make effective use of cheap (to fake) signals like the reported size of the team and social media communities, but other cheap signals such as the number of external advisors have negative effects on funding success. This may be a sign that the market is learning to interpret signals that can be misused.

The literature has examined the success of the ICOs and related signals from various perspectives. From the perspective of entrepreneurs, success may be measured by the amount of funding collected (Ante et al. 2018; Fisch et al. 2018) or whether the funding goals have been achieved (Adhami et al. 2018). From the perspective of investors, viable metrics of success include initial abnormal buy-and-hold returns within the first 30 trading days of secondary market trading (Benedetti and Kostovetsky 2019) and (abnormal) returns at the day of the first exchange listing (Momtaz 2019) can be considered as success or performance factors. The importance of such success factors is confirmed by the findings of Fisch et. Al. (2018). Based on a survey of 517 investors, the authors identify ideological, technological and financial motives as determinants to invest in ICOs. The hope of selling the tokens at a premium was stated as the most important reason to invest.

> **Hypothesis 1:** '*Successful' ICOs tend to have higher cross-listing returns. We operationalize success as H1a) the return on investment before the cross-listing event, H1b) the achievement of a project's funding goals and H1c) the amount of funding collected.*

2.3 ICO geography

The location and jurisdiction of ICOs is a highly relevant factor for the success of an ICO and the related secondary market performance, as the projects aim for the 'right' level of regulation while simultaneously seeking access to the widest possible audience. Some countries can be classified as ICO-friendly (e.g. Switzerland and Singapore), while others have even banned them altogether (e.g. China). Huang et al. (2019) investigate the determinants of ICO location choice using a sample of 915 projects from 187 countries. The authors consider four country characteristics: 1) the nature of the financial system (debt, public equity, private equity), 2) the development of information and communication technology (ICT), 3) the status of regulation, and 4) online crowdfunding platforms and their growth. They find that a more highly developed financial system and more investment in ICT infrastructure and human capital raise the likelihood of an ICO occurring in a given jurisdiction. Other studies have specifically analyzed the effects of jurisdictions on ICO success. Amsden and Schweizer (2018) test for effects of tax havens but fail to find significant results. For cross-listing returns of 327 crypto currencies over a 7-day event window, Ante (2019) finds a positive effect of being based in the US, while registration in South Korea or tax havens remains insignificant. Testing a sample of 151 security token sales, Ante and Fiedler (2019) find a positive effect of the ICO-friendly jurisdiction Singapore on funding success. Fenu et al. (2017) examine 1,388 ICOs and find that Slovenia and the USA are best suited to carry out a successful ICO, while Israel and China (before the ICO ban) are also less suited. The authors classified ICOs as successful that reached at least the soft cap declared by its proposers.

> **Hypothesis 2:** *An ICO's country of incorporation affects cross-listing returns. We operationalize geography as H2a) the 13 most prominent countries of incorporation plus 'other' countries,*

H2b) the three major continents of incorporation (Europe, Asia, America), and H2c) incorporation in a tax haven.

2.4 ICO characteristics

The choice of the blockchain infrastructure for token issuance is important not only for the usability of the technology, but also for the market success of a token, as protocols such as ERC-20 for Ethereum permit the creation of blockchain assets that users and market entities like cryptocurrency exchanges can easily handle. The Ethereum blockchain has been the dominant platform for both token creation and ICOs, likely due to network effects, as Ethereum was the first to enable smart contracts, which allow the simple creation of tokens and automated processing of ICO campaigns. 82% of the projects in our sample issued their tokens on Ethereum. Due to this dominance, most research has simply used a dummy variable for issuance on Ethereum as opposed to other platforms. Both Fisch (2019) and Howell et al. (2018) find positive effects of using Ethereum on the amount raised in ICOs.

Hypothesis 3: *The choice of blockchain infrastructure for ICO tokens affects cross-listing returns. We posit a positive effect for Ethereum-based tokens.*

In ICOs, the number of tokens is usually predefined. While most tokens are sold to investors, a certain number is often retained for the team, the company and/or its advisors. Investors will generally prefer a large share of tokens to be publicly sold, as these tokens are paid for. By contrast, the team will often receive their tokens for free as an incentive. Because team members do not pay for their tokens, they have no immediate cost base from which to calculate their return on investment. It is therefore rationally advantageous for them to sell their tokens at any time and price, as any price above zero will generate a profit for them. In addition to this moral hazard problem, asymmetric information also leads to the disadvantage of investors, as advisors and team members, as insiders, first have price-sensitive information and can act accordingly. To reduce the risk of misbehavior, team tokens are often vested. Nevertheless, as cryptocurrency markets are still largely unregulated, insider trading is ripe (Ante 2019; W. Feng et al. 2018).

Amsden and Schweizer (2018) and Lyandres et al. (2018) test the effect of the share of tokens sold on various measures of ICO success, finding that a higher share of tokens for sale leads to negative effects on the amount raised and on a measure of token tradability. Amsden and Schweizer (2018) justify this with a higher venture uncertainty with a larger supply of tokens. The share of tokens allocated to the team has been identified as a negative influence on the number of ICO investors (Fahlenbrach and Frattaroli 2019). Based on an analysis of ICO whitepapers, Florysiak and Schandlbauer (2019) suggest that project teams who retain a larger share of the tokens act as market makers on secondary markets and provide liquidity. In addition, such project teams quickly sell their share of tokens after an exchange listing in order to quickly realize profits or even to scam investors. Therefore, projects with teams that retain a large share of the tokens for themselves may be expected to experience lower returns surrounding cross-listing events. If a company is able to successfully finance itself in an ICO and is nevertheless in the position to distribute only a small part of its tokens this can be seen as a clear signal for quality. In such cases, additional tokens can be distributed over time by mining or after vesting periods, but the initial supply is limited.

Hypothesis 4: *The share of tokens sold affects cross-listing returns. We operationalize token allocation as H4a) the share of tokens that are sold to investors and H4b) the share of tokens retained by the project team.*

A short ICO campaign is more likely to be considered a success, as these campaigns are usually ended when the hard cap is reached and not after a pre-defined period of time. This can be seen as a quality signal. Empirical studies have identified a significantly negative effect of ICO duration on the amount raised (e.g. Fisch 2019).

Hypothesis 5: *The length of an ICO campaign affects cross-listing returns. We operationalize campaign length as the number of days between the start and the end of an ICO campaign.*

Whitepapers are a common source of information on ICO projects for investors, serving a similar function to a (non-technical) business plan, a pitch or a prospectus. The tradition was founded by a number of (technical) whitepapers on very successful crypto currency or ICO projects, including Bitcoin (Nakamoto 2008) and Ethereum (Buterin 2015; Wood 2014). For crowdfunding, which shares many similarities with ICOs, badly drafted offering documents are associated with fraudulent campaigns (Cumming et al. 2016), and the provision of more information promotes campaign success (Ahlers et al. 2015). Unlike for prospectuses, there are no standards for whitepapers, which often provide little information about the underlying entity of the ICO (Zetzsche et al. 2018). Based on a sample of 1,009 ICOs, Amsden and Schweizer (2018) show that ICO success declines with the level of venture uncertainty and increases with venture quality. Ante et al. (2018) analyze a sample of 278 ICOs, 52% of which have a whitepaper, and find that the existence of a whitepaper promotes funding success. In light of this body of evidence, we expect the existence of whitepapers to affect the returns from cross-listings.

Hypothesis 6: *Preparedness in terms of whether a project issued a whitepaper or not affects cross-listing returns.*

The literature has identified various characteristics that affect specific measures of ICO success. In this respect, it can be shown that these signals can at least partly explain the basic quality of an ICO project or its external assessment. While a variety of other factors, such as secondary market characteristics, company information, the size and jurisdiction of the secondary market or partnerships, will have clear influences, an ICO project's quality can be explained in part by the characteristics described above. Based on this evidence and assuming that the characteristics presented above signal the quality of an ICO token in line with the *Signaling theory* (Spence 1973), we expect that the ICO characteristics as described in the hypotheses will affect the return on cross-listings.

The general market reaction to cross-listings of ICOs is not the subject of this work – not least because Ante and Meyer (2019) investigate in detail CAARs over various event windows for the same dataset. Suffice it to say that the market model yields a CAAR of 9.97% for (-3, +3) and of 6.51% for (t = 0). Ante and Meyer (2019) furthermore analyze effects of individual cryptocurrency exchanges and liquidity metrics.

3. Data and methodology

3.1 Sample

The data set consists of 250 cross-listing events, which are distributed over 135 different ICO projects and their respective tokens. We included only listing events of ICO projects whose tokens traded at least 31 days prior to the listing date, so that we have a sufficient data basis for the estimation period. This ensures that all events are cross-listings, though we do not know exactly how many markets the tokens traded on previously. The cross-listing events were recorded via a publicly available telegram bot (t.me/cryptoeventbot), which connects to the application programming interfaces (APIs) of cryptocurrency exchanges and reports new trading pairs. This information was supplemented with data from the cryptocurrency market data provider block.cc, which also reports new exchange listings. Cross-listing events whose estimation or event window overlapped with another estimation or event window for the same cryptocurrency were rejected, in accordance to McWilliams and Siegel (1997). For each event, we collected information on daily closing prices, trading volumes and market capitalization (all in USD) for both the asset itself and Bitcoin from 31 days before to 10 days are after the listing. The data were collected from coinmarketcap.com. Since cryptocurrency markets trade 24 hours a day, 7 days a week, we use daily closing prices, which 1) incorporate the listing effects of the day, while opening prices likely do not and 2) are less affected by outliers than daily highs or lows. The same data set was used by Ante and Meyer (2019) to analyze the general market reaction to cross-listings of ICOs and the effects of cryptocurrency exchanges and liquidity metrics.

3.2 Event study

We calculate abnormal returns (ARs) to gauge the market reaction to cross-listing events. ARs represent excess returns, i.e. asset returns that are attributable to something other than the market's rate of return – in our case, the cross-listing events. They are calculated as the difference between the actual and the predicted returns during an event window, the prediction being based on a model that was developed over an estimation period prior to the event. Our estimation period is set to 21 days (t = -30 to -10), in line with Ante (2019) and Ante and Meyer (2019), to cope with the high volatility of the crypto markets. Another benefit of the short estimation period is that we encounter fewer overlapping events. Corresponding events are identified and modeled in line with Bowman (1983). The longest event window is a symmetric period of 7 days (t = -3 to +3) around the event, while the shortest intervals are individual days (e.g. t = 0). Different event windows allow us to study both ex-ante and ex-post effects.

To calculate the expected returns, we rely on the market model (Brown and Warner 1985; Collins and Dent 1984), as the more conservative choice compared to the Constant Mean Return Model (Masulis 1980). For the reference market, we choose Bitcoin, as the biggest and most relevant cryptocurrency, which furthermore correlates with most other cryptocurrencies (Burnie 2018; Gkillas et al. 2018; Hu et al. 2018). Formally, the market model depicts the predicted return of a cryptocurrency ($PR_{i,t}$) as the linear sum of a constant (a_i), the beta (b_i) of the token multiplied by the market return ($R_{BTC,t}$), and the error term ($e_{i,t}$):

$$PR_{i,t} = a_i + b_i R_{BTC,t} + e_{i,t} \tag{1}$$

Incidentally, if the beta or the market yield is set to 0, the market model is equivalent to the Constant Mean Return Model. The abnormal returns (AR) are then obtained by subtracting the predicted returns from the token's actual returns ($R_{i,t}$):

$$AR_{i,t} = R_{i,t} - PR_{i,t} \tag{2}$$

For event windows beyond a single day, the results are summarized in cumulative abnormal returns (CARs):

$$CAR_i(t_1, t_2) = AR_{i,t_1} + \cdots + AR_{i,t_x} \tag{3}$$

To consider all events within the sample, the results for individual tokens are aggregated as average abnormal returns (AARs) and cumulative average abnormal returns (CAARs), whose significance we test using t-tests and z-tests (non-parametric Wilcoxon test).

3.3 Variables

We test the effects of ICO characteristics within a number of sub-samples, which we define on the basis of success factors, jurisdictions and other technical and business factors. Table A1 in the Annex provides descriptive statistics for all variables. For analytical purposes, all non-binary variables are divided into quartiles.

Return on investment signifies the appreciation of a cryptocurrency before the cross-listing event. It is calculated as the asset's average closing price over the estimation window in relation to the issuance price. *Funding* represents the ICO's achieved campaign funding in USD, while *funding cap* is the desired amount of funding, i.e. the campaign goal. *Funding success* is a dummy variable that takes the value of one if an ICO achieved its funding goal, i.e. if *funding cap* equals *funds raised*. *ICO duration* is the number of days it took until an ICO was closed. If an ICO closed inside one day, the variable is assigned a score of 0.

When divided into quartiles, some variables are distributed evenly others unevenly *(tokens sold, tokens team* and *ICO duration)*. For example, 71 ICOs closed in less than one day are assigned to Q1 for the variable ICO duration, which does not necessarily correspond to a quarter of the sample. The respective intervals of the quartiles for each variable are provided in Table A2 in the Appendix.

We collected the corporate jurisdiction of each project if the information was available. Dummy variables were created for each of the 13 most common jurisdictions (see Table A1 for the full list). All other countries are grouped as *other*. Additionally, we created dummy variables for each of the three continents *Europe*, *Asia* and *America*, and for ICOs being located in a country that we consider a *tax haven*.[1] A further dummy variable indicates whether a token operates on the *Ethereum* blockchain, with two projects simultaneously using both Ethereum and another blockchain. *Tokens sold* and *tokens team* are the shares of tokens sold to investors and allocated to the project team, respectively. Tokens can also be distributed to the issuing company itself, advisors or as an incentive to third parties. It is also conceivable that tokens will only be distributed over time, e.g. to miners or other participants in the system. These token distributions have not passed this investigation. *WP: exists* is a dummy variable that refers to the existence of a project whitepaper.

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[1] Barbados, Belize, British Virgin Islands, Cayman Islands, Gibraltar, Liechtenstein, Malta.

4. Descriptive statistics

The sample comprises 250 cross-listing events of 135 different ICO tokens. The first ICOs closed in Q3/2013, most were conducted in the last three quarters of 2017, and the last one was recorded for Q2/2019. Most of the cross-listing events in turn took place between Q4/2017 and Q4/2018. The average time between the end of an ICO and the associated cross-listing event is just under a year (352 days), the lowest number being -176, as the EOS token was already listed on exchanges while its tokens were still being sold. In our sample, the longest time between an ICO and the associated cross-listing is 1,886 days. On average, the offering period lasted 21 days (SD = 48 days), but this number is inflated by the four observations of EOS, whose token sale lasted close to one year. 71 observations from 37 individual projects closed their token sale within one day.

We obtained funding statistics for projects of 244 respective cross-listing events. The average amount collected is $101 million. This number is highly influenced by the four individual observations for EOS, which raised close to $4.2 billion. This outlier is also reflected in the standard deviation of $532 million and the median of $24 million. Funding targets were only identified for projects involving 190 cross-listing events. These funding targets averaging $34.4 million. 80% of these projects achieved their funding targets. The mean share of tokens sold is 54.9%, while 15.9% of the tokens on average were retained by the project team. The remaining tokens were distributed to the issuing company itself, advisors, as an incentive to third parties, vested over time, burned, frozen or distributed in another way. Of the 250 cross-listing events, 90% relate to projects that have a whitepaper.

The mean return on investment before the cross-listing is 9,864%, with a standard deviation of 69,688% and a median of 340%, which can be explained by high outliers such as the very early and successful projects Next, Iota and Stratis. The minimum ROI is a loss of 99.99%. Overall, most of the projects in the sample are successful from an investor's perspective, which seems logical: Unsuccessful projects are less likely to be cross-listed, being unable to pay the listing fees, or the exchanges may simply lack interest to list them.

For 242 cross-listing events we were able to determine the jurisdiction of the associated companies. Where 36.7% of the cross-listing events relate to projects that are located in Europe, 33.5% in Asia and 28.9% in America. The most popular jurisdictions are Singapore (19.4%), the US (19%) and Switzerland (14.1%), followed by the Cayman Islands (7%), Hong Kong (5.4%), China (4.1%) and the UK (2.9%), while the remaining 28.1% are spread across 22 other jurisdictions. 15.7% of the events relate to projects based in tax havens, as defined above. Besides company jurisdictions, we also identified the countries where the teams (or most of their members) actually operate, finding a total of 23 different team locations for 234 observations. 39.6% of the projects operate from the same country where their company is registered. The leading location for teams is the US (37.2%), followed by China (19.2%), Singapore and Germany (7.3% each), Russia (5.6%) and the UK (3.4%). It seems that entrepreneurs who are physically based in highly regulated countries tend to choose more lightly regulated jurisdictions for their businesses.

In ICOs, the issued tokens mostly operate on an existing blockchain infrastructure that ensures immediate tradability. Ethereum has been the leading blockchain for ICOs (Ante et al. 2018), and so it is in our sample (82%). Among the 18 other blockchain infrastructures that were used for issuance, only NEO (2.5%) and Cardano (1.6%) account for more than one percent of the events.[2]

5. Results

5.1 Success

As stated above, the definition of ICO success depends on the perspective. Investors will mostly look for return on investment, while for entrepreneurs, achieving the funding target play a major role. Yet since some ICOs do not have funding caps but rather aim to raise as much as possible, we also test for any association between the absolute amount of funding and CAARs from cross-listings. The results are shown in Table 1.

Table 1. Market model-based CAARs over different event windows around up to 243 cross-listings of ICO tokens.

			-3 to +3		-3 to -2		-1		0		+1		+2 to +3	
Success metric	Sample	N	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)
Return on investment	Q1	61	0.62	8.6^{bx}	0.49	1.8	0.59	7.4^{bx}	0.56	1.2	0.49	-0.6	0.49	-1.5
	Q2	63	0.61	15.6^{ax}	0.61	6.7^{by}	0.39	-0.8	0.64	11.7^{ax}	0.38	-2.1^{cy}	0.37	-2.7^{y}
	Q3	61	0.64	13.8^{z}	0.43	-0.7	0.54	3.1	0.54	13.1^{z}	0.44	1.0	0.30	2.2^{cy}
	Q4	59	0.57	3.0	0.58	3.5	0.52	-0.4	0.53	0.7	0.43	1.4	0.47	-0.2
Funding success	yes	152	0.63	8.4^{ax}	0.53	3.7^{b}	0.51	3.1^{b}	0.53	3.5^{az}	0.43	-0.6^{z}	0.38	-1.3
	no	38	0.55	11.1^{z}	0.45	0.9	0.42	-0.8	0.74	11.2^{cx}	0.47	2.6	0.50	-2.9
Funding	Q1	61	0.62	21.6^{bx}	0.57	2.8^{c}	0.52	1.2	0.75	16.3^{cx}	0.52	2.6	0.49	-1.4
	Q2	63	0.52	1.4	0.44	-1.0	0.49	3.9	0.48	2.3	0.39	-0.1	0.37	-3.8^{cy}
	Q3	61	0.62	7.2^{by}	0.59	5.3^{by}	0.49	1.1	0.48	4.4^{b}	0.38	-1.4	0.30	-2.2^{bz}
	Q4	59	0.65	9.1^{by}	0.48	4.3	0.52	2.3	0.40	3.2^{b}	0.45	-0.5	0.47	-0.2

a, b, c indicates significance at the 1%, 5% and 10% level, respectively, for the t-statistic.
x, y, z indicates significance at the 1%, 5% and 10% level, respectively, for the z-statistic.
'Pos' indicates the proportion of positive CARs among the subsample.

For the two continuous metrics of success, return on investment and funds raised, the sample is divided into quartiles, with Q1 representing the lowest quartile. CAARs are calculated over six different time intervals. The table also states the number of events that fall into each success category, and the proportion of them that had a positive CAAR over each event window. The six time intervals allow us to observe the complete event window (-3, +3), to analyze any pre-event effects (-3, -2; t = -1), to observe the effect on the day of the cross-listing (t = 0) and to detect any downstream effects (t = +1; +2, +3).

For return on investment, over the full event window, we find significant effects for the lower three quartiles. Q1 has average positive returns of 8.6% that are significant at least at the 5%-level for both test statistics, and Q2 has a CAAR of 15.6% ($p_{t|z} < .01$). In all four quartiles, most CARs are positive (57% to 64%). One day before the event, Q1 has a significant CAAR of 7.4%, and on the event day,

[2] The other platforms used for issuance are ARK, CPChain, NEM, Qtum, Factom, HyperCash, Iota, Komodo, Lisk, Metaverse, Next, Omni, Stratis, Syscoin, Tezos and Waves.

Q2 has a highly significant CAAR of 11.7%, while the results for the other three quartiles lack significance. None of the event windows feature significant results for Q4.

The results for the full event window show that 63% of the events that concern projects reached their funding target achieved a positive CAR, but at 8.4% ($p_{t|z} < .01$), the CAAR is lower than for projects that missed their funding targets (11.1%), though the latter figure is only significant for the z-statistic at the 10%-level. Regardless of whether the funding target was reached, there are positive CAARs on the day of the event, which are significant at the 1% or 10% level, depending on the test. The CAAR is higher for projects that missed their funding target than for those that succeeded, by 7.7 percentage points. The share of projects that achieved a positive abnormal return in a cross-listing is also higher for 'unsuccessful' projects (74% vs 53%).

For the variable *funding* Q1 shows a significant CAAR of 21.6% for the full event window. Q3 (7.2%) and Q4 (9.1%) also feature significant CAARs, while Q2 lacks significance. The same picture emerges for the day of the event. Here, the 'least successful' projects achieve the highest and significant CAAR of 16.3%. In the (-3, -2) window, Q3 projects achieve a significantly positive CAAR of 5.3%. No significant results can be observed one day before or one day after the cross-listings. For the 2-day window after the event, Q2 and Q3 show significant negative CAARs of 3.8% and 2.2%, respectively.

5.2 Jurisdictions

Besides the success metrics described above, the projects' jurisdictions may also affect the returns from cross-listings. Table 2 shows event study results for the 13 most popular ICO jurisdictions and the 'Other' category for the 31 projects that were located in other countries. Additionally, aggregate results for Europe, Asia and America are shown. For the full event window, only three of the 14 countries (China, Liechtenstein and Barbados) show negative returns, and none of them are significant. Of the six countries with significant returns, Switzerland (25.8%) and Hong Kong (25%) have the highest effects, while the US (14%) has the highest level of significance ($p_{t|z} < .01$). Most results of the two pre-event windows lack significance. For both event windows, over half of the jurisdictions have overall positive returns.

On the listing day, only the US (7.3%; 65% positive ARs) and Thailand (8.8%; 100%) have significant positive returns. Several countries, including Hong Kong, China and Liechtenstein, feature only very marginal ARs of less than +/-1%. For the day after the listing, no country variable is significant, and only three of the countries have a share of positive events in excess of 50%. For the (+2, +3) period after the cross-listing, Barbados has the highest negative effects (-15.9%; $p_{t|z} < .05$).

All three continents show significant results for (-3, +3). ICOs from Asia show significant returns for both pre-event windows, with a positive CAAR of 4.8% ($p_{t|z} < .05$) over (-3, -2), while European (11.5%) and American (7.3%) ICOs have significant positive returns on the listing day. For the (+2, +3) window, only the returns of Asian ICOs are significant (-2.7%). While the only significant CAAR for projects based in tax havens is 5% in t = 0, the CAAR of the reference group is also significant and two percentage points higher. The results over the full event window are insignificant for the tax haven sample, while non-tax haven tokens have a highly significant CAAR of 12.1%.

Table 2. Market model-based CAARs over different event windows around up to 239 cross-listings of ICO tokens by jurisdiction samples.

		-3 to +3		-3 to -2		-1		0		+1		+2 to +3	
Location	N	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)
Singapore	47	0.51	3.5	0.53	3.0^{c}	0.51	0.4	0.45	1.2	0.47	0.8	0.26	-2.1^{bz}
United States	46	0.70	14.0^{ax}	0.52	4.8^{b}	0.52	1.9	0.65	7.3^{bx}	0.33	0.8	0.41	-0.8
Switzerland	34	0.62	25.8^{y}	0.47	3.0	0.41	0.4	0.50	19.3	0.47	2.0	0.53	1.2
Cayman Islands	17	0.65	13.2^{cz}	0.47	0.8	0.59	4.8	0.65	6.5	0.59	-1.5	0.64	2.6
Hong Kong	13	0.62	25.0^{bz}	0.54	11.4	0.69	16.6^{z}	0.38	-0.0	0.46	-1.1	0.46	-1.9
China	10	0.70	-0.4	0.50	7.5	0.50	1.8	0.30	-0.2	0.50	-3.5	0.40	-6.0
United Kingdom	7	0.57	7.0	0.57	-1.4	0.57	5.7	0.71	2.3	0.43	-1.3	0.57	1.7
Croatia	7	0.57	1.2	0.57	-1.8	0.57	0.4	0.57	5.4	0.57	1.9	0.43	-4.7
Liechtenstein	7	0.57	-2.3	0.43	1.5	0.43	0.1	0.29	-0.6	0.14	-1.5	0.29	-1.7
Barbados	5	0.20	-22.5	0.20	-2.5	0.40	-2.5	0.20	5.1	0.20	-6.8	0.00	-15.9^{by}
Poland	5	0.80	4.1	0.60	-1.9	0.80	7.1	1.00	3.6^{y}	0.40	-5.9	0.80	1.1
Taiwan	5	0.80	13.6^{bz}	0.80	-0.5	0.80	5.8	0.20	-2.3	0.80	6.6	0.60	3.9
Thailand	5	1.00	6.8^{by}	0.80	5.0	0.60	0.3	1.00	8.8^{cy}	0.40	-1.8	0.40	-5.5
Other	31	0.48	10.1	0.48	-0.6	0.45	2.6	0.71	12.6^{z}	0.42	0.1	0.29	-4.4^{y}
Europe	89	0.60	12.6^{cz}	0.53	0.7	0.49	1.5	0.63	11.5^{cy}	0.45	0.4	0.45	-1.5
Asia	81	0.60	7.4^{ax}	0.56	4.8^{ay}	0.57	4.2^{cz}	0.43	1.0	0.48	0.1	0.33	-2.7^{by}
America	70	0.66	11.1^{ax}	0.47	3.0^{c}	0.53	2.2^{c}	0.63	7.3^{ax}	0.39	-0.4^{y}	0.33	-1.0
Tax haven	38	0.47	0.3	0.37	-0.5	0.45	0.9	0.53	5.0^{bz}	0.37	-2.9	0.42	-2.4
No tax haven	204	0.64	12.1^{ax}	0.55	3.3^{bz}	0.54	2.8^{by}	0.57	7.0^{bx}	0.46	0.5	0.41	-1.5^{cy}

a, b, c indicates significance at the 1%, 5% and 10% level, respectively, for the t-statistic.
x, y, z indicates significance at the 1%, 5% and 10% level, respectively, for the z-statistic.
'Pos' indicates the proportion of positive CARs among the subsample.

5.3 ICO characteristics

Table 3 shows the CAARs for specific sub-samples based on ICO characteristics. Ethereum-based ICOs have a CAAR of 6.9% in (-3, 3), while the reference group shows returns of 15.9%, both significant. On the listing day, Ethereum-based tokens have a significant CAAR of 5.8%, while non-Ethereum token returns remain insignificant. For the period (+1, +3) (not reported in a table), only 38% of the tokens issued on Ethereum have positive CARs, which results in a highly significant CAAR of -3.1%.

All quartiles for *tokens sold* show positive CAARs over the full event window, though the size and level of significance varies. On the event day, all quartiles but the lowest show significant CAARs: 3.2% ($p_{t|z} < .1$) in Q2, 10.3% ($p_{t|z} < .05$) in Q3, and 3.9% ($p_{t|z} < .01$) in Q4. Further significant results are found only for Q4 in (-3, -2), with 3.5%.

Looking at the share of tokens retained by the team, over the full event window, Q1 has the largest number of projects, the highest proportion of positive CARs (66%) and also the highest CAAR (17%; $p_{t|z} < .01$). On the day of the event, all quartiles but Q2 have positive CAARs, which are significant for both test statistics. Q1 shows the highest CAAR (10.5%), followed by Q4 (7.1%) and Q3 (4.1%). After the event, we find significant negative CAARs of -2.6% for Q3 in t = +1 and of -6.0% for Q2 in (+2, +3), while the other quartiles exhibit only marginal significance, if any.

The time related variable *ICO duration* shows over the full event window, that the Q1 (13.8%) and the Q3 (13.9%) quartiles have the highest and most significant CAARs. On the event day, significant CAARs of 13% are obtained in Q1. During (+2, +3), however, significantly negative CAARs are identified for Q2.

Table 3. Market model-based CAARs over different event windows around up to 250 cross-listings of ICO tokens by ICO characteristics.

Characteristic		N	-3 to +3		-3 to -2		-1		0		+1		+2 to +3	
			pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)	pos	CAAR (%)
Ethereum	yes	169	0.59	6.9^{ax}	0.53	1.4	0.51	2.9	0.60	5.8^{ax}	0.44	-0.5^{z}	0.36	-2.7^{ax}
	no	83	0.63	15.9^{bx}	0.49	5.2^{c}	0.52	1.1	0.48	7.8	0.42	0.5	0.52	1.2
Tokens sold	Q1	82	0.57	11.8^{cy}	0.48	2.5	0.50	3.9	0.43	8.4	0.48	-0.9	0.44	-2.1
	Q2	47	0.64	9.3^{y}	0.47	4.1	0.53	2.5	0.60	3.2^{cz}	0.38	-0.3	0.43	-0.3
	Q3	55	0.58	9.9^{bz}	0.55	0.4	0.49	1.1	0.60	10.3^{by}	0.40	-1.0	0.53	-0.9
	Q4	61	0.66	8.8^{ay}	0.59	3.5^{bz}	0.52	1.1	0.70	3.9^{ax}	0.46	1.9	0.44	-1.5
Tokens team	Q1	98	0.66	17.0^{ax}	0.54	2.7^{c}	0.52	2.3^{b}	0.57	10.5^{cy}	0.45	0.6	0.49	0.8
	Q2	33	0.55	0.2	0.55	3.3	0.52	1.8	0.42	1.4	0.48	-0.3	0.24	-6.0^{ax}
	Q3	60	0.58	8.9^{cy}	0.57	5.2	0.48	3.1	0.65	4.1^{cz}	0.37	-2.6^{by}	0.40	-0.9
	Q4	37	0.59	3.5	0.43	-2.1	0.54	2.3^{c}	0.54	7.1^{by}	0.51	0.2	0.40	-4.1^{c}
ICO duration	Q1	71	0.65	13.8^{bx}	0.49	-0.3	0.56	1.6	0.62	13.0^{bx}	0.44	-0.9	0.46	-0.5
	Q2	52	0.63	4.8	0.58	2.4	0.44	2.4	0.63	3.0	0.50	0.7	0.37	-3.7^{bz}
	Q3	65	0.60	13.9^{by}	0.51	5.8	0.48	3.5	0.52	5.3	0.38	1.1	0.38	-1.9
	Q4	58	0.55	6.0	0.52	3.6	0.53	1.7	0.48	3.7	0.43	-1.3	0.40	-1.7^{z}
WP: exists	yes	225	0.60	9.8^{ax}	0.52	2.2	0.51	2.5	0.55	6.7^{by}	0.43	-0.0	0.40	-1.6^{cz}
	no	25	0.72	11.5^{z}	0.56	6.9	0.52	0.4	0.64	5.1^{cz}	0.52	-0.8	0.56	-0.0

a, b, c indicates significance at the 1%, 5% and 10% level, respectively, for the t-statistic.
x, y, z indicates significance at the 1%, 5% and 10% level, respectively, for the z-statistic.
'Pos' indicates the proportion of positive CARs among the subsample.

Projects with a whitepaper achieved a CAAR of 9.8% ($p_{t|z} < .01$) for the full event window, while those without a whitepaper obtained 11.5%, which is, however, only significant for the z-statistic at the 10%-level. On the day of the listing, projects with whitepapers have a CAAR of 6.7% ($p_{t|z} < .05$), 1.6 percentage points more than for those without ($p_{t|z} < .1$). A slightly negative CAAR of -1.6% ($p_{t|z} < .1$) can be observed for the (+2, +3) event window.

6. Discussion

Unlike stock companies for example, most cryptocurrency projects are not subject to any disclosure requirements. The availability and reliability of information about a project is therefore limited. Potential investors in a cross-listing will want to know as much as possible about the quality of a token or the underlying project, for which they have to rely on the information that is available on the market. This paper has assessed the extent to which specific pieces of information influence the returns on ICO token cross-listings to obtain some indication as which ones of the variables we investigate continue to be relevant.

6.1 Success

The results show that especially projects with lower prior return on investment experience significant excess returns in the course of a cross-listing event (8.6% and 15.6% in the two lower quartiles), leading us to reject hypothesis 1a. This may be because a cross-listing event, which requires effort and usually also a listing fee, serves as a signal of quality (Bris et al. 2007). Especially projects with poor prior performance can positively surprise the market with such a signal. Conversely, projects with high return on investment have no significant abnormal returns during the cross-listing – their quality has already been proven. It is also possible that successful projects have already completed several cross-listings, which reduces the effects (You et al. 2013).

The lower CAAR in Q1 compared to Q2 over the full event window may furthermore mean that the market cannot fully forget a project's previous negative performance. Both quartiles also show significant CAARs prior to the event, which may indicate informed trading (Ante 2019). On the day of the event, a highly significant positive CAAR (11.7%) is found only for Q2, while the Q1 CAAR (1.2%) is small and insignificant. It seems that new investors are less attracted to projects with poor prior performance. The significant negative CAAR of 2.1% for Q2 one day after the event may indicate market overreaction during the cross-listing. Alternatively, early investors are using the event to liquidate their positions.

The dummy variable *funding success* indicates whether a project has reached its stated funding goal. The large majority of projects in our sample (80.7%) were successful in this sense. Over the full event window, cross-listings of fully financed ICOs are associated with highly significant positive returns, while those of the other group are even higher but hardly significant. On the day of the event, the CAARs of both groups are significant, although the returns of only partly funded projects are 7.7 percentage points higher. This can be a sign that the market in particular rewards formerly less successful projects that signal their quality through cross-listing and raise their visibility (Baker et al. 2002). We thus reject hypothesis 1b.

The absolute amount of funding also affects the success of a cross-listing, though not necessarily as expected. We reject hypothesis 1c as, over the full event window, projects that collected the most funding achieve significant positive returns but those that collected the least have even higher significant CAARs. To projects that collected less funding, the fees for a cross-listing present more of an obstacle, overcoming which the market may appreciate as a signal of the project's ability to use its limited resources efficiently (Bris et al. 2007). In contrast to these projects, well-funded projects (Q3 and Q4) have a large investor base and enjoy more attention on the cryptocurrency market. Especially the first cross-listing, by doubling the number of exchanges that the token may be traded on, improves liquidity. This interpretation is supported by Chowdhry and Nanda (1991), who state that cross-listings attract liquidity traders who compete for order flow. Due to the increased liquidity it is conceivable that cross-listings reduce existing investors' return expectations because the liquidity risk is reduced. Furthermore, a large number of new investors could be attracted due to the high level of attention devoted to such projects within a cross-listing event– in line with the investors recognition hypothesis (Merton 1987).

In sum, we find relevant effects for all success metrics – prior returns on the one hand and historical success in project financing on the other. The implication is that these criteria may be useful for market participants as a basis to assess project quality (and the resulting returns from cross-listings) – albeit to a different extent than assumed in the hypotheses.

6.2 Jurisdictions

We identify clear differences between the individual jurisdictions of incorporation, confirming hypothesis 2a. Six of the fourteen tested variables yield significant results over the complete event window; tokens of US-based projects have the highest significance (14%; $p_{t|z} < .01$). On the event day, US-based projects have a significant CAAR of 7.3%. One reason for the significant abnormal returns of US projects in particular may be that the strict regulation and strong investor protection in the country make cross-listings rarer and therefore more meaningful. For stock markets, Lang et al. (2003) report increased scrutiny of cross-listed firms in the US market, and Doidge et al. (2004) find a valuation premium for cross-listed companies. Exchanges that list US projects risk having to comply with US laws and being prosecuted for any failure to do so, which may dissuade the exchanges from listing such projects.

At 25%, Hong Kong has the highest CAAR among those jurisdictions that show significance for both test statistics. Hong Kong itself is a small market, which is why the access to additional markets enabled by a cross-listing is particularly valuable there. The geographical and legal proximity to China may also explain the strong effect. As ICOs are now banned in China, Chinese teams may opt to incorporate their project in Hong Kong, starting from where cross-listings can afford them access to both Asian and Western markets while still enjoying legal certainty, which in turn acts as a quality signal. Swiss-based projects also have a high CAAR, possibly for similar reasons as in Hong Kong. The Cayman Islands (13.2%), Taiwan (13.6%) and Thailand (6.8%) also have significant CAARs over the full event window. Here, too, projects based in these small home markets have much to gain from cross-listing abroad. The Cayman Islands may signal legal flexibility for US teams, but also lower investor protection.

In terms of continents, cross-listings of European and American projects in particular yield high CAARs. Both regions are considered to be tightly regulated and to offer strong investor protection. A cross-listing event thus offers new investors, who only trade on specific exchanges, the opportunity to invest in projects more securely compared previous options. There is also the fact that on the event day itself, European (11.5%) and American (7.3%) projects show significant abnormal returns. Also, no significant negative effects can be observed after the cross-listing event. Consequently, we accept hypothesis 2b.

At 7.4%, the CAAR for Asian projects over the 7-day window is also highly significant, yet lower than for the other two regions. We identify significant pre-listing CAARs for tokens from Asia, while there is no significant effect on the event day. Post-listing returns are negative and significant (-2,7%). These results can be interpreted as evidence of informed trading.

By contrast, incorporation in a tax haven does not have any significant effects, with the sole exception of a marginally significant positive CAAR of 5% on the listing day itself. However, the reference group has a highly significant CAAR of 12.1% over the full event window. We accept hypothesis 2c but note that while we do find significant effects, those of the reference group are stronger in size and significance. Despite the low level of investor protection, we do not find any evidence of informed trading in cross-listings of tax haven-based projects.

6.3 ICO characteristics

Ethereum is the most popular blockchain infrastructure for ICO projects. About two-thirds of the cross-listing events in our sample refer to Ethereum-based tokens. Although these projects generate a highly significant CAAR of 6.9% across the entire event window, tokens hosted on alternative blockchains achieve an even higher CAAR of 15.9%. We thus reject hypothesis 3 because the use of a different blockchain results in higher CAAR compared with the commonly used Ethereum blockchain. It is conceivable that new investors who gain access to the asset through a cross-listing event reward such a feature and invest more than they would with an Ethereum project. A project's use of its own or a non-Ethereum blockchain may signal competence, as technical adjustments will be needed. Using such non-standard blockchains also requires the exchanges to implement new technology, which they will only do for promising projects. Listing a non-Ethereum token on an additional exchange can therefore be a quality signal.

We find that projects that sold a smaller share of their tokens achieve especially high abnormal cross-listing returns, so hypothesis 4a is accepted. If a company is successful despite having sold only a small share of its tokens, this can be seen as a valuable quality signal. Hypothesis 4b is likewise accepted as projects that have given fewer tokens to their teams achieve the highest abnormal returns in cross-listings. Team members usually do not pay for their tokens, which means that the funds collected from investors are diluted. Furthermore, unless the team tokens are vested, investors constantly face the risk of those tokens being dumped onto the market, depressing prices. This allegedly already happened several times on cryptocurrency markets (e.g. beincrypto 2019; NewsBTC 2019; Trustnodes 2019). For both reasons, in accordance with our results, investors consider a small share of team tokens a signal of quality (Ante and Fiedler 2019).

Projects that have published a whitepaper experience a highly significant CAAR in their cross-listings, but to a lesser extent than those that have not published a whitepaper. We therefore reject hypothesis 6. On the day of the event, the returns of the projects with a whitepaper exceed those of the reference group without it. A whitepaper provides (new) investors with a convenient opportunity to inform themselves about the product, the team and the company. It is therefore surprising that projects without a whitepaper perform better during a cross-listing event. One reason for this could be that the cross-listing event itself is perceived as a signal of quality and has a particularly strong impact, as no such quality signals were previously present regarding the respective ICO projects.

Our results show that ICO characteristics affect downstream events such as cross-listings, suggesting that market participants indeed process the available information to evaluate the projects.

6.4 Limitations and future research

Despite the large number of existing event studies on exchange cross-listings, ours is one of the first to investigate ICO cross-listings. That being said, the study is subject to several restrictions. Due to the novelty of the financing form, the number of events is limited. Our sample does not cover all cross-listing events of cryptocurrencies issued through an ICO, as not all data are available and some observations had to be excluded due to overlapping time intervals. Our source for market data, coinmarketcap.com, calculates volume-weighted prices across a selection of different exchanges that includes all the major ones but excludes others.

While our overall dataset contains 250 observations and yields many significant results, certain sub-samples, such as projects without a whitepaper, comprise much fewer observations and produce results of low statistical robustness. Our findings should be validated in future studies as more data becomes available. Also, we do not know how many exchanges the tokens already trade on before the cross-listing in question, and this information may affect the results. Future research should address this question on the basis of better data.

Of course, cross-listing returns for ICO tokens depend on more variables than we investigate. Potential additional explanatory factors include measures of whitepaper quality (Zhang et al. 2019), the vesting of team and company tokens, the circulating supply of tokens (Cohney et al. 2019), and order book data of cryptocurrency exchanges (Meyer and Fiedler 2019). Furthermore, alternative approaches to the event study methodology can produce additional valuable insights. For example, future research might look at shorter time intervals (minutes or seconds) and longer-term price effects of cross-listings (e.g. for one or six months after the event).

Besides various ICO and success characteristics, we have tested the influence of an ICO's jurisdiction on cross-listing events, concluding that projects in more strictly regulated countries like the US generate significant excess returns. Future research could analyze how these countries differ in terms of investor protection and disclosure requirements and how these specific characteristics affect the returns of cross-listings. This could allow much more precise explanations of the effects identified here. It also worth investigating any effects of whether the operational center of a project is located in the country where the project is incorporated – many projects operate in one country and carry out their ICO in another, likely to avoid regulation.

7. Conclusion

We investigate a range of characteristics of 135 ICO projects and their influence on 250 cross-listing events. In addition to success metrics, we analyze the effects of jurisdictions and ICO characteristics. The results contribute to the literature on cross-listings (of cryptocurrency) and to research on entrepreneurial finance, especially the area of ICOs.

Our results show that the market indeed utilizes existing information to assess the quality of ICO projects in the context of cross-listings. This is an important finding for various market participants. It helps investors estimate the anticipated effects of cross-listings at an early stage, which can afford them considerable time and information advantages at the time of an event. Projects are able to assess how they will be perceived by the market at a later point in time. They can to some extent present themselves in such a fashion as to maximize returns in a cross-listing. For cryptocurrency exchanges, the results allow a better assessment of the potential effects of new currency pairs. Exchanges may use our results as an additional tool to evaluate projects. Generally, the results allow a better assessment of cryptocurrency markets, specifically the market for ICOs.

We show that cross-listings can help projects with low to moderate prior success signal their quality. The jurisdiction of a project also affects cross-listing returns. For example, cross-listings of ICOs from the US (strict regulation) achieved large excess returns. Projects from smaller markets or less strict regulated jurisdictions (e.g. Cayman Islands) were also able to signal their quality and attract new investors through cross-listings. Looking at continents, we find a significant pre-event CAAR for projects from Asia, which suggests informed trading.

Companies that issue their tokens on the Ethereum blockchain achieve a lower abnormal return (6.9%) than those that use a different blockchain (15.9%). The market seems to interpret the use of alternative technologies as a signal of quality. A smaller share of tokens sold and a smaller share of tokens retained by the team yield higher abnormal returns as the token supply is low and the risk of moral hazard is reduced.

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Appendix

Table A1. Descriptive statistics for the ICO characteristics.

Variable	N	Mean	SD	Median	Min.	Max.
Return on investment	243	98.64	696.89	3.40	0.00	8,526.19
Funds raised	244	101,000,000	532,000,000	24,000,000	15,087	4,200,000,000
Funding cap	191	34,400,000	37,900,000	25,000,000	543,303	400,000,000
Funding success	190	0.80	-	1	0	1
Singapore	242	0.19	-	0	0	1
United States	242	0.19	-	0	0	1
Switzerland	242	0.14	-	0	0	1
Cayman Islands	242	0.07	-	0	0	1
Hong Kong	242	0.05	-	0	0	1
China	242	0.04	-	0	0	1
United Kingdom	250	0.03	-	0	0	1
Croatia	250	0.03	-	0	0	1
Liechtenstein	250	0.03	-	0	0	1
Barbados	250	0.02	-	0	0	1
Poland	250	0.02	-	0	0	1
Taiwan	250	0.02	-	0	0	1
Thailand	250	0.02	-	0	0	1
Europe	242	0.37	-	0	0	1
Asia	242	0.33	-	0	0	1
America	242	0.29	-	0	0	1
Tax haven	242	0.16	-	0	0	1
Ethereum	250	0.68	-	1	0	1
Tokens sold	245	0.55	0.22	0.51	0.04	1.00
Tokens team	228	0.16	0.11	0.15	0.00	0.96
ICO duration	246	21.99	48.41	10	0	340
WP: exists	250	0.90	-	1	0	1

Table A2. Quantiles distributions across variables

Variable	Q1	Q2	Q3	Q4
Return on investment	0.01 - 0.73	0.75 - 3.40	3.43 - 11.51	11.79 – 8,526.19
Funding	0.02 - 9.88	10.00 - 24.00	24.42 - 36.00	37.80 – 4,198.00
Tokens sold	0.04 - 0.40	0.44 - 0.51	0.60 - 0.70	0.72 - 1.00
Tokens team	0.00 - 0.10	0.11 - 0.15	0.16 - 0.20	0.25 - 0.96
ICO duration	0	1 - 8	12 - 29	30 - 340

Declarations

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on request.

Conflicts of interest

Not applicable.

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