Embracing the Future or Buying into the Bubble: Do Sophisticated Institutions Invest in Crypto Assets?

Luke DeVault and Kainan Wang*

ABSTRACT

We document that institutional investors increasingly invest in assets that do business in the cryptocurrency industry, which we call crypto assets. Cryptocurrency is a new and risky asset class. Investing in such assets demonstrates that managers are willing to accept change in the financial markets. Investing in new assets and being wrong can lead to both reputational costs and career concerns. We examine the performance of institutions willing to make investments in this new industry relative to the performance of their peers who are not. The results show that institutions that invest in crypto assets outperform their peers by about 2.8% per year, suggesting that the willingness to invest in new and uncertain assets may be a predictor of institutional performance.

Keywords: Institutional investor; Cryptocurrency; portfolio performance; trading skill

JEL Classification: G11; G23

* DeVault is from the Department of Finance, College of Business, Clemson University, Clemson, SC, 29634; E-mail: ldevaul@clemson.edu. Wang is from the Department of Finance, John B. and Lillian E. Neff College of Business and Innovation, University of Toledo, Toledo, OH, 43606; E-mail: kainan.wang@utoledo.edu.

"*There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success then to take the lead in the introduction of a new order of things*" Nicolo Machiavelli, The Prince-1532

1. Introduction

Cryptocurrency represents a new set of investment products with an uncertain future. Today there are multiple publicly traded securities, that we call crypto assets, whose share prices are dependent on cryptocurrencies. These include Grayscale trusts, blockchain ETFs, and cryptocurrency mining companies. These assets represent a new class of investment vehicles. In this study, we examine the portfolio return and risk characteristics of institutional investors who do and who do not invest in crypto assets. Doing so we hope sheds light on both the crypto asset industry as well as the investment profiles of institutional managers who are more accepting of financial market change.

One way that managers who invest in crypto assets may differ from those who do not is their willingness to change. Some evidence from psychology supports the notion that individuals more resistant to change are less likely to adopt new products (Oreg, 2003). Willingness to change is associated with characteristics that may or may not be valuable for a money manager. On the one hand, individuals willing to accept change are less risk averse (Judge et al., 1999), which could lead to excessive risk-taking. On the other hand, individuals prone to change exhibit characteristics such as self-discipline, an orientation toward creative achievement (Mumford et al., 1999), and positive self-concept (Judge et al., 1999). Positive self-concept reflects an individual's ability to deal with difficult/stressful situations (Judge, Locke, and Durham, 1997; Judge et al., 1998). Thus, it is unclear if employing a money manager that is more accepting of change will add value to the fund or increase portfolio risk. Managers with greater discipline or more creativity may add value. However, managers with low risk-aversion could erode risk-adjusted returns.

Crypto assets themselves could play multiple roles in a portfolio, to either increase returns or enhance diversification. The current literature suggests several potentially valuable characteristics of crypto assets. For instance, cryptocurrencies produce high expected returns, exhibit low correlation with traditional assets, and act as a hedge against uncertainty or a store of value.[1] On the contrary, some studies indicate a great deal of risk in cryptocurrency finding that crypto assets may not be priced efficiently or have any fundamental value, and are subject to fast-changing regulations.[2] Thus, it remains debatable whether crypto assets as a new investment class offer desirable properties to a money manager.

We examine institutional investors' direct investments in crypto assets. Given that institutional managers are sophisticated investors (e.g., more informed and less behaviorally biased than individual investors) whose trades account for the majority of market trading volume, our focus on these investors allows us to draw conclusions reflecting the mainstream market perception of crypto assets. We posit that if managers who invest in crypto assets are more accepting of change because they are less risk averse, then they will underperform and manage riskier portfolios than managers who do not. Alternatively, if managers who invest in crypto assets are more accepting of

[1] Stoffels (2017) finds that crypto assets have high expected returns. Makarov and Schoar (2020) and Borri and Shaknov (2018) find that crypto assets present potential arbitrage profits. Liu and Tsyvinski (2021) show that cryptocurrency exhibits time-series momentum. Chuen Lee, Guo, and Wang (2018) and Liu and Tsyvinski (2021) find low correlations between crypto and traditional assets. Corbet et al. (2018) and Bouri et al. (2017a) find that crypto assets help with portfolio diversification. Crypto assets may also provide a valuable role as either a hedge or a store of value (e.g., Bouri et al., 2017b; Dyhrberg, 2016). However, Yermack (2015) suggests that Bitcoin does not serve well as a medium of exchange, store of value, or unit of account.

[2] Some work finds that crypto assets are efficiently priced (Tran and Leirvik, 2020; Kristoufek, 2018; Kristoufek and Vosvrada, 2019), while other work finds inefficient pricing and predictable returns (Urquhart, 2018; Vidal-Tomas and Ibanez, 2018; Jiang, Nie, and Ruan, 2018; Wei, 2018; Hu, Valera, and Oxley, 2019; Caporale, Gil-Alana, and Plastun, 2018; Zargar and Kumar, 2019; Al-Yahyaee, Mensi, and Yoon, 2018; Nan and Kaizoji, 2019). It remains debatable whether cryptocurrency has fundamental value (Cong, Li, and Wang, 2021; Sockin and Xiong, 2021; Cheah and Fry, 2015).

change because of positive characteristics (e.g., creativity or discipline), then their portfolios should outperform and have lower overall risk than managers who do not invest in crypto assets.

Our empirical results reveal that a small but growing number of institutions invest in crypto assets. Institutions investing in crypto assets outperform those institutions who do not, supporting the notion that sophisticated institutions invest in crypto assets. Moreover, institutions investing in crypto assets hold portfolios consisting of securities with lower average beta and return volatility, suggesting that crypto assets are pursued by managers that place a premium on diversification.

Our study contributes to the literature on crypto assets and institutional investors. Our results suggest first that crypto assets are becoming an accepted investment instrument for sophisticated investors. Further, if investing in crypto assets is a proxy for a manager's willingness to change, then such a characteristic appears beneficial to the portfolio and underlying investor. Financial institutions who invest in crypto assets appear to possess superior skill and to place a premium on portfolio diversification.

2. Data and descriptive statistics

Our data come from several sources. 13F institutional holdings are from the Thomson S34 Database. The Securities and Exchange Commission (SEC) requires that all institutions with at least $100 million in assets under management disclose their holdings in Form 13F every quarter. The list of crypto securities is obtained using two methods. We first select three Grayscale trusts including Grayscale Bitcoin Trust, Grayscale Ethereum Trust, and Grayscale Ethereum Classic Trust, and three blockchain ETFs including Siren Nasdaq NexGen Economy ETF, First Trust Indxx Innovative Transaction & Process ETF, and Amplify Transformational Data Sharing ETF. We include blockchain ETFs because blockchain is the foundation that enables the existence and development of cryptocurrencies. Next, we select individual stocks whose returns are highly

correlated with the returns of Bitcoin. Bitcoin prices are obtained from CoinDesk.[3] At the end of each quarter we calculate every CRSP security's return correlation with Bitcoin based on daily prices over the past 252 trading days. We then keep the top five stocks with the highest correlations for each quarter. We further use online news reports to manually check if each stock is involved in crypto related businesses such as direct investment in cryptocurrencies, cryptocurrency mining, and blockchain development, and if so, we classify the stock as a crypto security.[4] Appendix A provides a detailed list of crypto securities used in this study.

Our sample contains 45,213 institution-quarter observations over the period of March 2018 to March 2020, covering 6,041 13F institutions. The sample begins in March 2018, the first quarter in which institutions publicly revealed crypto holdings in Form 13F, and ends in March 2020, the most recent quarter of 13F reports in the S34 database. Among all institutions in our sample, 215 report holding a crypto security for at least one quarter, corresponding to 878 institution-quarter observations. The majority of institutions reporting a crypto security position hold the position over multiple quarters. In comparison, only 58 institutions report a crypto security holding for one quarter.

Figure 1 plots the total number of institutions (blue line) and the number of institutions that hold a crypto security (red line) in our sample from March 2018 to March 2020. It shows that the number of institutions holding a crypto security has increased over time, along with the size of the institutional sample, while the fraction reporting a crypto position has remained relatively stable at

[3] The data are downloadable at https://www.coindesk.com/price/bitcoin. We use Bitcoin for this test because it is most well-known and has the longest track record of any crypto asset.
[4] We exclude the securities that do not have any affiliation with cryptocurrencies, despite a high return correlation with Bitcoin. Examples of such securities include Reality Shares DIVCON Dividend Guard ETF in December 2018 and GraniteShares Gold Trust in September 2019.

around 2%. For instance, in March 2020, 106 of 5,333 institutions held a crypto security in their portfolios.

To understand what type of institutions hold a crypto security, we use the institution classification data compiled by Brian Bushee.[5] In unreported tables, we find that the majority of institutions holding a crypto security are independent investment advisors (87.5%), followed by bank trusts (8.0%). Insurance companies, investment companies, and public pension funds together account for less than 3% of the sample. These statistics are comparable to those for the institutions not holding a crypto security, suggesting that institutions with a crypto holding are not demographically different from those without a crypto holding. However, corporate pension funds or university and foundation endowments do not invest in crypto assets. When institutions are classified based on investment horizon, we find that quasi-indexers are the dominant type, followed by transient institutions.[6] This pattern is largely consistent for both institutions with and without a crypto holding.

Table 1 provides summary statistics of portfolio characteristics for institutions holding a crypto security and those institutions not holding a crypto security. We follow the recent literature on measuring institutional characteristics (Gompers and Metric, 2001) and consider the number of securities in an institution's portfolio, the dollar value of an institution's portfolio, the quarterly return of an institution's equity portfolio, the portfolio R^2, and the past return volatility of an institution's equity portfolio. The portfolio R^2 measures managers' stock selectivity skills and is computed using the Carhart 4-factor model (Carhart, 1997) over a 10-year rolling historical window.[7]

[5] The data are downloadable at https://accounting-faculty.wharton.upenn.edu/bushee. The data end in 2018 so we do not have data for institutions that recently became 13F institutions after 2018.
[6] According to Bushee (2001), quasi-indexers (transient institutions) have a diversified portfolio and a long-term (short-term) investment horizon.
[7] Amihud and Goyenko (2013) show that a lower portfolio R^2 indicates better manager skills.

The past return volatility reflects managers' risk management effectiveness and is calculated as the standard deviation of quarterly portfolio returns over the same 10-year rolling window. Appendix B provides detailed definitions for these variables.

[Insert Table 1 about here]

Panels A and B report the results for institutions without and with a crypto holding, respectively. We find that institutions investing in crypto assets manage much larger portfolios than those not investing in crypto assets, in terms of both the number of securities and portfolio value. For instance, the average portfolio value of institutions that hold a crypto security is $66 billion, which is more than 20 times larger than the portfolio value of institutions that do not hold a crypto security. In addition, institutions with a crypto holding earn an average return of 0.07% per quarter. In comparison, the quarterly return for institutions without a crypto holding is -0.39%. Institutions investing in crypto assets also have a slightly higher R^2 and a slightly lower past return volatility than their counterparts.

Panel C reports summary statistics measuring the degree of institutional investment in crypto assets. Here, we constrain the sample to institutions that hold a crypto security. We find that institutions on average hold 1.67 crypto securities which account for 1.06% of the portfolio size in terms of the number of securities and 0.04% in terms of the holding value. Most institutions hold only one crypto security. These small portfolio allocations are consistent with diversification motivating crypto asset investment.

Next, we examine the type of crypto securities held by institutions. In unreported results, we find that institutions primarily invest in blockchain ETFs. Out of the 1,462 observations for institutional crypto holdings, blockchain ETFs account for 74.7%. The rest of the holdings are in

individual stocks (18.4%) and Grayscale trusts (6.9%). Interestingly, none of the institutions in our sample hold multiple types of crypto securities in any quarter.

3. Empirical results

In this section, we examine whether institutional performance is related to institutional holdings of crypto assets. We start with a univariate test. At the end of each quarter, we sort institutions into two groups based on whether they hold a crypto security in the quarter. We then calculate the mean buy-and-hold returns for each group over the next one, two, and four quarters.[8] Table 2 presents the results. We find that institutions with a crypto holding consistently earn higher future returns than those without. The performance differences are economically meaningful. For instance, the annual outperformance of institutions holdings a crypto security over other institutions is 2.82%. Considering that institutions with a crypto holding manage portfolios worth $66.33 billion on average (Panel B of Table 1), this return indicates a value gain of $1.87 billion per year for these institutions. The return differences are also statistically significant at the 1% level for the two- and four-quarter holding periods. These results provide a first insight into the relation between institutional performance and crypto holdings.

[Insert Table 2 about here]

Next, we use panel regressions to control for institutional characteristics that may impact institutional performance. We follow Gompers and Metric (2001) and use the following controls: the number and value of institutional holdings, R^2, past return volatility, and value-weighted stock characteristics including stock price, market capitalization, return volatility, dividend yield, book-to-market ratio, S&P 500 membership, and age. We use the estimation approach of Petersen (2009) and

[8] Following DeVault, Turtle, and Wang (2021), we calculate an institution's quarterly return as the value-weighted return of all equity holdings the institution has at the beginning of a quarter.

cluster standard errors at both institution and quarter levels. Table 3 presents the results. The regressor of interest is Crypto, a dummy variable equal one if an institution holds a crypto security and zero otherwise. We find that institutions investing in crypto assets perform better than other similar institutions not investing in crypto assets. In the post four-quarter holding period, the coefficient on Crypto is 0.011 (Column 6), implying an outperformance of 1.1% per year for institutions with a crypto holding, after controlling for institutional and stock characteristics of portfolios.

[Insert Table 3 about here]

To ensure robustness, we also consider two alternative measures of institutional crypto holdings. The first one is the ratio of the value of crypto holdings to the value of all equity holdings (Crypto Ratio), and the second one is the number of crypto securities held by an institution (Num. Crypto). The results based on these measures are presented in Table 4. We find that both measures positively predict institutional performance in the future, thus providing further support to the notion that institutions who are more willing to embrace changes in their investment strategies end up performing better.

[Insert Table 4 about here]

We also explore the implication of crypto assets to the diversification of institutional portfolios. To do that, we place institutions into two groups based on whether they hold a crypto security in each quarter. For each institution, we calculate the value-weighted average of the return volatility, the CAPM beta, and the Carhart beta of all stocks in the institution's portfolio. The CAPM and Carhart betas are estimated using daily stock returns over the past 252 trading days. We then report the sample means of these characteristics for each institutional group in Table 5. Consistent with the literature that shows that crypto assets provide investors with diversification benefits, we

find that institutions holding crypto securities manage portfolios with a lower average return volatility and market beta. This suggests that institutions favoring crypto assets value diversification and do not concentrate their investment in a small set of securities. More importantly, this finding implies that the superior performance of institutional portfolios investing in crypto assets does not come at the cost of a higher risk exposure.

[Insert Table 5 about here]

4. Conclusion

Crypto assets as a new asset class present both opportunities and challenges to investors. This study examines how sophisticated financial institutions perceive the value of crypto assets and their related investment actions. The empirical results reveal that institutions invest in crypto assets. Those institutions that invest in crypto assets outperform those that do not for at least one year into the future. Further, it appears that crypto assets are held by institutions that place a premium on portfolio diversification. Institutions with crypto investments hold securities with lower market betas on average and lower degrees of overall risk.

Crypto assets represent a fast-growing new industry with uncertain value. Our results suggest that willingness to accept change is a predictor of institutional sophistication. While investing in a new industry with unclear fundamentals is risky, it appears that sophisticated institutions are willing to take this risk.

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Table 1

Descriptive Statistics

	Mean	Median	Std. Dev.
Panel A: Institutions not holdings a crypto security			
Num. securities	129.60	49.00	262.89
Port. Value ($millions)	3,205.44	319.69	24,670.74
RET (%)	-0.39	2.80	14.68
R^2 (%)	87.45	92.78	14.22
Port. VOL (%)	8.67	7.87	2.93
Panel B: Institutions holdings a crypto security			
Num. securities	941.02	734.50	812.32
Port. Value ($millions)	66,332.63	1,072.97	274,892.31
RET (%)	0.07	3.25	11.31
R^2 (%)	95.13	97.76	8.05
Port. VOL (%)	7.65	7.36	1.96
Panel C: Institutional crypto holdings			
Num. crypto securities	1.67	1.00	0.95
Fraction (num) crypto securities (%)	1.06	0.23	4.80
Value crypto securities ($millions)	0.64	0.03	2.09
Fraction (value) crypto securities (%)	0.04	0.00	0.24

Notes: This table presents summary statistics for 13F institutions not holding a crypto security (Panel A), 13F institutions holding a crypto security (Panel B), and 13F institutional crypto holdings (Panel C). The rows in Panels A and B report the number of securities, portfolio value, quarterly returns, portfolio R^2, and past return volatility. The rows in Panel C report the number of crypto securities, the fraction of crypto securities in an institution's portfolio, the value of crypto securities, and the dollar value fraction of crypto securities in an institution's portfolio.

Table 2

Univariate Test of Institutional Performance and Crypto Holdings

	Crypto Holding		
	No	Yes	Diff
RET_{q+1}	2.489%	2.952%	0.464%
			(0.86)
$RET_{q+1,q+2}$	0.510%	2.063%	1.553%***
			(3.57)
$RET_{q+1,q+4}$	5.003%	7.827%	2.824%***
			(4.05)

Notes: This table presents the portfolio value-weighted returns over quarter q+1, quarters q+1 to q+2, and quarters q+1 to q+4 for institutions that hold (do not hold) a crypto security in quarter q. The last column reports the return differences between the two types of institutions. t-statistics are reported in parentheses. ***, ** and * represent 1%, 5% and 10% significance, respectively.

Table 3

Cross-sectional Regressions of Institutional Performance and Crypto Holdings, Discrete Measure

	(1) RET_{q+1}	(2) $RET_{q+1, q+2}$	(3) $RET_{q+1, q+4}$	(4) RET_{q+1}	(5) $RET_{q+1, q+2}$	(6) $RET_{q+1, q+4}$
$Crypto_q$	0.005	0.016***	0.028***	0.003	0.005***	0.011**
	(1.21)	(3.66)	(3.59)	(1.21)	(2.81)	(1.99)
Num. $Security_q$				0.000	0.002	-0.001
				(0.16)	(0.59)	(-0.17)
Port. $Value_q$				0.001	0.001	0.003
				(1.15)	(0.51)	(1.44)
PRC_q				-0.000	0.002	0.002
				(-0.12)	(1.26)	(1.04)
$MktCap_q$				0.006*	0.005	0.009
				(1.72)	(1.02)	(1.50)
VOL_q				1.113	-0.550	0.167
				(0.84)	(-0.51)	(0.11)
$DivYld_q$				-0.443	-0.867	-1.125
				(-1.39)	(-1.60)	(-1.24)
BM_q				-0.051**	-0.105***	-0.148***
				(-2.34)	(-2.73)	(-2.69)
$SP500_q$				0.015*	0.040**	0.087***
				(1.70)	(1.99)	(3.25)
AGE_q				-0.011	-0.014	-0.035
				(-1.17)	(-1.55)	(-1.32)
R^2_q				-0.003	-0.024	-0.040
				(-0.22)	(-1.01)	(-1.18)
Port. VOL_q				0.088	0.020	-0.368
				(0.79)	(0.11)	(-1.50)
RET_q	-0.057	0.060	0.157	-0.099	-0.021	-0.159
	(-0.75)	(0.78)	(1.17)	(-1.61)	(-0.25)	(-1.44)
$RET_{q-4,q-1}$	0.042	0.127***	0.128	-0.012	-0.010	0.013
	(1.27)	(2.58)	(1.45)	(-0.29)	(-0.21)	(0.16)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	36,133	31,181	22,240	15,169	13,224	9,618
Adj. R^2	0.7135	0.5043	0.4286	0.8157	0.6879	0.6528

Notes: This table reports the cross-sectional regression estimates of an institution's future one-quarter (Columns 1 and 4), two-quarter (Columns 2 and 5), and one-year (Columns 3 and 6) returns regressed on a dummy variable indicating whether the institution holds a crypto security and other characteristics of the institution's portfolio. Num. Security and Port. Value are the number of securities in and the total dollar value of the institution's portfolio. Other control variables are the value-weighted averages of the characteristics of the stocks in the institution's portfolio. Num. Security, Port. Value, PRC, MktCap, and AGE are expressed as natural logarithms. *t*-statistics based on standard errors clustered by quarter and institution are reported in parentheses. ***, ** and * represent 1%, 5%, and 10% significance, respectively.

Table 4

Cross-sectional Regressions of Institutional Performance and Crypto Holdings, Continuous Measure

	(1) RET_{q+1}	(2) $RET_{q+1, q+2}$	(3) $RET_{q+1, q+4}$	(4) RET_{q+1}	(5) $RET_{q+1, q+2}$	(6) $RET_{q+1, q+4}$
Crypto Ratio$_q$	30.361***	36.349***	64.260***			
	(3.21)	(4.01)	(2.60)			
Num. Crypto$_q$				0.002*	0.002***	0.005***
				(1.73)	(2.60)	(2.64)
Num. Security$_q$	0.000	0.002	-0.001	0.000	0.002	-0.001
	(0.21)	(0.62)	(-0.12)	(0.16)	(0.60)	(-0.17)
Port. Value$_q$	0.001	0.001	0.003	0.000	0.001	0.003
	(1.22)	(0.54)	(1.50)	(1.15)	(0.51)	(1.44)
PRC$_q$	-0.000	0.002	0.002	-0.000	0.002	0.002
	(-0.10)	(1.27)	(1.08)	(-0.12)	(1.26)	(1.04)
MktCap$_q$	0.006*	0.005	0.009	0.006*	0.005	0.009
	(1.72)	(1.01)	(1.49)	(1.72)	(1.02)	(1.50)
VOL$_q$	1.112	-0.552	0.169	1.112	-0.553	0.160
	(0.84)	(-0.52)	(0.11)	(0.84)	(-0.52)	(0.11)
DivYld$_q$	-0.443	-0.866	-1.124	-0.444	-0.867	-1.126
	(-1.39)	(-1.59)	(-1.24)	(-1.39)	(-1.60)	(-1.24)
BM$_q$	-0.051**	-0.105***	-0.148***	-0.051**	-0.105***	-0.148***
	(-2.34)	(-2.73)	(-2.69)	(-2.34)	(-2.73)	(-2.69)
SP500$_q$	0.015*	0.040**	0.088***	0.015*	0.040**	0.087***
	(1.70)	(2.00)	(3.26)	(1.70)	(1.99)	(3.25)
AGE$_q$	-0.011	-0.014	-0.035	-0.011	-0.014	-0.035
	(-1.17)	(-1.55)	(-1.32)	(-1.17)	(-1.55)	(-1.32)
R^2_q	-0.003	-0.024	-0.041	-0.003	-0.024	-0.040
	(-0.24)	(-1.02)	(-1.20)	(-0.22)	(-1.01)	(-1.18)
Port. VOL$_q$	0.089	0.021	-0.366	0.088	0.020	-0.369
	(0.80)	(0.11)	(-1.50)	(0.79)	(0.11)	(-1.50)
RET$_q$	-0.099	-0.021	-0.159	-0.099	-0.021	-0.159
	(-1.62)	(-0.25)	(-1.44)	(-1.61)	(-0.25)	(-1.44)
$RET_{q-4,q-1}$	-0.012	-0.010	0.013	-0.012	-0.010	0.013
	(-0.29)	(-0.21)	(0.16)	(-0.29)	(-0.21)	(0.16)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,169	13,224	9,618	15,169	13,224	9,618
Adj. R^2	0.8157	0.6879	0.6527	0.8157	0.6879	0.6528

Notes: This table reports the cross-sectional regression estimates of an institution's future one-quarter (Columns 1 and 4), two-quarter (Columns 2 and 5), and one-year (Columns 3 and 6) returns regressed on continuous measures of crypto holdings in the institution's portfolio. Crypto Ratio is the dollar value of crypto holdings divided by the dollar value of an institution's portfolio. Num. Crypto is the number of crypto securities in an institution's portfolio. *t*-statistics based on standard errors clustered by quarter and institution are reported in parentheses. ***, ** and * represent 1%, 5%, and 10% significance, respectively.

Table 5

Univariate Test of Portfolio Diversification and Crypto Holdings

	Crypto Holding		
	No	Yes	Diff
VOL	1.933%	1.751%	-0.181%***
			(-12.02)
CAPM Beta	1.005	0.992	-0.013**
			(-3.11)
Carhart Beta	1.002	0.993	-0.010**
			(-3.01)

Notes: This table presents the averages of portfolio diversification measures for institutions that hold (do not hold) a crypto security. An institution's degree of diversification is measured by the value-weighted average of the return volatility, the CAPM beta, or the Carhart beta of all stocks in the institution's portfolio. The CAPM and Carhart betas are estimated using daily returns over the past 252 trading days. The last column reports the differences between the two types of institutions. *t*-statistics are reported in parentheses. ***, ** and * represent 1%, 5% and 10% significance, respectively.

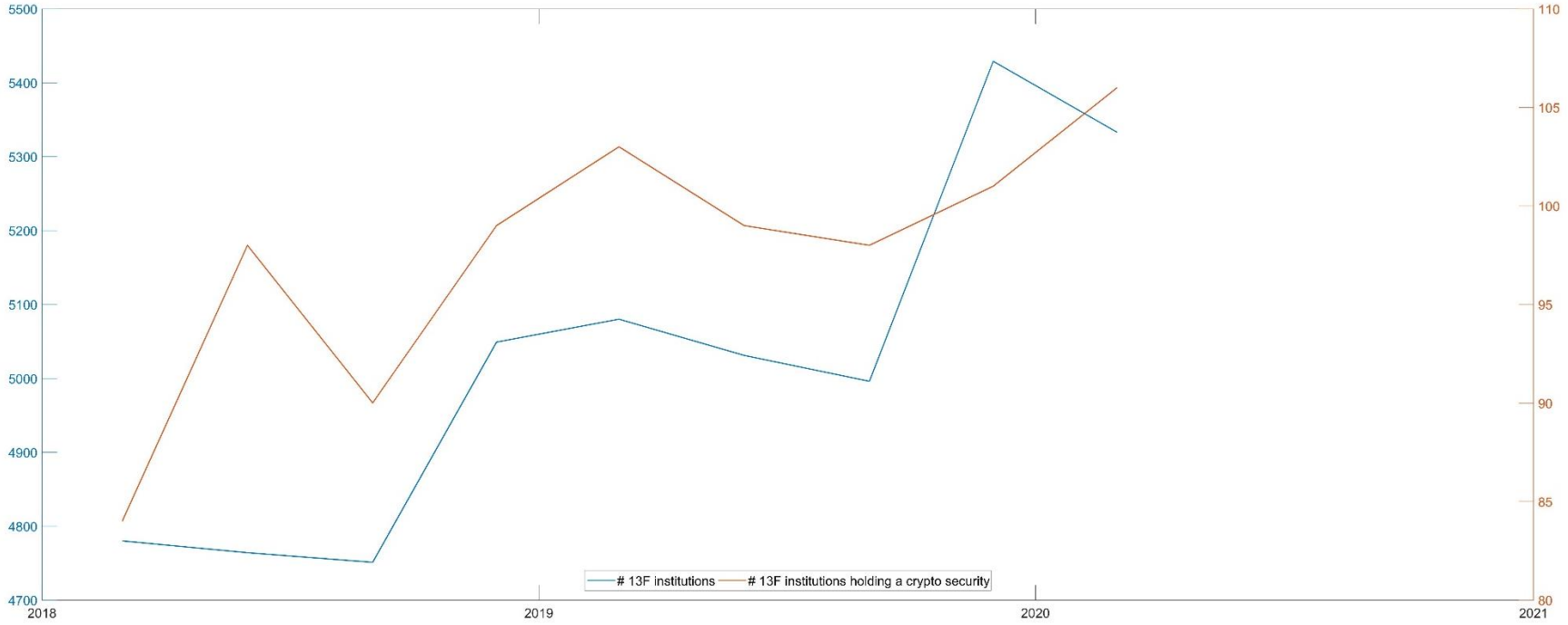

Figure 1. Time-series Evolution of the Number of 13F Institutional Investors. The blue line corresponds to the left axis and reports the number of 13F institutions over the period from March 2018 to March 2020. The red line corresponds to the right axis and presents the number of 13F institutions holding a crypto security over the same period.

Appendix A

List of Crypto Securities

Name	Ticker
Grayscale Bitcoin Trust	GBTC
Grayscale Ethereum Trust	ETHE
Grayscale Ethereum Classic Trust	ETCG
Marathon Digital Holdings	MARA
Riot Blockchain Inc.	RIOT
Siren Nasdaq NexGen Economy ETF	BLCN
First Trust Indxx Innovative Transaction & Process ETF	LEGR
Amplify Transformational Data Sharing ETF	BLOK

Appendix B

Variable definitions

Variable	Definition
Panel A: Institutional characteristics	
Num. Security	Number of securities in the institution's portfolio.
Port. Value	Value of equity holdings in the institution's portfolio.
RET	Value-weighted return of institutional equity holdings.
R^2	R^2 of regressing quarterly institutional returns on Carhart four factors (Carhart, 1997) over the past 10 years.
Port. VOL	Standard deviation of quarterly institutional returns over the past 10 years.
Panel B: Stock characteristics	
MktCap	Stock price times total shares outstanding.
PRC	Split-adjusted stock price.
VOL	Standard deviation of daily returns over the past 252 trading days.
DivYld	Cash dividend divided by stock price.
BM	Book value of equity for the fiscal year ending before the most recent June 30 divided by the market capitalization as of December 31 during that fiscal year.
SP500	Dummy variable indicating membership of the S&P 500 index.
AGE	Number of months since stock price first appeared in CRSP.
CAPM Beta	Coefficient of the market factor by regressing stock excess returns on the market factor. The estimation is based on daily returns over the past 252 trading days.
Carhart Beta	Coefficient of the market factor by regressing stock excess returns on Carhart four factors (Carhart, 1997). The estimation is based on daily returns over the past 252 trading days.
Panel C: Institutional crypto holdings	
Crypto	Dummy variable indicating institutional crypto holdings.
Crypto Ratio	Fraction of the value of crypto holdings in the institution's portfolio.
Num. Crypto	Number of crypto securities in the institution's portfolio.