Inflation Expectation and Cryptocurrency Investment

Lin William Cong, Pulak Ghosh, Jiasun Li, and Qihong Ruan

September 2024

Motivation

Where do demands for cryptocurrencies come from?

- A fundamental question in cryptocurrency research
  - help appreciate how cryptocurrencies accrue values

- A myriad of possible explanations from the literature
  - financing illicit activities (Foley et al. (2019), Li et al. (2021), etc.)
  - bypassing capital controls (Makarov and Schoar (2020), etc.)
  - ensuring financial freedom (Choi et al. (2022), Pagnotta (2022), etc.),
  - supporting platforms (Cong et al. (2021), Li and Mann (2018), etc.).

- Cryptocurrencies as inflation hedges?
  - arguably one of the most oft-advocated advantages of cryptocurrencies
  - yet little theory or empirical evidence

Challenges

Lack of granular individual-level data on cryptocurrency investment

- investor-level data on off-chain exchanges are not public
- on-chain trading does not reflect fiat fund flows
- naive corr. b/w crypto returns and inflation exp. render mixed results

Ambiguous *ex ante* theorey: substitution or precautionary savings?

Need *direct* evidence to answer:

- Do households *really* regard crypto investment as inflation hedges?
  - How much does inflation expectation drive crypto investment?
  - What cryptocurrency do households view as inflation hedges?
  - Does the result differ across demographic groups?
  - What about emerging economies given cryptos being global assets?

How we address the challenges

- Proprietary trading data
  - from the dominant crypto exchange in India
- matched with granular household inflation expectation
  - from surveys run by the Reserve Bank of India

Main findings

- 1% increase in one-year ahead inflation expectation is associated with
  - about ₹1,000 more net crypto purchase per investor the next period
- Extensive margin on new customers
- heterogeneous effects across assets
  - significant for Bitcoin — first/largest cryptocurrency with a fixed supply
  - significant for Tether (USDT) — stablecoin pegged to the US dollar
  - insignificant for other cryptocurrencies
- heterogeneous effects across geography/time
- no significant difference across demography (among crypto investors)
  - although men tend to have lower inflation expectations than women;
  - young people tend to have lower inflation expectations than old people
  - within the whole population
- causal interpretations
  - current inflation as IV for inflation expectation (Weber et al., 2023)

Why India?

Significant position in the global cryptocurrency landscape

- No.4 in adoption (Chainalysis 2022 Global Crypto Adoption Index)
- projected to exceed 11% by the end of 2023 (Statista).
- poised to surpass adoption rates in the US, UK, Japan, and Russia
- No.1 in population (median age 28)

Plagued by high inflation historically

- average inflation rate 6.32% over the past decade
  - peaking at 10.91% in 2013 and bottoming at 3.59% in 2017

Difficult to hedge inflation via fiat currencies.

- strict capital controls under Foreign Exchange Management Act (FEMA) managed by the Reserve Bank of India (RBI)

HOME > USD / INR • CURRENCY

United States Dollar to Indian Rupee

83.4501 ↑165.64% +52.0351 MAX

Oct 4, 11:00:56 PM UTC · Disclaimer

1D 5D 1M 6M YTD 1Y 5Y MAX

▸ INR's Inflation Rate, Exchange Rate, and Differences

Data

Largest Indian cryptocurrency exchange

- proprietary trading data from January 2018 to June 2022
  - trading pair (e.g., BTC/INR), timestamp, price, quantity, investor IDs
- demographic attributes of each investor ID
  - age, gender, city, country, pincode, date of joining, etc.

Inflation Expectation Survey of Households (IESH)

- "bi-monthly" since Nov. 2006 by Reserve Bank of India, covering:
- survey period, city, pincode, gender, age group, job category
- view on current / 3 months ahead / 1 year ahead inflation rate
  - rate buckets (e.g., 1%-2% or actual input above 16%)

Match by pincode and period and calculate

- average inflation expectations in each match
- subsequent-period volume of each Investor_ID/trading pair/period

Data

Largest Indian cryptocurrency exchange

- proprietary trading data from January 2018 to June 2022
  - trading pair (e.g., BTC/INR), timestamp, price, quantity, investor IDs
- demographic attributes of each investor ID
  - age, gender, city, country, pincode, date of joining, etc.

Inflation Expectation Survey of Households (IESH)

- "bi-monthly" since Nov. 2006 by Reserve Bank of India, covering:
- survey period, city, pincode, gender, age group, job category
- view on current / 3 months ahead / 1 year ahead inflation rate
  - rate buckets (e.g., 1%-2% or actual input above 16%)

Match by pincode and period and calculate

- average inflation expectations in each match
- subsequent-period volume of each Investor_ID/trading pair/period

Data

Largest Indian cryptocurrency exchange

- proprietary trading data from January 2018 to June 2022
  - trading pair (e.g., BTC/INR), timestamp, price, quantity, investor IDs
- demographic attributes of each investor ID
  - age, gender, city, country, pincode, date of joining, etc.

Inflation Expectation Survey of Households (IESH)

- "bi-monthly" since Nov. 2006 by Reserve Bank of India, covering:
- survey period, city, pincode, gender, age group, job category
- view on current / 3 months ahead / 1 year ahead inflation rate
  - rate buckets (e.g., 1%-2% or actual input above 16%)

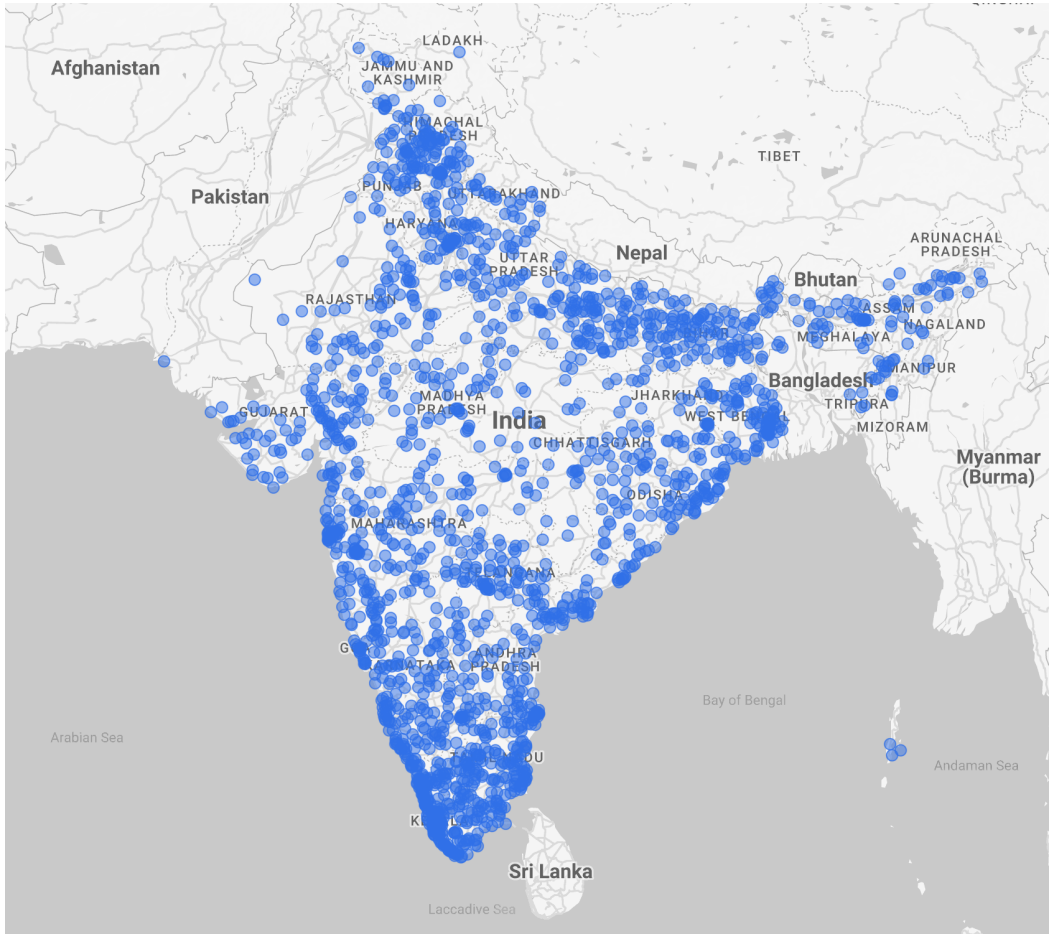
Match by pincode and period and calculate

- average inflation expectations in each match
- subsequent-period volume of each Investor_ID/trading pair/period

Crypto investor demographics

Crypto investors:

- median age: 31
- gender composition:
  - male: 83.66%
  - female: 11.71%
  - undisclosed: 4.63%
- pincode distribution



Empirical specification

Fama-MacBeth regression (investor i and survey period t)

$$\text{net\_inr\_buy}_{i,t+1} = \alpha + \beta \times \text{infl\_exp}_{i,t} + \gamma \times \text{age}_{i,t} + \lambda \times \text{male}_{i,t} + \epsilon_{i,t+1}$$

- extract cross-sectional relationship between households'
  - inflation expectations
  - net cryptocurrency purchase amounts
- large cross-section of investors each with infrequent trades over time
- not require each individual to have multiple time-series observations
- enables estimating time-varying coefficients

Establishing causality

- Perceived current inflation as inflation expectation instrument variable
- Weber et al. (2023)

Crypto Purchase on Inflation Expectations

Dependent var: net_crypto_buy_inr_amt	(1)	(2)	(3)	(4)	(5)
current_inflation	1,112**				
	(485.0)				
3_mo_infl_exp		819.3**			
		(340.2)			
1_yr_infl_exp			998.5**		
			(419.3)		
3_mo_infl_exp (instrumented)				965.0**	
				(420.8)	
1_yr_infl_exp (instrumented)					1,069**
					(466.2)
age	354.9	352.9	347.8	352.2	351.1
	(402.9)	(403.6)	(404.4)	(403.2)	(403.3)
gender	-20,080	-20,095	-20,043	-20,015	-19,973
	(12,745)	(12,726)	(12,694)	(12,727)	(12,716)
Constant	-12,417	-10,285	-12,276	-12,770	-14,117
	(22,633)	(22,907)	(22,079)	(22,608)	(22,524)
Obs.	652,168	652,164	652,152	652,168	652,168
R^2	0.005	0.005	0.005	0.005	0.005
Groups	26	26	26	26	26

▸ First Stage IV

Placebo Tests

Crypto Purchases with USDT as Base Currency

Dependent var: net_crypto_buy_inr_amt	(1)	(2)	(3)	(4)	(5)
current_inflation	-247.9				
	(235.4)				
three_months_inflation		-257.3			
		(224.0)			
one_year_inflation			-231.6		
			(225.0)		
three_months_inflation_hat				-215.1	
				(204.2)	
one_year_inflation_hat					-238.3
					(226.2)
age	-114.1	-115.4	-118.8	-113.5	-113.2
	(119.8)	(119.5)	(119.3)	(119.4)	(119.3)
gender_index	3,453	3,418	3,315	3,439	3,429
	(2,405)	(2,392)	(2,371)	(2,403)	(2,401)
Constant	6,761	7,122	7,036	6,839	7,139
	(6,524)	(6,701)	(6,803)	(6,585)	(6,821)
Observations	652,168	652,164	652,152	652,168	652,168
R-squared	0.001	0.001	0.001	0.001	0.001
Number of groups	26	26	26	26	26

Placebo Tests

Crypto Purchases with BTC as Base Currency

Dependent var: net_crypto_buy_inr_amt	(1)	(2)	(3)	(4)	(5)
current_inflation	-128.0				
	(109.1)				
three_months_inflation		-119.3			
		(99.49)			
one_year_inflation			-101.9		
			(81.71)		
three_months_inflation_hat				-111.0	
				(94.65)	
one_year_inflation_hat					-123.0
					(104.9)
age	101.7	102.8	101.6	102.0	102.1
	(68.10)	(68.40)	(67.68)	(68.15)	(68.17)
gender_index	5,953**	5,950**	5,875**	5,946**	5,941**
	(2,603)	(2,607)	(2,590)	(2,601)	(2,599)
Constant	-6,130	-6,095	-6,182	-6,090	-5,935
	(3,911)	(3,865)	(3,944)	(3,909)	(3,903)
Observations	652,168	652,164	652,152	652,168	652,168
R-squared	0.003	0.003	0.002	0.003	0.003
Number of groups	26	26	26	26	26

Inflation Expectations and New Customer Acquisition

	Dependent Variable: New_Customer				
	(1)	(2)	(3)	(4)	(5)
Current Inflation	1.149***				
	(0.178)				
Three Months Inflation		1.190***			
		(0.173)			
One Year Inflation			1.037***		
			(0.150)		
Three Months Inflation Fitted				1.145***	
				(0.178)	
One Year Inflation Fitted					1.106***
					(0.172)
Number of Survey Respondents	0.611***	0.635***	0.603***	0.611***	0.610***
	(0.187)	(0.187)	(0.187)	(0.187)	(0.187)
Proportion of Self Employed	20.18***	19.75***	20.19***	19.87***	20.76***
	(6.536)	(6.518)	(6.523)	(6.534)	(6.541)
Constant	13.17***	10.27**	12.79***	11.72***	11.00**
	(4.249)	(4.417)	(4.308)	(4.397)	(4.474)
Observations	7,735	7,733	7,733	7,735	7,735
R-squared	0.008	0.011	0.010	0.008	0.008
Number of pincode_index	945	944	945	945	945

Heterogeneity across cryptocurrencies

Base Currency	INR		USDT		BTC	
	Coefficient	Std.err	Coefficient	Std.err	Coefficient	Std.err
USDT	818.6*	(411.4)	-	-	-	-
BTC	383.7**	(173.1)	-171.1	(188.7)	-	-
XRP	-16.23	(27.29)	-69.47*	(35.25)	-11.34	(29.58)
DOGE	-5.054	(8.196)	1.264*	(0.725)	-	-
SHIB	1.186	(2.247)	0.858	(0.710)	-	-
WIN	-0.366	(0.825)	0.688	(0.688)	-	-
TRX	-29.61	(30.24)	21.19	(18.57)	-14.04	(18.85)
ETH	-56.61	(34.94)	-66.36	(62.44)	-36.25	(21.92)
BTT	-10.02**	(4.580)	5.444	(3.653)	-17.26	(18.26)
ADA	1.232	(2.337)	-5.127**	(2.453)	1.913	(4.819)
MATIC	-3.469	(6.445)	0.628	(2.580)	-10.42	(9.643)
WRX	-20.64	(16.29)	15.38	(11.27)	9.310	(17.34)
BNB	-2.797	(2.540)	2.378	(2.489)	-2.036	(3.206)

Geographic Heterogeneity

VARIABLES	Dependent Variable: INR_Amount_Net				
	(1)	(2)	(3)	(4)	(5)
One Year Inflation	1,038**	2,629*	1,030**		
	(429.7)	(1,355)	(427.4)		
One Year Inflation (IV)				2,658*	1,107**
				(1,331)	(476.1)
Age	341.1	332.9	341.9	336.1	347.2
	(414.2)	(415.8)	(414.0)	(414.2)	(412.0)
Male	-20,347		-20,336		-20,245
	(12,886)		(12,885)		(12,896)
Semi_Urban	15,863***	15,799***		16,664***	
	(4,837)	(4,769)		(5,322)	
Rural	2,773	2,816		3,258	
	(2,902)	(2,909)		(2,917)	
Inflation*Male		-1,835			
		(1,123)			
Inflation*Semi_Urban			1,046***		
			(368.6)		
Inflation Fitted*Male				-1,783	
				(1,063)	
Inflation Fitted*Semi_Urban					1,242***
					(419.9)
Constant	-12,750	-30,067*	-12,564	-31,866*	-14,598
	(22,535)	(15,263)	(22,514)	(15,786)	(22,890)
Observations	638,818	638,818	638,818	638,834	638,834
R-squared	0.006	0.006	0.006	0.006	0.005
Number of groups	26	26	26	26	26

Expected Return from Independent Survey

	Dependent Variable: INR_Amount_Net				
	(1)	(2)	(3)	(4)	(5)
Current Inflation	2,089**				
	(813.2)				
Three Months Inflation		1,403**			
		(683.6)			
One Year Inflation			1,604*		
			(827.4)		
Three Months Inflation_hat				1,741**	
				(677.6)	
One Year Inflation_hat					2,055**
					(800.1)
Expected Return	0.00428*	0.00430*	0.00471*	0.00453**	0.00509**
	(0.00219)	(0.00227)	(0.00240)	(0.00226)	(0.00242)
Annual Income (₹5-7.5$\times 10^5$)	43,021*	42,338*	41,251*	42,593*	41,243*
	(22,250)	(22,145)	(21,759)	(22,131)	(21,762)
Annual Income (₹7.5-10$\times 10^5$)	-16,428	-16,249	-16,431	-16,825	-17,155
	(28,776)	(28,858)	(28,770)	(28,840)	(28,894)
Annual Income (₹10-50$\times 10^5$)	15,009	14,666	15,132	14,820	15,443
	(18,494)	(18,537)	(18,621)	(18,470)	(18,550)
Annual Income ($>$ ₹50$\times 10^5$)	-19,920	-20,727	-20,286	-19,077	-18,233
	(27,386)	(27,632)	(27,885)	(27,467)	(27,552)
Age	-2,671**	-2,698**	-2,717**	-2,700**	-2,725**
	(1,356)	(1,363)	(1,370)	(1,362)	(1,367)
Male	11,691	10,365	9,870	10,839	10,285
	(13,659)	(13,641)	(13,698)	(13,687)	(13,709)
Constant	33,048	41,181	39,516	34,690	31,456
	(37,969)	(37,958)	(38,972)	(38,119)	(37,832)
Observations	681	681	681	681	681
R-squared	0.025	0.024	0.025	0.025	0.025

References

Choi, K. J., A. Lehar, and R. Stauffer (2022). Bitcoin microstructure and the kimchi premium. *Available at SSRN 3189051*.

Cong, L. W., Y. Li, and N. Wang (2021). Tokenomics: Dynamic adoption and valuation. *The Review of Financial Studies 34*(3), 1105–1155.

Foley, S., J. R. Karlsen, and T. J. Putniņš (2019). Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies? *The Review of Financial Studies 32*(5), 1798–1853.

Li, J., F. Baldimtsi, J. P. Brandao, M. Kugler, R. Hulays, E. Showers, Z. Ali, and J. Chang (2021). Measuring illicit activity in defi: The case of ethereum. In *Financial Cryptography and Data Security. FC 2021 International Workshops: CoDecFin, DeFi, VOTING, and WTSC, Virtual Event, March 5, 2021, Revised Selected Papers 25*, pp. 197–203. Springer.

Li, J. and W. Mann (2018). Digital tokens and platform building.

Makarov, I. and A. Schoar (2020). Trading and arbitrage in cryptocurrency markets. *Journal of Financial Economics 135*(2), 293–319.

Pagnotta, E. S. (2022). Decentralizing money: Bitcoin prices and blockchain security. *Review of Financial Studies 35*(2), 866–907.

Weber, M., Y. Gorodnichenko, and O. Coibion (2023). The expected, perceived, and realized inflation of us households before and during the covid19 pandemic. *IMF Economic Review 71*(1), 355.

First-stage IV Regressions

	(1) 3_mo_infl_exp	(2) 1_yr_infl_exp
current_inflation	1.153***	1.040***
	(0.000544)	(0.000890)
age	0.00277***	0.00351***
	(0.000438)	(0.000717)
gender	-0.0666***	-0.100***
	(0.00976)	(0.0160)
Constant	0.366***	1.590***
	(0.0188)	(0.0308)
Obs.	652,164	652,152
R^2	0.873	0.677

Back

INR's Inflation Rate, Exchange Rate, and Differences

Year	Infl. Rate (%)	FX (USD/INR)	FX Change (%)	Diff. (%)
2011	8.87	46.67	-	-
2012	9.30	53.44	14.51	-5.21
2013	10.91	58.60	9.66	1.25
2014	6.37	61.03	4.15	2.22
2015	5.87	64.15	5.11	0.76
2016	4.94	67.19	4.74	0.20
2017	3.59	64.46	-4.06	7.65
2018	4.86	69.92	8.47	-3.61
2019	4.51	70.39	0.67	3.84
2020	6.20	74.84	6.32	-0.12
2021	4.91	73.49	-1.80	6.71
2022	6.70	82.75	12.60	-5.90
2023	5.70	83.25	0.60	5.10
Avg.	6.36	66.94	5.08	1.07

Back