The Effects of Cryptocurrency Wealth on Household Consumption and Investment

FDIC Research Symposium

Darren Aiello
BYU

Scott R. Baker
Northwestern

Tetyana Balyuk
Emory

Marco Di Maggio
HBS

Mark Johnson
BYU

Jason Kotter
BYU

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Motivation: Crypto Investing has Exploded but Volatility Remains High

Crypto Market Cap

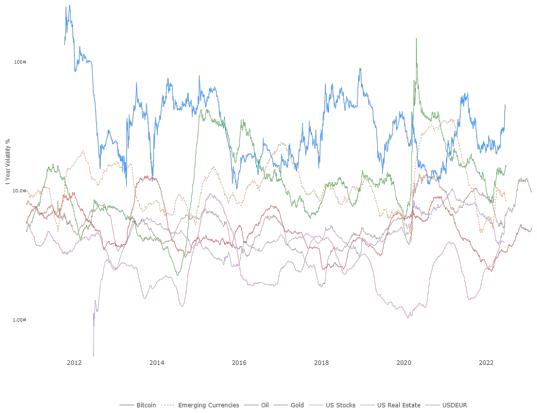
Bitcoin + Add to myFT

FINANCIAL TIMES

US bitcoin ETFs pull in $871mn in first three days of trading

Grayscale has outflows of more than $1.1bn as investors turn to BlackRock and Fidelity for new crypto products

BTC 1-Year Volatility vs Other Assets



How does crypto wealth affect household consumption and investment?

Empirical Questions

- Does crypto wealth affect household consumption and investment?
  - How does cryptocurreny fit into household investment portfolios relative to other asset classes?
  - How does MPC out of crypto wealth compare to that of (1) stock market gains, (2) income shocks, (3) lottery winnings
- Does crypto wealth affect investment in real assets (e.g., housing)?
  - Do fluctuations in crypto wealth have spillovers on local economy?

Challenge: Anonymous nature of public blockchains

This Paper

We use bank transaction data from millions of U.S. households to:

1. Characterize retail crypto investing
2. Examine the effect of crypto wealth on consumption and investment behavior
3. Zoom in on the effect of crypto wealth on housing spending
4. Document spillovers of crypto wealth to the local economy

▸ Data ▸ Validation ▸ Geographic

Key Results

1. Retail crypto investors hold crypto as one part of a broader portfolio
   - Crypto users are wealthier and are active equity investors

2. Marginal propensity to consume (MPC) out of crypto wealth is about 2X equity
   - But around 1/3 MPC out of one-time income shocks

3. Households use crypto wealth, in part, to purchase housing
   - $\uparrow$ housing spending after crypto withdrawal
   - $\uparrow$ new homeownership

4. As a result, crypto wealth shocks spill over into local house prices
   - Identification: 2 quasi-natural experiments

Contribution

- Literature on crypto investing
  - Survey-based data (Benetton & Compiani 2022), on-chain trading (Kogan et al 2022, Divakaruni et al 2021, Makarov & Schoar 2021), or off-chain aggregated data (Chava et al 2022)
  - This paper: Fuller picture of crypto investors, their consumption and investing, and how crypto wealth spills over to real economy
- Literature on consumption effects of investment wealth
  - MPC out of capital gains & dividends (Hartzmark & Solomon 2019, Di Maggio et al 2020), housing wealth (Aladangady 2017, Berger et al 2018), income shocks (Agarwal & Qian 2014, Baker 2018)
  - This paper: Consumption response to new asset class
- Literature on real effects of regional wealth shocks
  - Equity wealth spillovers to local consumption (Chodorow-Reich et al 2021) or house values (Hartman-Glaser et al 2018)
  - This paper: Effects of crypto gains on local house price appreciation

What does the typical crypto user look like?

Average Monthly Income/Spending for Crypto vs Non-Crypto Users

Variable	Crypto Users	Non-Crypto Users	Difference
Total Income	7,467	6,648	819***
Total Spending	4,979	4,738	241***
Traditional Investment	-260	-152	-107***
Crypto Investment	74	0	74***
Crypto Gains	61	0	61***
Percent of Spending:			
Cash/Check	16.8	19.4	-2.7***
Entertainment/Travel	7.6	6.5	1.1***
Mortgage	8.8	8.2	0.7***
Restaurants	10.2	9.1	1.0***

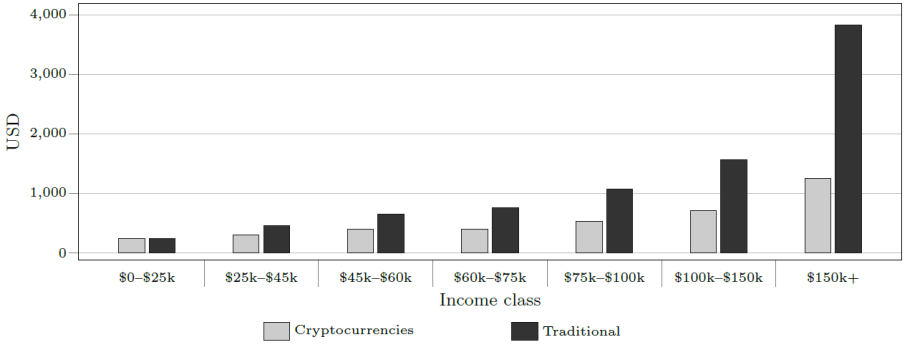
Crypto users:

- have higher income
- invest more in traditional brokerages
- have higher discretionary spending

See our companion paper, "Who Invests in Crypto? Wealth, Financial Constraints, and Risk Attitudes"

▸ SummaryStats ▸ Full Spending

Median Annual Investment by Asset and Income Class



- Crypto users have substantial exposure to traditional post-tax investments
- BUT: Distribution of crypto investing somewhat more even

How do crypto gains affect household consumption?

OLS estimates of the MPC out of crypto wealth are large

	Total Quarterly Spending
	OLS
	(1)
Avg. Quarterly Crypto Gains	0.114***
	(5.97)
Avg. Quarterly Crypto Gains × Covid Indicator	
Avg. Quarterly Crypto Gains × Post-Covid Indicator	
Lagged Income Control	X
Household FE	X
State × Quarter FE	X
Sample	All Households
Observations	3,274,658
Adjusted R^2	0.676

- MPC out of \$1 of crypto gains is \$0.11
- Identified? Spending might drive crypto investments . . .
- Solution? An instrument!

Passive Gains Instrument: Empirical Strategy

- Instrument for Crypto Gains with:

$$\text{PassiveGains}_{i,q} = \text{CryptoWealth}_{i,q-4} \times \left(\frac{\text{BTC}_q}{\text{BTC}_{q-4}} - 1 \right) \times \frac{\text{BTCWealth}_{i,q-4}}{\text{CryptoWealth}_{i,q-4}} + \left(\frac{\text{ETH}_q}{\text{ETH}_{q-4}} - 1 \right) \times \frac{1 - \text{BTCWealth}_{i,q-4}}{\text{CryptoWealth}_{i,q-4}}$$

- Crypto Wealth 1-year prior $\times$ allocation-weighted Bitcoin and Ethereum return
  - Crypto gains that the household would have experienced if there were no deposits or withdrawals over the year
- Estimate the effect of crypto gains on changes in future consumption using 2SLS
  - Passive Gains strongly predict actual gains: F-stat $\approx$ 2,500

2SLS estimates of the MPC out of crypto wealth are smaller, but still large

	Total Quarterly Spending				
	OLS	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)
Avg. Quarterly Crypto Gains	0.114***	0.0879***	0.0729***		
	(5.97)	(4.43)	(3.08)		
Avg. Quarterly Crypto Gains × Post-Covid Indicator			0.0325		
			(0.79)		
Avg. Quarterly Investment Gains				0.0678***	0.0487***
				(2.95)	(4.45)
Lagged Income Control	X	X	X	X	X
Household FE	X	X	X	X	X
State × Quarter FE	X	X	X	X	X
Sample	All Households	All Households	All Households	Crypto Investors	Non-Crypto Investors
Observations	3,274,658	3,274,658	3,274,658	569,102	2,705,537
Adjusted R^2	0.692	0.082	0.082	0.081	0.081
Weak ID KP F Stat		11,526	3,383	2,847	9,543

- MPC out of \$1 of crypto gains is \$0.09
- Roughly 2X MPC out of equity wealth
- But $< \frac{1}{3}$ MPC out of stimulus/lotteries

MPCs from crypto gains and losses

	Total Quarterly Spending		
	2SLS	2SLS	2SLS
	(1)	(2)	(3)
Avg. Quarterly Crypto Gains	0.084**	0.114***	0.0587*
	(2.25)	(2.81)	(1.76)
Avg. Quarterly Crypto Gains			0.0575
× Negative Gains Indicator			(0.98)
Lagged Income Control	X	X	X
Household FE	X	X	X
State × Quarter FE	X	X	X
Sample	Non-Covid, Positive Gains	Non-Covid, Negative Gains	Non-Covid
Observations	3,170,985	3,209,457	3,274,658
Adjusted R^2	0.080	0.082	0.082
Weak ID KP F Stat	3,122	60,527	2,556

- First two columns exclude quarters with negative or positive gains, respectively
- No significant difference between the two, though weak evidence for higher MPC from losses

MPC split by net savings

	Total Quarterly Spending		
	2SLS	2SLS	2SLS
	(1)	(2)	(3)
Avg. Quarterly Crypto Gains	0.139***	0.0494***	0.141*
	(3.12)	(2.39)	(3.15)
Avg. Quarterly Crypto Gains × High Savings			-0.0896*
			(-1.83)
Lagged Income Control	X	X	X
Household FE	X	X	X
State × Quarter FE	X	X	X
Sample	Low Savings	High Savings	All Households
Observations	1,627,832	1,646,815	3,274,647
Adjusted R^2	0.101	0.072	0.082
Weak ID KP F Stat	3,601	8,094	1,801

- MPCs higher for relatively constrained households ($0.14 vs $0.05)
- Similar behaviour for imputed equity gains ($0.10 vs $0.03)

What do households consume following crypto withdrawals?

Event study of large ($>$\$5,000) withdrawals

Large Crypto Withdrawals are Broadly Spent

Annualized Monthly Spending Category	Coefficient On Post First Crypto Withdrawal >$5,000
Total	5,753***
	(4.68)
Auto	211.4**
	(2.50)
Cable/Telecom	-56.95
	(-1.40)
Cash/Check	1,833*
	(1.85)
Charity	11.75
	(0.36)
Education	-54.46
	(-0.32)
Entertainment	395.4**
/Travel	(2.56)
General Merchandise	2,105***
	(6.82)

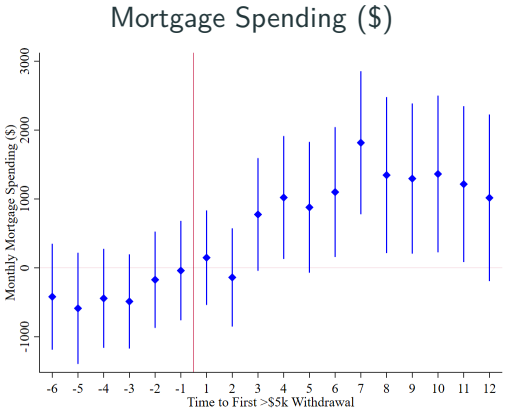
Annualized Monthly Spending Category	Coefficient On Post First Crypto Withdrawal >$5,000
Groceries	177.9**
	(2.22
Insurance	173.4**
	(2.21)
Medical	32.00
	(0.64)
Mortgage	500.7**
	(2.27)
Rent	-64.94
	(-0.61)
Restaurants	395.3***
	(3.81)
Utilities	92.67*
	(1.71)

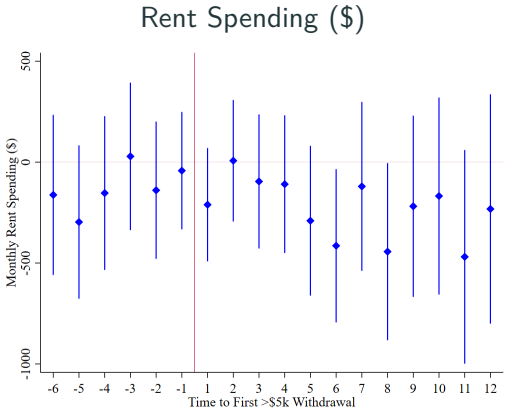
*Separate account and year fixed effects included

▸ Withdrawals through Time

- Much of this spending is consistent with purchasing a new house

Event Study Estimates of Effect of Crypto Withdrawals





- Effect on mortgage spending while no effect on rent
- No pre-withdrawal trends in mortgage spending

Crypto Withdrawals and Housing Consumption

	Monthly Mortgage Spending, Annualized		New Homeowner	
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
Post First Crypto Withdrawal >$5,000	500.7**		0.0477***	
	(2.27)		(5.98)	
Post First Crypto Withdrawal >$10,000		597.2**		0.820***
		(2.01)		(6.87)
Lagged Income Control	X	X	X	X
Household FE	X	X	X	X
Year FE	X	X	X	X
Observations	38,471	20,177	38,476	20,180
Adjusted R^2	0.714	0.715	0.243	0.261

- ↑ prob of new homeownership by 4.8 pp, or 45% relative to mean

Aggregate effect of crypto wealth on local housing markets

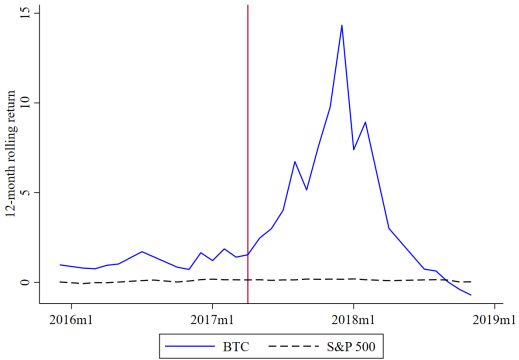
Two identification strategies

2017 Bitcoin Runup Diff-in-Diff: Setting

- Massive Bitcoin returns during 2017
  - BTC crosses $10,000 for the first time
  - Peak year-over-year return of over 2,000%
  - Generated large crypto gains for early adopters, many of whom cashed out

▸ Wealth by County ▸ Crypto Withdrawals

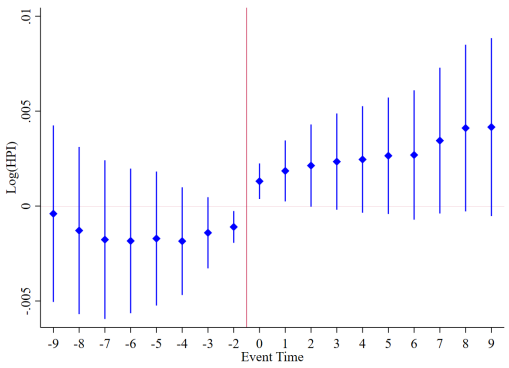
▸ Bitcoin and Nasdaq ▸ Equity Withdrawals



2017 Bitcoin Runup Diff-In-Diff: Empirical Strategy

Idea: Counties that had early crypto exposure experienced a large crypto wealth shock during the 2017 BTC Runup

- Compare house prices in counties with high pre-runup crypto wealth to counties with low pre-runup crypto wealth
- Before and after BTC runup begins (May 2017)



2017 Bitcoin Run-Up Diff-In-Diff: County-Month Housing Prices

	County-Month Log Median House Price		County-Month Median House Price	
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
High Crypto Wealth County × Post Run-up	0.00426***		2005.3***	
	(2.44)		(3.49)	
Log County Crypto Wealth × Post Run-up		0.00138**		772.5***
		(2.18)		(3.43)
Per Capita Equity Gains	X	X	X	X
12-Month Lagged Outcome	X	X	X	X
County FE	X	X	X	X
Month FE	X	X	X	X
Observations	18,072	27,747	18,072	27,747
Adj. Within R^2	0.333	0.267	0.466	0.521

House prices in high crypto wealth counties grow 43 bp faster than low crypto wealth counties

- Or roughly 12% of s.d. in 2018 house price growth

. . . and the median house price increases by about $2,000 in 12 months

Passive Gains Instrument: Empirical Strategy

- We extend the analysis to the entire sample using a 2SLS strategy
  - Similar to the household-level MPC analysis
- Estimate the effect of 12-month county crypto gains on changes in house prices
- Instrument for county-level crypto gains with:

$$\text{PassiveGains}_{c,t} = \frac{\text{CryptoWealth}_{c,t-12}}{\text{Households}_{c,t-12}} \times \left(\frac{\text{BTC}_t}{\text{BTC}_{t-12}} - 1 \right) \times \frac{\text{BTCWealth}_{c,t-12}}{\text{CryptoWealth}_{c,t-12}} + \left(\frac{\text{ETH}_t}{\text{ETH}_{t-12}} - 1 \right) \times \frac{1 - \text{BTCWealth}_{c,t-12}}{\text{CryptoWealth}_{c,t-12}}$$

– Scaled crypto wealth 12-months prior $\times$ Crypto Return over the year, weighted by county's portfolio allocations

Effect of Crypto Gains on Housing Prices

	Change in House Price Index, Next 3 Months				
	OLS	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)
Per Capita Crypto Gains, Prior 12-Months	0.194***	0.192**	0.156**	0.162**	0.147**
	(2.72)	(2.39)	(2.17)	(2.15)	(2.17)
Per Capita Equity Gains, Prior 12-Months			0.511	0.481	0.491
			(1.33)	(1.31)	(1.31)
Δ House Price Index, Prior 3-Months	X	X	X	X	X
Income Growth, Per Capita				X	X
Month FE	X	X	X	X	X
County FE	X	X	X	X	X
Instrumental Variable		Passive Gains			Excess Passive Gains
Observations	179,681	179,681	179,681	169,499	169,499
Adj. Within R^2	0.293				
Weak ID KP F Stat		1,276	1,215	1,130	633

- $1 crypto gains per household leads county house prices ↑ $0.15 over 3 months
- A 1 s.d. increase in per household crypto gains leads to a $500-$600 dollar higher house price over next 3 months, or 20 to 30bps increase from mean

Conclusion

Summary of findings

- Crypto is one part of a larger investment portfolio for typical retail investor
- The MPC out of crypto wealth is 2X MPC out of equity wealth, but $\frac{1}{3}$ the MPC of one-time income shocks
- Households use crypto gains to increase housing spending, leading shocks to crypto wealth to spill over into local house prices

Conclusion

Bottom line

- The spillover of crypto into other financial assets has so far been limited
  - e.g., FTX collapse had limited 'contagion' to traditional banks and investment firms
- However, shocks to crypto wealth spill over into local house prices and consumption
- Consequently, distribution of crypto wealth can have a meaningful impact on the real economy

Thanks!

Additional feedback? Email me at markjjohnson@byu.edu

Appendix

Data

Data Provider

- Data provider is a large financial aggregation and analytics firm
- Provider contracts with banks/FinTechs to aggregate transactions
  - Avoids active selection of users into the data

Transaction Data

- We see bank and credit card transactions for 60 million households (not only crypto users) & billions of transactions
  - Good coverage from 2014–2023
- We observe transaction date/amount, category, merchant information, and residence (city)

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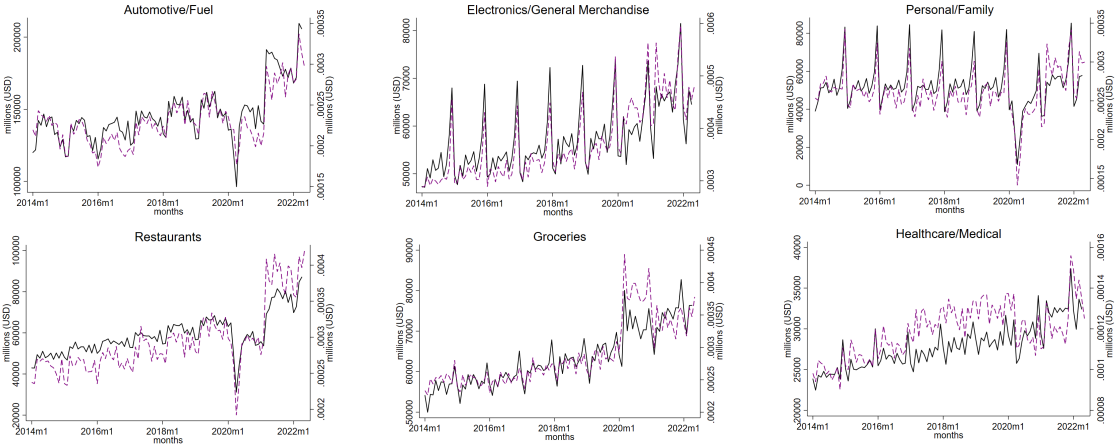
Data Validation



Note: Solid → Census Retail Sales Survey, dashed → transaction data

- Trends in transaction data match Census surveys (corr $>$ 90%)

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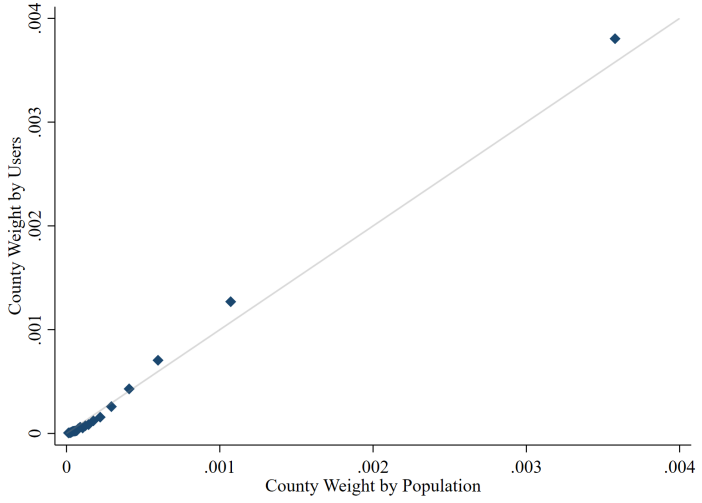
County Weights by Population vs. Transaction Users



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Summary Stats A + B

Variable	Obs.	Mean	Std. Dev.	Q5	Q25	Q50	Q75	Q95
Panel A: MPC Household-level Sample								
Total Quarterly Spending	102,730	15,392	12,541	3,923	7,707	12,244	19,062	36,674
Total Quarterly Income	102,730	21,739	15,029	5,095	10,775	17,915	28,531	52,004
Conditional on Crypto User								
Avg. Quarterly Crypto Gains	16,202	310	1,325	-23	-1	2	59	1,503
Crypto Exit	16,202	0.091	0.288	0	0	0	0	1
In Final User Period								
Crypto Wealth	16,202	21,797	146,072	0	171	1,024	6,225	74,727
Cumulative Crypto Deposits	16,202	18,885	42,795	81	618	3,000	14,033	105,120
Cumulative Crypto Withdrawals	16,202	10,651	105,586	0	0	0	1,776	37,267
Panel B: Household-level Withdrawal Event Sample								
Total Monthly Spending, Annualized	27,286	84,838	88,145	6,283	31,905	61,325	106,760	239,698
Lagged Monthly Income	27,286	11,421	8,919	302	5,190	8,999	15,517	30,008
New Homeowner Indicator	27,286	0.108	0.311	0	0	0	0	1
Crypto Withdrawal >$5,000	1,339	15,475	19,592	5,224	6,500	9,660	15,670	49,170

▸ Wealth Skewness ▸ Back

Summary Stats C + D

Variable	Obs.	Mean	Std. Dev.	Q5	Q25	Q50	Q75	Q95
Panel C: County-level Diff-in-Diff Sample								
Median County House Price	27,837	183,572	118,895	71,722	109,845	154,498	219,394	393,522
Log(Median County House Price)	27,837	12.0	0.5	11.2	11.6	11.9	12.3	12.9
Annual House Price Growth	27,837	4.9	4.0	-1.2	2.6	4.9	7.3	11.1
Log(County Crypto Wealth per capita, Dec. 2016)	27,837	2.3	1.5	0.0	1.2	2.3	3.2	4.8
Panel D: County-level 2SLS Sample								
Median County House Price	151,856	188,758	128,278	69,360	110,112	155,931	228,020	411,153
3-month Change in Median County House Prices	151,856	4,508	6,337	-623	1,359	2,960	5,680	14,793
6-month Change in Median County House Prices	143,939	8,807	11,457	-367	3.034	5,977	10,906	27,501
Annual per capita County Crypto Gains	151,856	431	3,336	-144	3	41	241	1,834
Annual per capita County Equity Gains	151,856	2,948	9,160	-384,962	508	1,365	3,211	1,079,786

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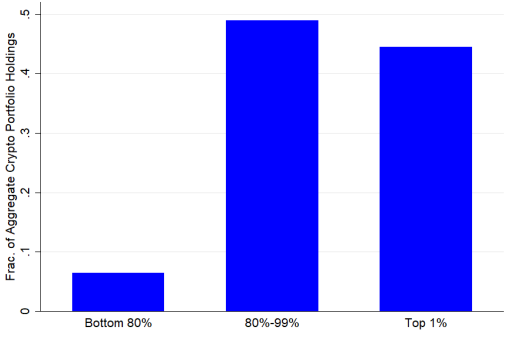
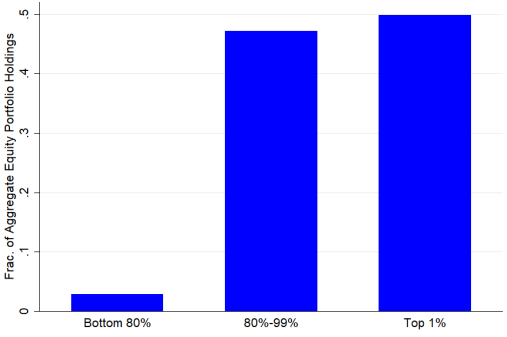
Distribution of Investment Wealth





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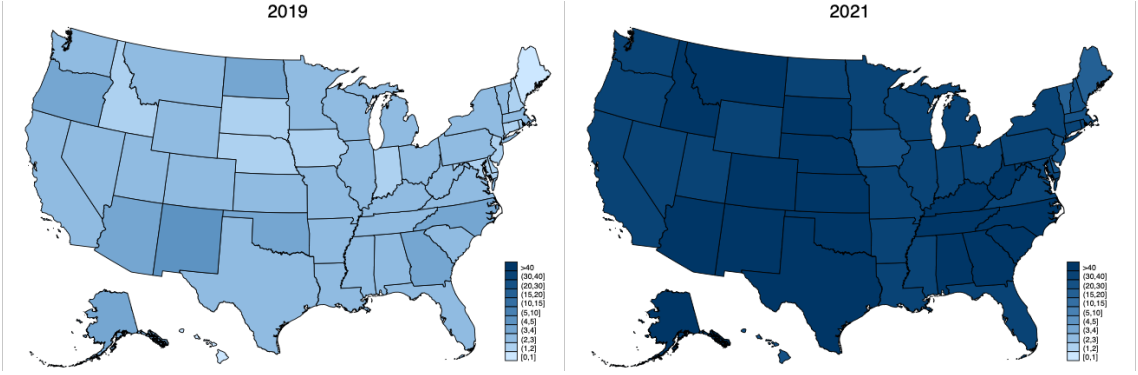
Growth in Crypto Users over Time



- Surges in new users across geographies coincide with price spikes in major cryptocurrencies

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Full Monthly Spending for Crypto vs Non-Crypto Users

Variable	Crypto Users	Non-Crypto Users	Difference
Percent of Spending:			
AutoFuel	5.2	4.7	0.5***
Cable/Telecom	6.0	6.2	-0.2***
Cash/Check	17.8	21.1	-3.2***
Charity	0.5	0.5	0.1
Education	0.4	0.3	0.1
Entertainment/Travel	7.4	6.3	1.1***
General Merchandise	21.6	21.4	0.2
Groceries	8.8	9.0	-0.2**
Insurance	4.9	5.1	-0.2***
Medical	1.8	2.1	-0.2***
Mortgage	9.9	9.2	0.7***
Rent	2.1	1.7	0.4***
Restaurants	9.7	8.5	1.1***
Utilities	3.8	3.9	-0.1***

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Definition: Crypto Gains

For each household, average quarterly crypto gains is

$$\text{AvgCryptoGains}_{i,q} = \frac{1}{4} \times \text{CryptoWealth}_{i,q} - \text{CryptoWealth}_{i,q-4} + \text{NetWithdraw}_{i,q-3 \to q} \quad ,$$

- Crypto gains includes both realized and unrealized changes in crypto wealth
- We examine the effect of crypto gains on household investment
- For a sample of crypto and non-crypto users, estimate:

$$\text{Invest}_{i,q} = \beta \, \text{AvgCryptoGains}_{i,q} + \alpha_i + \delta_{s,q} + \Gamma \, X_{i,q-1} + \varepsilon_{i,q}.$$

α_i = household FE, $\delta_{s,q}$ = state by year-quarter FE, and $X_{i,q-1}$ includes lagged income

▸ CryptoWeath ▸ Back

We Measure Crypto Wealth Based on Transactions With Crypto Exchanges

- Random sample of 152,693 households from top 10% of users by quality rank
- We assume deposits to crypto exchanges are invested in a basket of Bitcoin and Ether weighted by relative market cap (robust to alternatives)
- Track crypto wealth as:

$$\text{CryptoWealth}_{i,d} = \text{CryptoWealth}_{i,d-1} \times \frac{\text{CryptoIndex}_{i,d}}{\text{CryptoIndex}_{i,d-1}} + \text{Deposits}_{i,d} - \text{Withdrawals}_{i,d}$$

$$\text{CryptoWealth}_{i,t} = \text{CryptoWealth}_{i,d} \mid \max_{d \in t} d$$

where $\text{CryptoIndex}_{i,d}$ consists of Bitcoin and Ether weighted by the household's asset mix on the prior day

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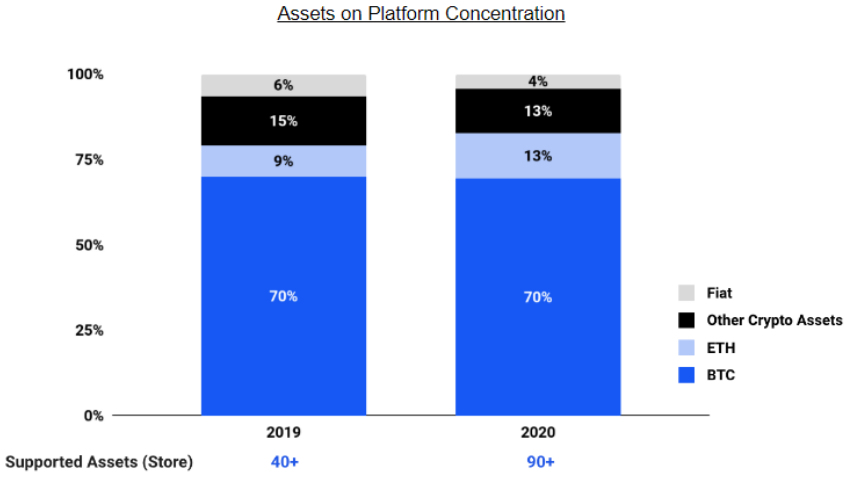
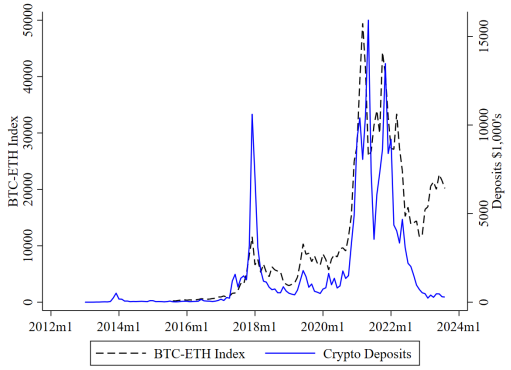
Cryptocurrency Assets Held Through Coinbase

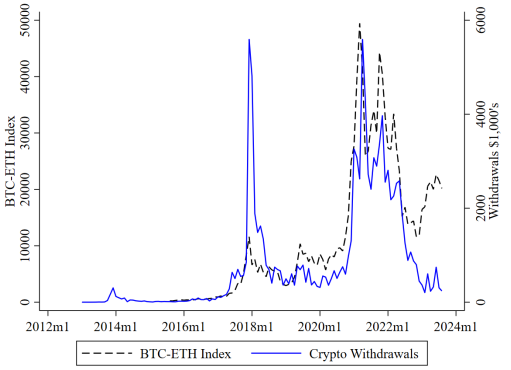


Crypto Adoption and Crypto Portfolio Activity A

Crypto Deposits over Time



Crypto Withdrawals over Time



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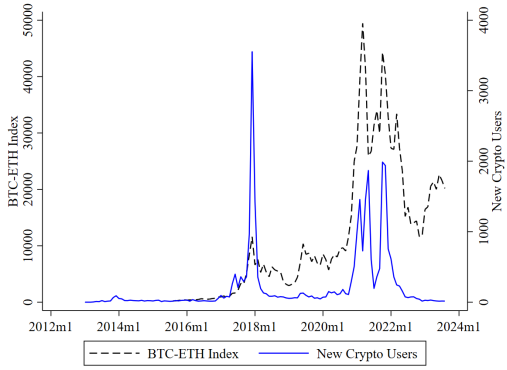
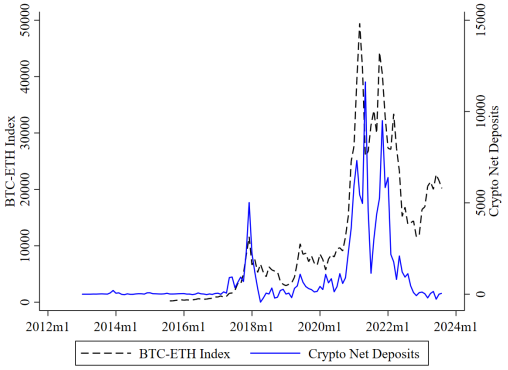
Crypto Adoption and Crypto Portfolio Activity B

New Crypto Users over Time



Net Crypto Deposits over Time



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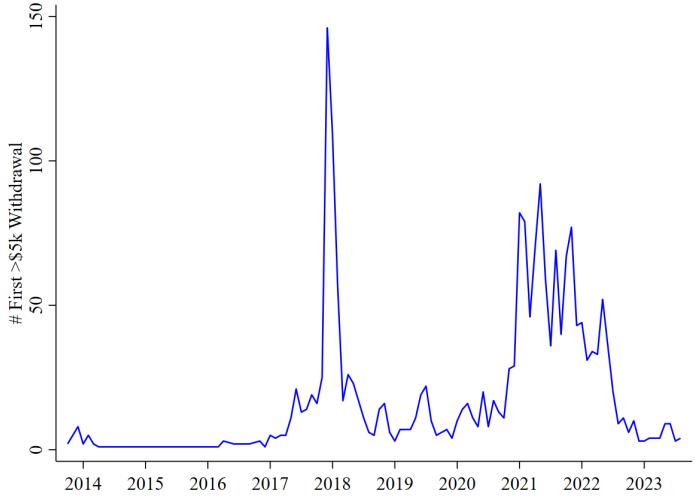
Large Crypto Withdrawals Over Time



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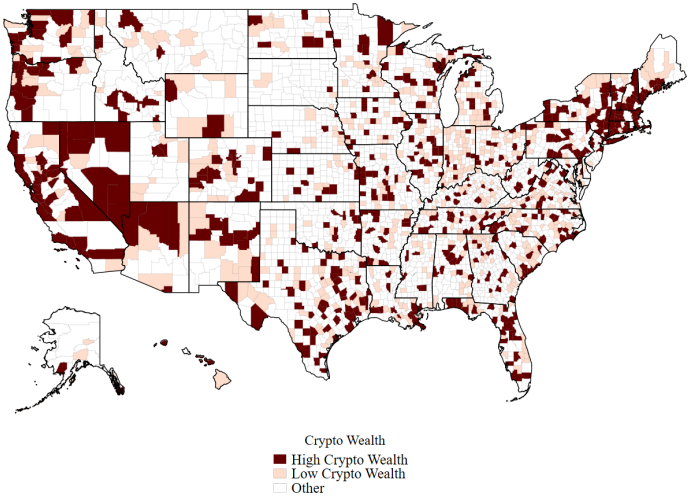
Crypto County Wealth



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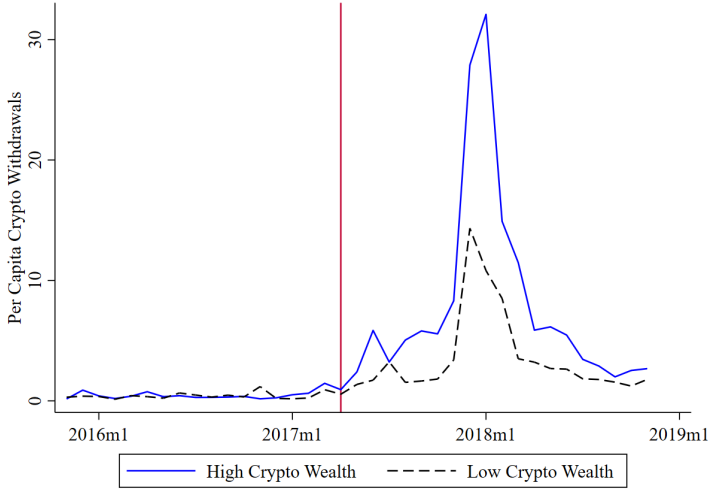
Crypto Withdrawals During the Run-up



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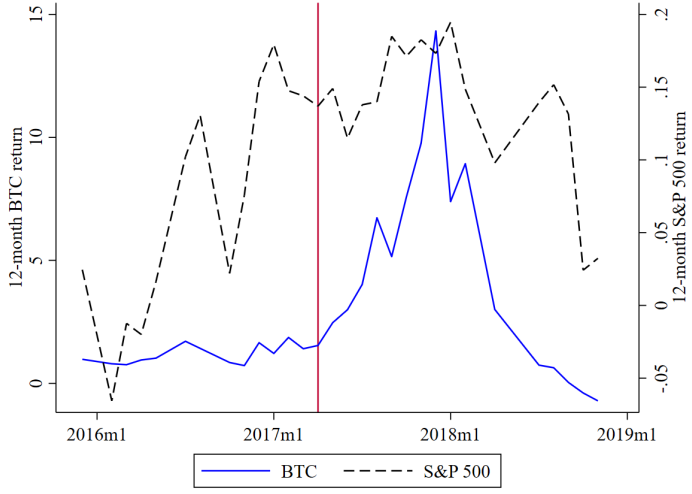
Bitcoin and Nasdaq Rolling 12-month Returns



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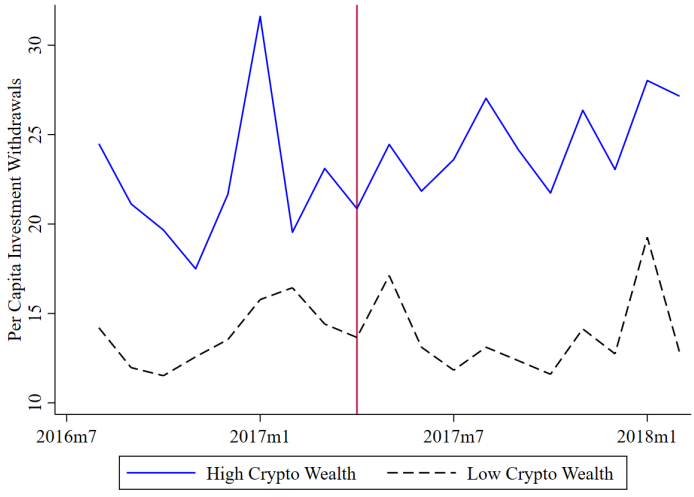
Equity Investment Withdrawals around Bitcoin Run-up by Crypto Wealth



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Effect of Crypto Gains on Housing Prices—2SLS Breakdown

	Change in House Price Index, Next 3 Months	Change in House Price Index, Next 3 Months	Per Capita Crypto Gains, Prior 12 Months	Change in House Price Index, Next 3 Months	Per Capita Crypto Gains, Prior 12 Months
	OLS	RF	FS	RF	FS
	(1)	(2)	(3)	(4)	(5)
Per Capita Crypto Gains, Prior 12-Months	0.0711**				
	(2.42)				
Passive Gains		0.0756**	1.032***		
		(2.12)	(37.29)		
Excess Passive Gains				0.0732**	1.116***
				(2.14)	(37.06)
Per Capita Equity Gains, Prior 12-Months	0.0130**	0.0132**	0.00333	0.0134**	0.00459
	(2.02)	(2.03)	(1.24)	(2.03)	(1.47)
Δ House Price Index, Prior 3-Months	X	X	X	X	X
Month FE	X	X	X	X	X
County FE	X	X	X	X	X
Observations	162,654	162,654	162,654	162,654	162,654
Adj. R^2	0.759	0.759	0.909	0.759	0.910

Effect of Crypto Gains on Housing Prices—Lagged IV

	Change in House Price Index		Change in House Price Index		Change in House Price Index	
	Next 3 Months	Next 6 Months	Next 3 Months	Next 6 Months	Next 3 Months	Next 6 Months
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Crypto Gains, Prior 12-Months	0.0372	0.139*	0.0669*	0.205*	0.0573*	0.179*
	(1.50)	(1.77)	(1.85)	(1.90)	(1.71)	(1.80)
Δ House Price Index, Prior 3-Months	X	X	X	X	X	X
Month FE	X	X	X	X	X	X
County FE			X	X	X	X
Instrumental Variable	Lagged Passive Gains		Lagged Passive Gains		Lagged Excess Passive Gains	
Observations	133,399	125,505	133,387	125,498	133,387	125,498
Weak ID KP *F* Stat	147.7	118.3	198.3	158.4	193.4	165.8

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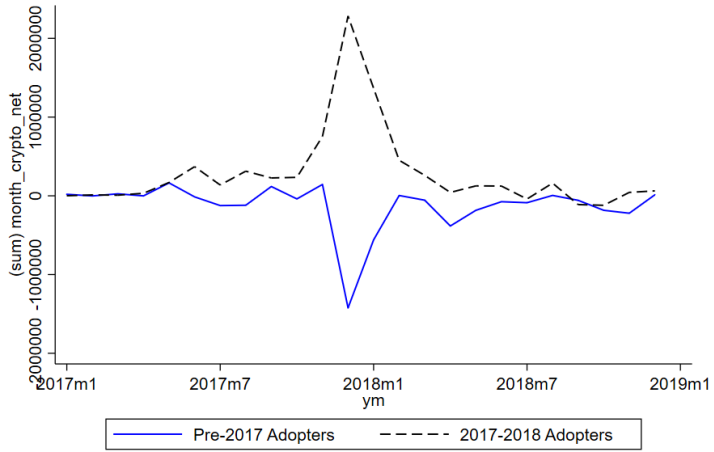
Net Deposits (Withdrawals) by Adoption Cohort



- Large variation in trading behavior during price run-ups

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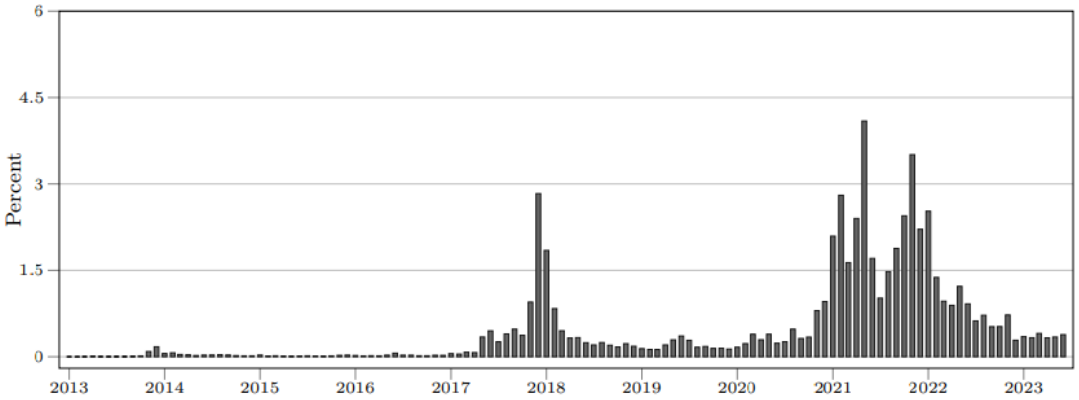
Share of Income Spent on Crypto Investments (by Investors)



- Share of income invested by crypto investors peaks around 3-4%