

Table 1: Summary statistics of observable risk factors

This table reports summary statistics of observable risk factors: a value-weighted market portfolio, size, volatility, illiquidity, bid-ask spread, reversal strategies and four momentum portfolios formed on past returns over 7, 14, 21, and 30 trading days. A complete description of the observable risk factors is in Section 2. Mean and standard deviation (both in percent), skewness and kurtosis are reported on the daily basis. Sharpe ratio statistics are annualized. The sample of observations is from December 2nd 2016 to July 9th 2021.

	VW Market	Size	Volatility	Liquidity			Momentum			
				Amihud	bid-ask	Reversal	r7_1	r14_1	r21_1	r30_1
Mean	0.22**	0.06	0.38	-0.12	0.66**	1.55***	-0.06	0.03	0.04	0.07
t(mean)	(2.14)	(1.76)	(1.16)	(-0.79)	(2.18)	(9.34)	(-0.29)	(0.18)	(0.21)	(0.89)
SR (annualised)	0.99	0.12	0.50	-0.22	0.93	4.58	-0.12	0.07	0.08	0.11
Skewness	-1.01	0.64	-0.23	0.14	-0.08	0.47	-0.51	-0.89	-0.33	-0.29

Table 2: In-sample asset pricing performance

This table reports in-sample total R_{total}^2 and predictive R_{pred}^2 for the restricted ($\Gamma_\alpha = 0$) and unrestricted ($\Gamma_\alpha \neq 0$) IPCA models with $K = 1, \dots, 6$ factors. Performance statistics are computed for individual assets (Panel A) and characteristic-managed portfolios (Panel B). Panel C reports the p-values for the test of $\Gamma_\alpha = 0$ based on a bootstrap with 10000 draws. All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

		K					
		1	2	3	4	5	6
Panel A: Individual assets							
R_{total}^2	$\Gamma_\alpha = 0$	13.00	16.52	17.15	17.71	18.22	18.68
	$\Gamma_\alpha \neq 0$	15.89	16.56	17.16	17.72	18.23	18.69
R_{pred}^2	$\Gamma_\alpha = 0$	0.01	2.91	2.93	2.95	2.94	2.91
	$\Gamma_\alpha \neq 0$	2.51	2.62	2.91	2.93	2.92	2.95
Panel B: Characteristic-based portfolios							
$R_{total,x}^2$	$\Gamma_\alpha = 0$	93.12	95.16	96.49	97.64	97.79	98.06
	$\Gamma_\alpha \neq 0$	94.70	95.65	96.49	97.64	97.78	98.06
$R_{pred,x}^2$	$\Gamma_\alpha = 0$	0.11	1.73	1.75	1.74	1.72	1.71
	$\Gamma_\alpha \neq 0$	1.25	1.52	1.75	1.74	1.73	1.74
Panel C: Bootstrap Test ($H_0 : \Gamma_\alpha = 0$)							
W_α p-value		0.0	0.0	96.1	73.5	70.9	77.5

Table 3: Latent vs observable factors

This table reports in-sample total R_{total}^2 and predictive R_{pred}^2 for the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors (Panel A) and a set of observable risk factor models with dynamic (Panel B) and static (Panel C) loadings. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) with a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6. Performance statistics are computed for individual cryptocurrencies r_t and characteristic-managed portfolios x_t . All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

Test assets	Statistics	K					
		1	2	3	4	5	6
Panel A: IPCA							
r_t	R_{total}^2	13.00	16.52	17.15	17.71	18.22	18.68
	R_{pred}^2	0.01	2.91	2.93	2.95	2.94	2.91
x_t	$R_{total,x}^2$	93.12	95.16	96.49	97.64	97.79	98.06
	$R_{pred,x}^2$	0.11	1.75	1.75	1.74	1.74	1.74
Panel B: Observable risk factors (dynamic loadings)							
r_t	R_{total}^2	8.84	8.86	8.87	8.89	8.90	9.27
	R_{pred}^2	-0.01	0.00	0.01	0.02	0.03	0.67
x_t	$R_{total,x}^2$	63.81	63.83	63.87	63.90	63.93	64.10
	$R_{pred,x}^2$	-0.17	-0.16	-0.15	-0.14	-0.13	0.26
Panel C: Observable risk factors (static loadings)							
r_t	R_{total}^2	9.18	9.27	9.36	9.43	9.54	9.62
	R_{pred}^2	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
x_t	$R_{total,x}^2$	63.75	63.76	63.80	63.82	63.85	64.05
	$R_{pred,x}^2$	-0.17	-0.17	-0.16	-0.14	-0.13	0.22

Table 4: IPCA including observable factors

This table reports R_{total}^2 (Panel A) and R_{pred}^2 (Panel B) R^2 from IPCA specifications with various numbers of latent factors K (corresponding to columns) while also controlling for observable factors. Rows labeled 0, 1, 4, and 6 correspond to no observable factors or the CAPM, FFC4, or FFC6 factors, respectively. The table also reports tests of the incremental explanatory power of each observable factor model with respect to the IPCA model (Panel C). In all specifications, both latent and observable factor loadings are instrumented with observable cryptocurrency characteristics. R^2 's and p-values are in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

Obs. Factors	K					
	1	2	3	4	5	6
Panel A: R_{total}^2						
0	13.00	16.52	17.15	17.71	18.22	18.68
1	13.19	16.61	17.24	17.78	18.29	18.75
2	13.21	16.62	17.25	17.79	18.30	18.76
6	13.57	16.63	17.26	17.80	18.31	18.77
Panel B: R_{pred}^2						
0	0.01	2.91	2.93	2.95	2.94	2.91
1	0.40	2.89	2.91	2.92	2.90	2.93
4	0.40	2.88	2.91	2.90	2.91	2.92
6	0.88	2.87	2.91	2.90	2.92	2.90
Panel C: Individual significance (p-value)						
MKT	0.02	0.01	0.07	0.11	0.13	0.14
SIZE	0.12	0.26	0.12	0.17	0.16	0.12
MOM	0.13	0.11	0.15	0.10	0.32	0.16
LIQ	0.79	0.78	0.89	0.73	0.65	0.45
VOL	0.31	0.97	0.97	0.92	0.97	0.93
REV	0.00	0.51	0.46	0.43	0.28	0.29

Table 5: IPCA portfolio alphas

This table reports unconditional and conditional portfolio alphas when controlling for the factors from the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors (Panel A) and the observable factor models FF1 through FF6 (Panel B). The test assets are characteristic-managed portfolios. Unconditional alphas are the intercepts of time-series regressions of portfolio returns on the corresponding factors. Conditional alphas are the time-series average of portfolio residuals from the IPCA or instrumented observable factor models. The reported values are the average absolute alphas across all managed portfolios. All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

Panel A: IPCA factors						
	No. Factors					
	1	2	3	4	5	6
Unconditional	9.14	5.48	4.28	4.16	4.14	3.87
Conditional	8.63	0.84	0.61	0.60	0.59	0.58
Panel B: Observable factors						
	FF1	FF2	FF3	FF4	FF5	FF6
Unconditional	10.15	10.22	10.24	10.19	10.21	10.79
Conditional	9.22	9.24	9.21	9.23	9.25	8.54

Table 6: Out-of-sample asset pricing performance

This table reports in-sample total R_{total}^2 and predictive R_{pred}^2 for the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors (Panel A) and a variety of observable factor models with dynamic (Panel B) and static (Panel C) loadings. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) including a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6. The out-of-sample analysis follows a recursive estimation scheme outlined in the main text starting from the second half of the available data, i.e., the first prediction is made in September 2019. Performance statistics are computed for individual cryptocurrencies r_t and characteristic-managed portfolios x_t . All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

Test assets	Statistics	K					
		1	2	3	4	5	6
Panel A: IPCA							
r_t	R_{total}^2	11.90	15.56	16.16	16.68	17.18	17.61
	R_{pred}^2	-0.07	2.95	2.95	2.95	2.95	2.96
x_t	$R_{total,x}^2$	92.08	94.45	95.77	96.66	97.40	97.62
	$R_{pred,x}^2$	-0.63	1.29	1.29	1.29	1.30	1.30
Panel B: Observable risk factors (dynamic loadings)							
r_t	R_{total}^2	7.05	7.03	7.02	7.02	7.02	7.38
	R_{pred}^2	0.01	0.02	0.02	0.03	0.03	0.67
x_t	$R_{total,x}^2$	53.70	53.65	53.57	53.59	53.59	53.70
	$R_{pred,x}^2$	0.05	0.05	0.05	0.06	0.06	0.46
Panel C: Observable risk factors (static loadings)							
r_t	R_{total}^2	6.90	6.89	6.88	6.88	6.88	6.87
	R_{pred}^2	0.01	0.01	0.00	0.00	0.01	0.00
x_t	$R_{total,x}^2$	53.50	53.46	53.38	53.40	53.40	53.31
	$R_{pred,x}^2$	0.05	0.04	0.04	0.04	0.04	-0.01

Table 7: Out-of-sample mean-variance efficiency

This table reports out-of-sample annualized Sharpe ratios of individual factors (“Univariate”) and mean-variance optimal portfolios (“Tangency”) combining IPCA (Panel A) or observable (Panel B) factors. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) with a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6 specifications with two through six factors. The out-of-sample analysis follows a recursive estimation scheme outlined in the main text starting from the second half of the available data, i.e., the first portfolio weights are constructed in September 2019.

	K					
	1	2	3	4	5	6
Panel A: IPCA						
Univariate	-0.30	-1.19	1.65	1.75	-0.16	-0.16
Tangency	-0.30	13.72	13.34	10.81	7.82	7.82
Panel B: Observable risk factors						
Univariate	0.73	-0.81	0.59	-0.89	-0.86	6.58
Tangency	0.73	0.54	0.69	0.51	0.46	1.79

Table 8: Significance of the characteristics

This table reports the significance of characteristics to overall fit in the restricted ($\Gamma_\alpha = 0$) IPCA models estimated based on the daily data from the whole sample (the “Full sample” columns) as well as the sub-samples (the “Sub-samples” columns) or based on the weekly data from the whole sample (the “Weekly” column). For the full sample period from December 2016 to July 2021, we report the significance results for the IPCA models with $K = 2, \dots, 4$ factors. For the two sub-sample periods from December 2016 to January 2020 and from January 2020 to July 2021, we report the results corresponding to IPCA models with $K = 3$ and $K = 6$ factors, respectively. For the weekly data, we present the results of the $K = 4$ IPCA model estimated from the whole sample of weekly returns. A variable significance is measured jointly for all factors based on the bootstrap test. The significance of the l^{th} characteristic for all factors boils down to testing that the whole l^{th} row in $\Gamma_\beta = [\gamma_{\beta,1}, \dots, \gamma_{\beta,L}]'$ is equal to zero, that is, the null hypothesis is

$$H_0 : \gamma_{\beta,l} = 0_{K \times 1}.$$

The numbers in the table are the p-values from the significance test. The sample of observations is from December 2nd 2016 to July 9th 2021.

Name	Full sample			Sub-samples		Weekly
	K=2	K=3	K=4	12:16-01:20 (K=3)	01:20-07:21 (K=6)	K=4
new add	0.240	0.390	0.310	0.860	0.227	0.495
active add	0.010	0.320	0.120	0.320	0.816	0.988
transaction count	0.120	0.160	0.190	0.350	0.302	0.698
avg trans value	0.110	0.130	0.080	0.080	0.126	0.911
trading volume	0.000	0.020	0.030	0.030	0.000	0.042
illiq	0.051	0.270	0.210	0.260	0.081	0.112
bid-ask	0.000	0.040	0.030	0.020	0.041	0.021
vol shock 15	0.210	0.210	0.330	0.650	0.486	0.748
vol shock 30	0.230	0.340	0.440	0.350	0.732	0.345
size	0.000	0.031	0.020	0.170	0.063	0.041
capm α	0.270	0.890	0.950	0.620	0.744	0.214
capm β	0.000	0.040	0.730	0.240	0.004	0.707
idio vol	0.120	0.060	0.060	0.240	0.102	0.254
rvol	0.070	0.080	0.250	0.160	0.542	0.251
VaR(5%)	0.000	0.140	0.090	0.260	0.512	0.345
ES (5%)	0.000	0.040	0.040	0.040	0.208	0.174
rev	0.000	0.000	0.000	0.000	0.000	0.000
mom 7_1	0.030	0.240	0.170	0.250	0.066	0.105
mom 14_1	0.070	0.480	0.680	0.680	0.665	0.047
mom 21_1	0.520	0.580	0.310	0.850	0.131	0.044
mom 30_1	0.210	0.670	0.940	0.170	0.340	0.671

Table 9: Asset pricing performance across sub-samples

This table reports in-sample total R_{total}^2 and predictive R_{pred}^2 for the restricted ($\Gamma_\alpha = 0$) and unrestricted ($\Gamma_\alpha \neq 0$) IPCA models with $K = 1, \dots, 6$ factors estimated based on the two sub-samples from December 2016 to January 2020 (Panel A) and from January 2020 to July 2021 (Panel B). Performance statistics are computed for individual assets and characteristic-managed portfolios. The bottom row reports the p-values for the test of $\Gamma_\alpha = 0$ based on a bootstrap with 10000 draws. All numbers are expressed in percent.

	Panel A: Sample from 12:2016 to 01:2020						Panel B: Sample from 01:2020 to 07:2021						
	K						K						
	1	2	3	4	5	6	1	2	3	4	5	6	
Individual assets													
R_{total}^2	$\Gamma_\alpha = 0$	14.04	17.44	18.07	18.66	19.19	19.63	12.34	15.92	16.59	17.16	17.68	18.15
	$\Gamma_\alpha \neq 0$	16.79	17.46	18.10	18.69	19.22	19.66	15.39	16.08	16.67	17.21	17.71	18.18
R_{pred}^2	$\Gamma_\alpha = 0$	0.18	2.10	2.91	2.92	2.89	2.88	0.04	2.00	3.02	3.21	3.32	3.41
	$\Gamma_\alpha \neq 0$	2.00	2.21	2.91	2.93	2.91	2.92	2.12	2.22	3.12	3.12	3.11	3.11
Characteristic-based portfolios													
$R_{total,x}^2$	$\Gamma_\alpha = 0$	93.89	95.76	97.15	97.53	98.20	98.32	92.42	94.68	95.73	97.14	97.65	98.07
	$\Gamma_\alpha \neq 0$	95.33	95.77	97.14	97.52	98.20	98.31	94.22	95.28	96.74	97.36	97.69	98.01
$R_{pred,x}^2$	$\Gamma_\alpha = 0$	0.96	2.09	2.39	2.40	2.41	2.42	0.05	1.95	1.95	1.95	1.93	1.92
	$\Gamma_\alpha \neq 0$	1.91	2.12	2.91	2.90	2.90	2.89	1.96	1.96	1.95	1.95	1.94	1.92
Bootstrap Test ($H_0 : \Gamma_\alpha = 0$)													
W_α p-value		0.00	0.07	61.3	44.5	29.2	28.3	0.00	0.00	0.00	0.00	0.00	33.2

Table 10: Latent vs observable factors: Sub-sample analysis

This table reports in-sample total R_{ttotal}^2 and predictive R_{tpred}^2 for the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors and a variety of observable factor models with dynamic and static loadings. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) with a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6. The table presents the results for the models estimated based on the two sub-samples from December 2016 to January 2020 (Panel A) and from January 2020 to July 2021 (Panel B). Performance statistics are computed for individual cryptocurrencies r_t and characteristic-managed portfolios x_t . All numbers are expressed in percent.

	Panel A: Sample from 12:2016 to 01:2020						Panel B: Sample from 01:2020 to 07:2021					
	K						K					
	1	2	3	4	5	6	1	2	3	4	5	6
IPCA												
r_t	14.04	17.44	18.07	18.66	19.19	19.63	12.34	15.92	16.59	17.16	17.68	18.15
R_{ttotal}^2	0.18	2.10	2.91	2.92	2.89	2.88	0.04	2.00	3.02	3.21	3.32	3.41
R_{tpred}^2	93.89	95.76	97.15	97.53	98.20	98.32	92.42	94.68	95.73	97.14	97.65	98.07
x_t	0.96	2.09	2.39	2.40	2.41	2.42	0.05	1.95	1.95	1.95	1.93	1.92
$R_{tpred,x}^2$												
Observable risk factors (dynamic loadings)												
r_t	11.16	11.18	11.22	11.23	11.25	11.64	7.40	7.42	7.46	7.53	7.57	7.95
R_{ttotal}^2	0.03	0.05	0.05	0.05	0.06	0.71	0.05	0.06	0.09	0.17	0.19	0.81
R_{tpred}^2	75.66	75.68	75.82	75.83	75.84	76.08	54.67	54.70	54.76	54.94	55.05	55.37
x_t	0.24	0.25	0.25	0.25	0.25	0.75	0.08	0.09	0.11	0.18	0.19	0.57
$R_{tpred,x}^2$												
Observable risk factors (static loadings)												
r_t	11.64	11.80	11.98	12.16	12.42	12.57	7.84	8.03	8.21	8.39	8.61	8.80
R_{ttotal}^2	0.03	0.04	0.03	0.03	0.04	0.06	0.01	0.01	0.01	0.01	0.02	0.00
R_{tpred}^2	75.65	75.66	75.78	75.79	75.81	76.06	54.60	54.62	54.68	54.83	54.95	55.31
x_t	0.25	0.26	0.26	0.26	0.26	0.71	0.09	0.10	0.12	0.18	0.19	0.53
$R_{tpred,x}^2$												

Table 11: Asset pricing performance on weekly returns

This table reports in-sample total and predictive R^2 for the restricted ($\Gamma_\alpha = 0$) and unrestricted ($\Gamma_\alpha \neq 0$) IPCA models with $K = 1, \dots, 6$ factors estimated based on the weekly data. Performance statistics are computed for individual assets (Panel A) and characteristic-managed portfolios (Panel B). Panel C reports the p-values for the test of $\Gamma_\alpha = 0$ based on a bootstrap with 10000 draws. All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

		K					
		1	2	3	4	5	6
Panel A: Individual assets							
R^2_{total}	$\Gamma_\alpha = 0$	25.53	26.84	27.49	28.04	28.55	29.01
	$\Gamma_\alpha \neq 0$	26.38	27.05	27.64	28.18	28.67	29.12
R^2_{pred}	$\Gamma_\alpha = 0$	0.15	0.93	0.93	0.93	0.91	0.91
	$\Gamma_\alpha \neq 0$	0.96	0.95	0.95	0.95	0.94	0.94
Panel B: Characteristic-based portfolios							
$R^2_{total,x}$	$\Gamma_\alpha = 0$	97.05	97.57	98.16	98.73	99.02	99.17
	$\Gamma_\alpha \neq 0$	97.34	97.95	98.32	98.80	99.08	99.18
$R^2_{pred,x}$	$\Gamma_\alpha = 0$	0.61	0.83	0.83	0.82	0.80	0.80
	$\Gamma_\alpha \neq 0$	0.86	0.85	0.85	0.84	0.83	0.82
Panel C: Bootstrap Test ($H_0 : \Gamma_\alpha = 0$)							
W_α p-value		4.41	4.65	3.32	7.72	4.86	23.3

Table 12: Latent vs observable factors: Weekly data

This table reports total and in-sample predictive R^2 for the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors (Panel A) and a variety of observable factor models with dynamic (Panel B) and static (Panel C) loadings estimated based on the weekly data. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) with a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6. Performance statistics are computed for individual cryptocurrencies r_t and characteristic-managed portfolios x_t . All numbers are expressed in percent. The sample of observations is from December 2nd 2016 to July 9th 2021.

Test assets	Statistics	K					
		1	2	3	4	5	6
Panel A: IPCA							
r_t	R_{total}^2	25.53	26.84	27.49	28.04	28.55	29.01
	R_{pred}^2	0.15	0.93	0.93	0.93	0.91	0.91
x_t	$R_{total,x}^2$	97.05	97.57	98.16	98.73	99.02	99.17
	$R_{pred,x}^2$	0.61	0.83	0.83	0.82	0.80	0.80
Panel B: Observable risk factors (dynamic loadings)							
r_t	R_{total}^2	18.71	19.88	19.95	20.05	20.14	20.66
	R_{pred}^2	-0.12	0.04	0.04	0.08	0.15	0.53
x_t	$R_{total,x}^2$	70.35	73.84	73.97	74.04	74.23	74.76
	$R_{pred,x}^2$	-0.54	0.01	0.05	0.03	0.15	1.04
Panel C: Observable risk factors (static loadings)							
r_t	R_{total}^2	19.69	21.32	21.81	22.35	22.96	23.41
	R_{pred}^2	-0.23	-0.06	-0.05	-0.04	0.00	0.29
x_t	$R_{total,x}^2$	70.37	73.85	73.95	74.02	74.18	74.74
	$R_{pred,x}^2$	-0.57	-0.03	-0.01	-0.02	0.15	0.29

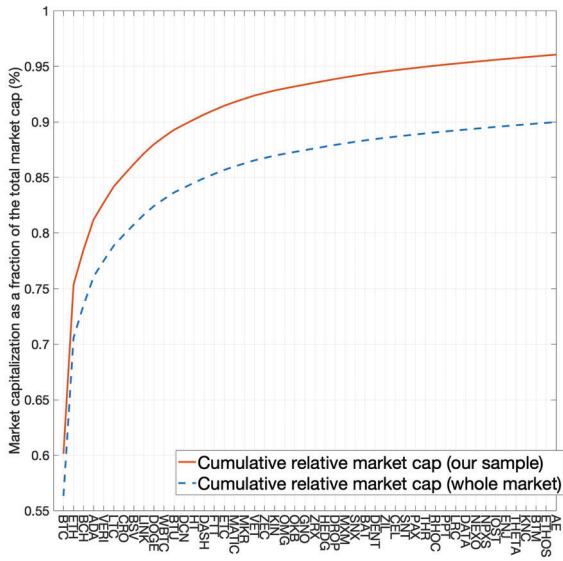
Table 13: Out-of-sample asset pricing performance on weekly returns

This table reports out-of-sample total and predictive R^2 for the restricted ($\Gamma_\alpha = 0$) IPCA models with $K = 1, \dots, 6$ factors (Panel A) and a variety of observable factor models with dynamic (Panel B) and static (Panel C) loadings estimated based on the weekly data. Observable factor models begin with a cryptocurrency analogue of CAPM (FF1) including a market factor, and then add size, momentum, liquidity, volatility, and reversal factors to obtain FF2, FF3, FF4, FF5 and FF6. The out-of-sample analysis follows a recursive estimation scheme outlined in the main text starting from the second half of the available data, i.e. the first prediction is made in September 2019. Performance statistics are computed for individual cryptocurrencies r_t and characteristic-managed portfolios x_t . All numbers are expressed in percent.

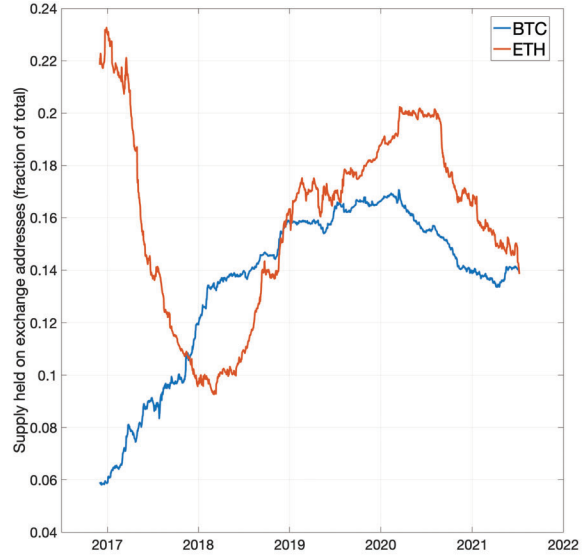
Test assets	Statistics	K					
		1	2	3	4	5	6
Panel A: IPCA							
r_t	R_{total}^2	19.63	21.03	21.49	21.86	22.19	22.57
	R_{pred}^2	1.65	0.82	0.82	0.82	0.81	0.83
x_t	$R_{total,x}^2$	95.29	96.00	96.59	97.01	97.34	97.61
	$R_{pred,x}^2$	8.21	7.51	7.52	7.53	7.53	7.56
Panel B: Observable risk factors (dynamic loadings)							
r_t	R_{total}^2	14.91	15.75	15.73	15.75	15.67	15.97
	R_{pred}^2	0.07	0.00	0.00	0.01	0.03	0.42
x_t	$R_{total,x}^2$	61.28	64.51	64.51	64.46	64.17	64.02
	$R_{pred,x}^2$	0.28	-0.14	-0.15	-0.14	-0.15	-0.63
Panel C: Observable risk factors (static loadings)							
r_t	R_{total}^2	14.60	15.33	15.32	15.29	15.23	15.17
	R_{pred}^2	0.07	-0.04	-0.04	-0.04	-0.04	-0.21
x_t	$R_{total,x}^2$	60.97	64.10	64.07	63.93	63.67	63.39
	$R_{pred,x}^2$	0.29	-0.14	-0.16	-0.15	-0.18	-0.86

Figure 1: A first look at the data

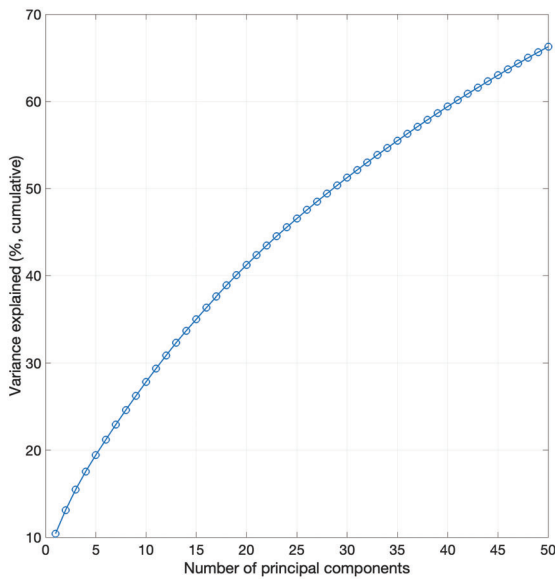
This figure shows the cumulative sum of the market capitalization of the top 50 cryptocurrencies relative to the aggregate market and our sample (the top-left panel). The top-right panel reports the percent supply held on exchange addresses for two largest digital assets, Bitcoin (BTC) and Ethereum (ETH). The bottom-left panel demonstrates the explained variance from the first 50 principal components for the same cross-section of returns used in the main empirical analysis. The bottom-right panel illustrates the median, 5th and 95th percentiles of the estimated loadings for each asset on the first principal component estimated based on a rolling window PCA estimate using 360 daily observations.



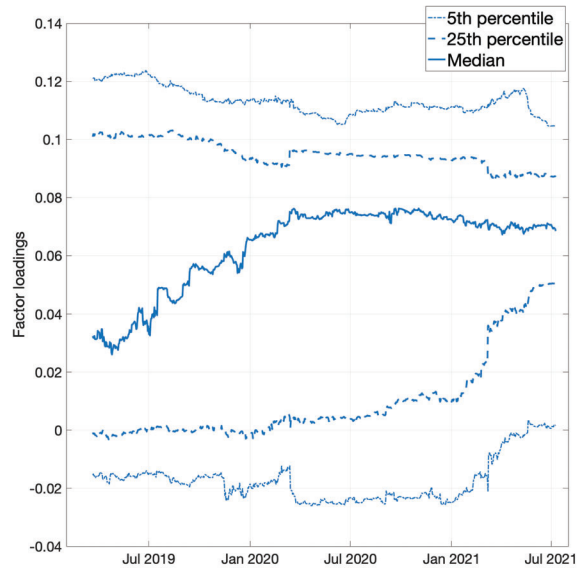
(a) Relative market cap of top 50 assets



(b) The percent supply of BTC and ETH



(c) % supply held in exchanges



(d) The rolling window factor loadings

Figure 2: **Sample coverage**

This figure shows the market capitalization of the aggregate market and our sample. The sample period is from December 2, 2016 to July 9, 2021.

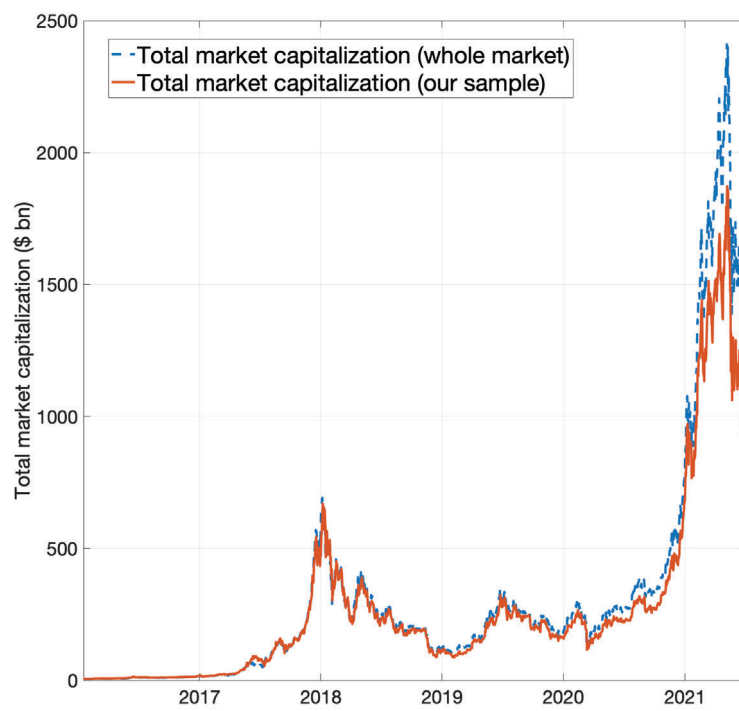
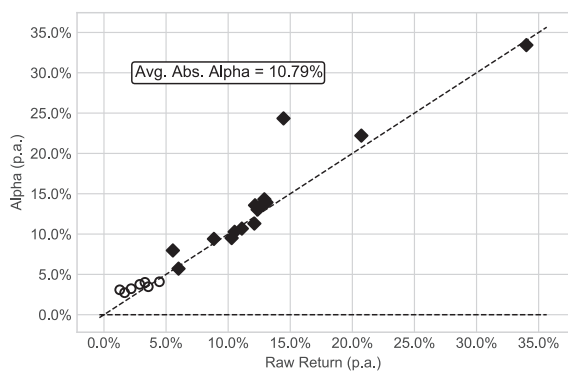
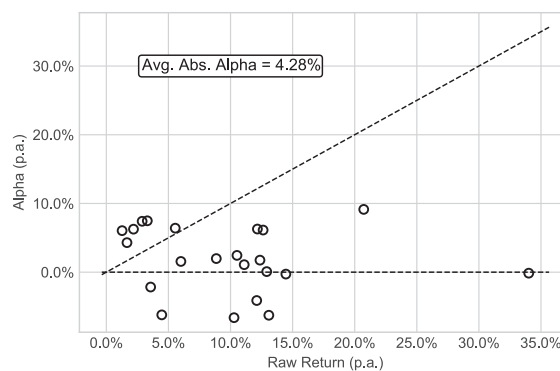


Figure 3: Alphas of characteristic-managed portfolios

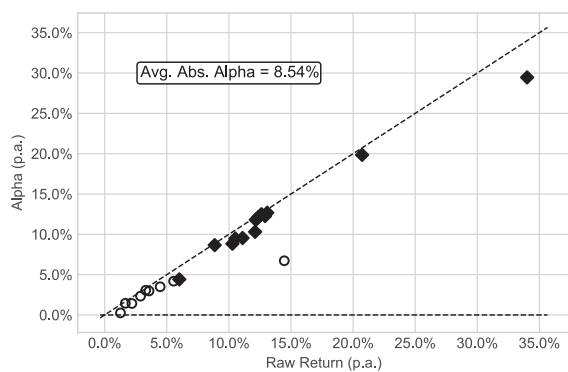
This figure shows unconditional alphas estimated from a time-series regression of portfolio returns on observable factors from the FF6 model (Panel (a)) or IPCA factors from the $K = 3$ specification (Panel (b)). The alphas are computed for characteristic-managed portfolios and are plotted against portfolios' raw average excess returns. Significant alphas with absolute values of t-statistics greater than 2.0 are depicted with filled diamonds, while insignificant alphas are denoted with unfilled circles. The figure also reports conditional alphas from instrumented observable FF6 or three-factor IPCA models (Panels (c) and (d)), which are computed as the time-series averages of period-by-period portfolio residuals. Each panel further shows the average absolute alphas for each specification. All reported values are expressed in percentage per annum.



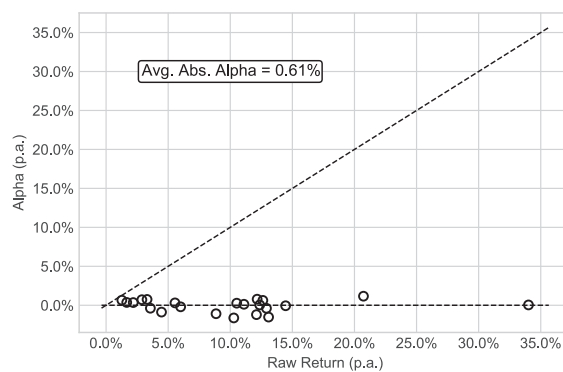
(a) FF6 (Uncond.)



(b) IPCA3 (Uncond.)



(c) FF6 (Cond.)



(d) IPCA3 (Cond.)

Figure 4: Marginal R^2 for IPCA factors

This figure shows the marginal R^2 for the IPCA factors from the restricted ($\Gamma_\alpha = 0$) $K = 3$ specification. The marginal R^2 is the R^2 statistic from regressions of each of characteristic-managed portfolios onto each IPCA factor, one at a time.

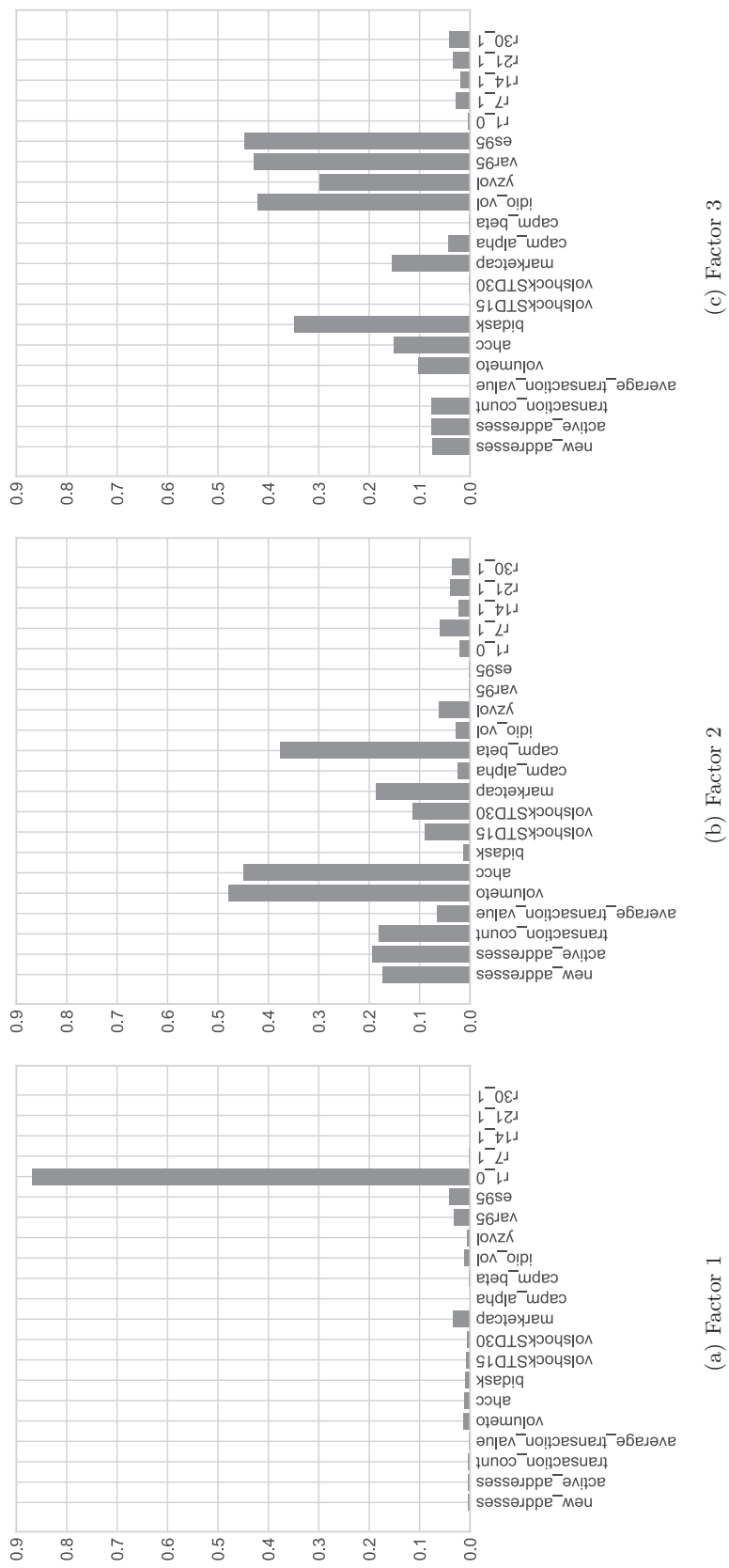
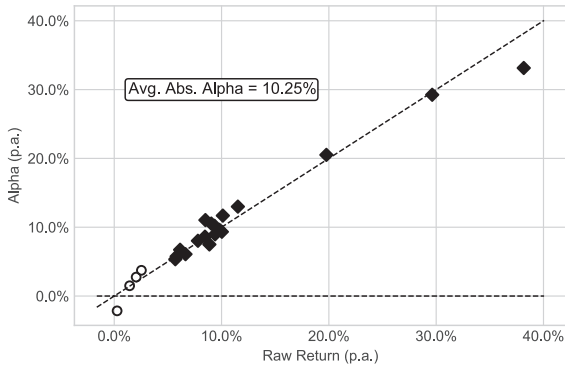


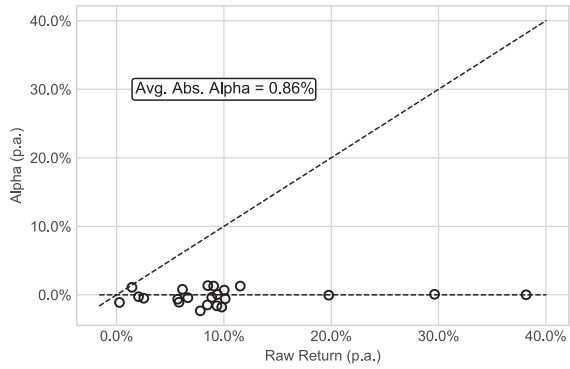
Figure 5: **Alphas of characteristic-managed portfolios: Sub-samples**

This figure shows unconditional alphas estimated from a time-series regression of portfolio returns on observable factors from the FF6 model estimated based on the two sub-samples from December 2016 to January 2020 (Panel (a)) and from January 2020 to July 2021 (Panel (b)). The alphas are computed for characteristic-managed portfolios and are plotted against portfolios' raw average excess returns. Significant alphas with absolute values of t-statistics greater than 2.0 are depicted with filled diamonds, while insignificant alphas are denoted with unfilled circles. The figure also reports conditional alphas from the $K = 3$ (Panel (b)) and $K = 6$ (Panel (d)) IPCA models estimated based on the two sub-samples from December 2016 to January 2020 and from January 2020 to July 2021, respectively. The conditional alphas are computed as the time-series averages of period-by-period portfolio residuals. Each panel further shows the average absolute alphas for each specification. All reported values are expressed in percentage per annum.

Panel A: Sample from 12:2016 to 01:2020

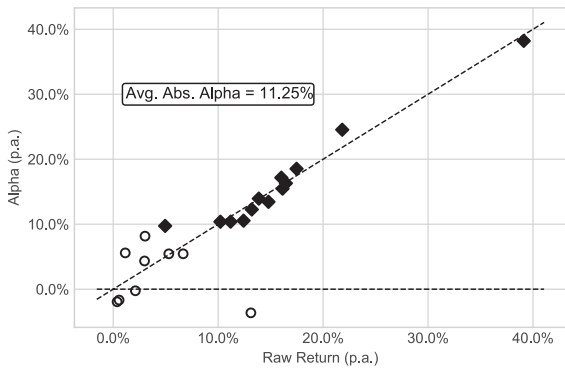


(a) FF6 (Uncond.)

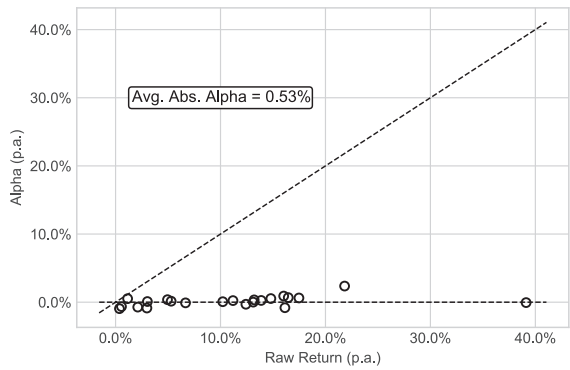


(b) IPCA3 (Cond.)

Panel B: Sample from 01:2020 to 07:2021



(c) FF6 (Uncond.)



(d) IPCA6 (Cond.)

Figure 6: Marginal R^2 for IPCA factors: Sub-sample from 12:2016 to 01:2020

This figure shows the marginal R^2 for the IPCA factors from the restricted ($T_\alpha = 0$) $K = 3$ specification estimated based on the sub-sample from December 2016 to January 2020. The marginal R^2 is the R^2 statistic from regressions of each of characteristic-managed portfolios onto each IPCA factor, one at a time.

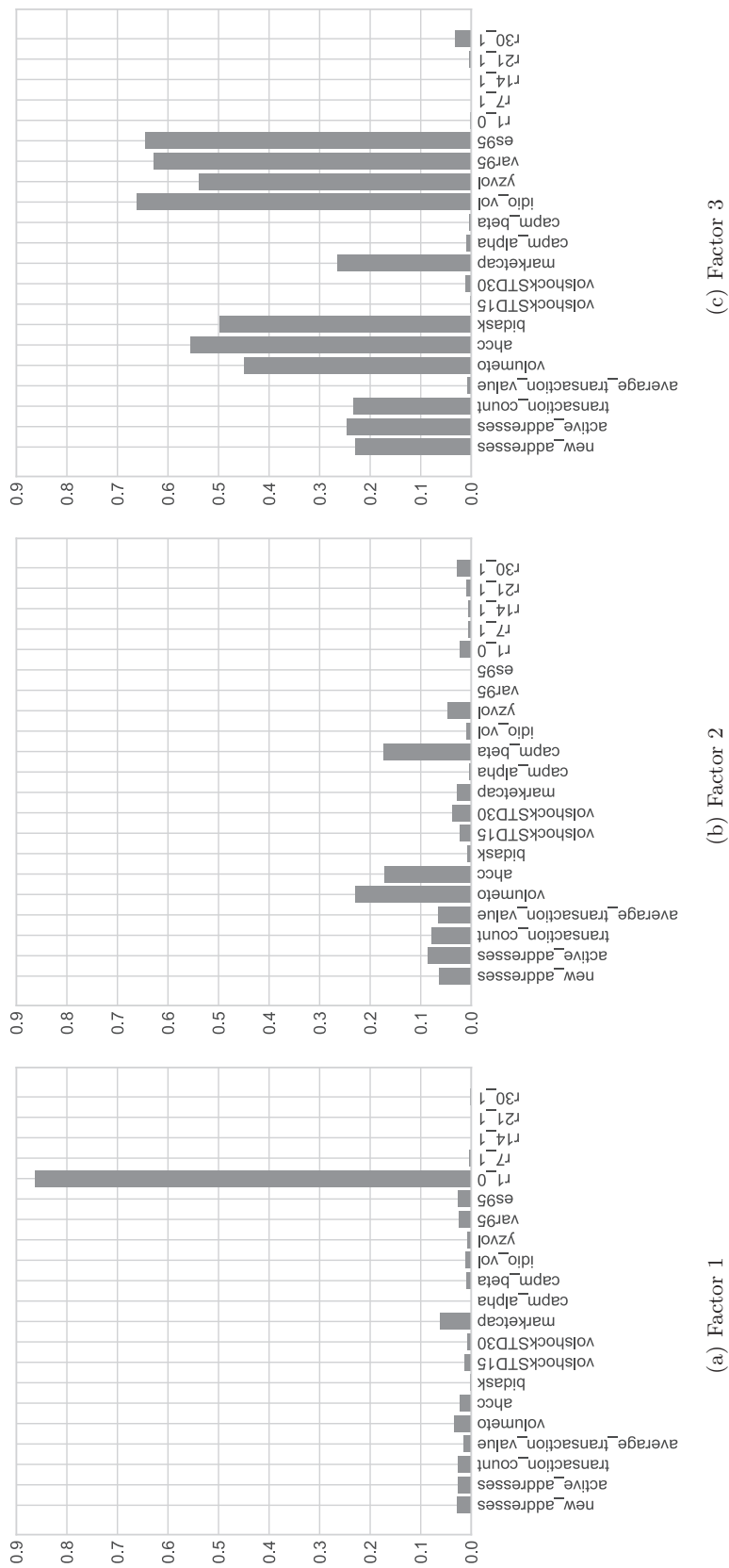
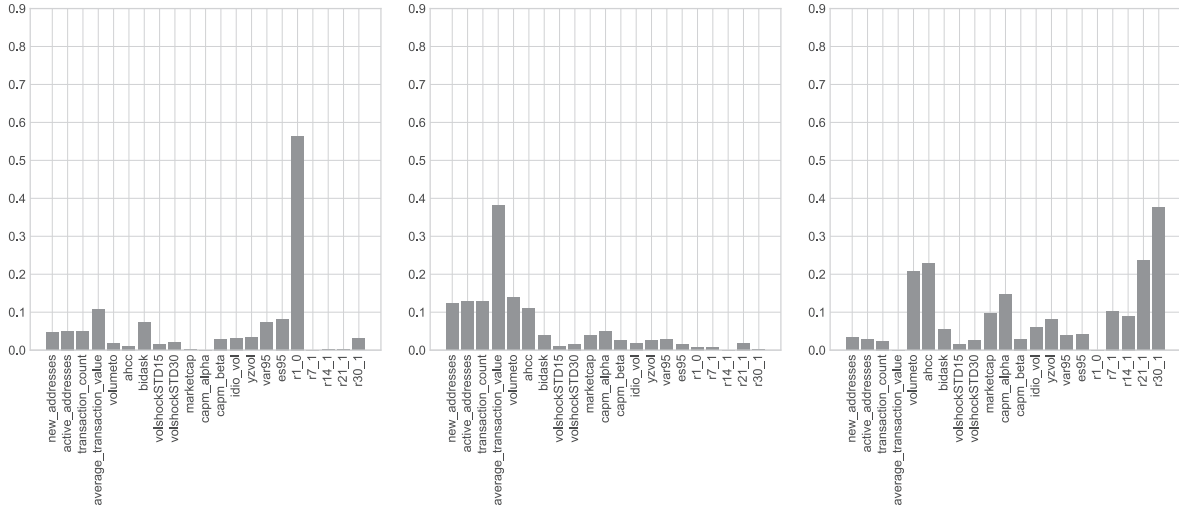


Figure 7: Marginal R^2 for IPCA factors: Sub-sample from 01:2020 to 07:2021

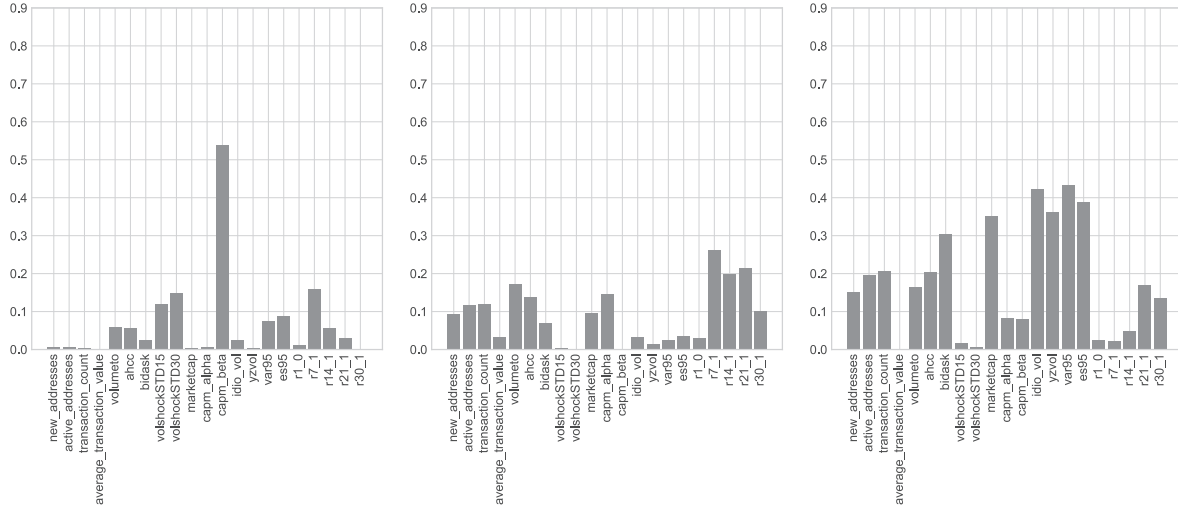
This figure shows the marginal R^2 for the IPCA factors from the restricted ($\Gamma_\alpha = 0$) $K = 6$ specification estimated based on the sub-sample from January 2020 to July 2021. The marginal R^2 is the R^2 statistic from regressions of each of characteristic-managed portfolios onto each IPCA factor, one at a time.



(a) Factor 1

(b) Factor 2

(c) Factor 3



(d) Factor 4

(e) Factor 5

(f) Factor 6

Figure 8: **Alphas of characteristic-managed portfolios: Weekly data**

This figure shows unconditional alphas estimated from a time-series regression of portfolio returns on observable factors from the FF6 model (Panel (a)) or IPCA factors from the $K = 4$ specification (Panel (b)). The alphas are computed for characteristic-managed portfolios and are plotted against portfolios' raw average excess returns. Significant alphas with absolute values of t-statistics greater than 2.0 are depicted with filled diamonds, while insignificant alphas are denoted with unfilled circles. The figure also reports conditional alphas from instrumented observable FF6 or four-factor IPCA models (Panels (c) and (d)), which are computed as the time-series averages of period-by-period portfolio residuals. Each panel further shows the average absolute alphas for each specification. All reported values are expressed in percentage per annum. The results are reported for the models estimated based on the weekly data.

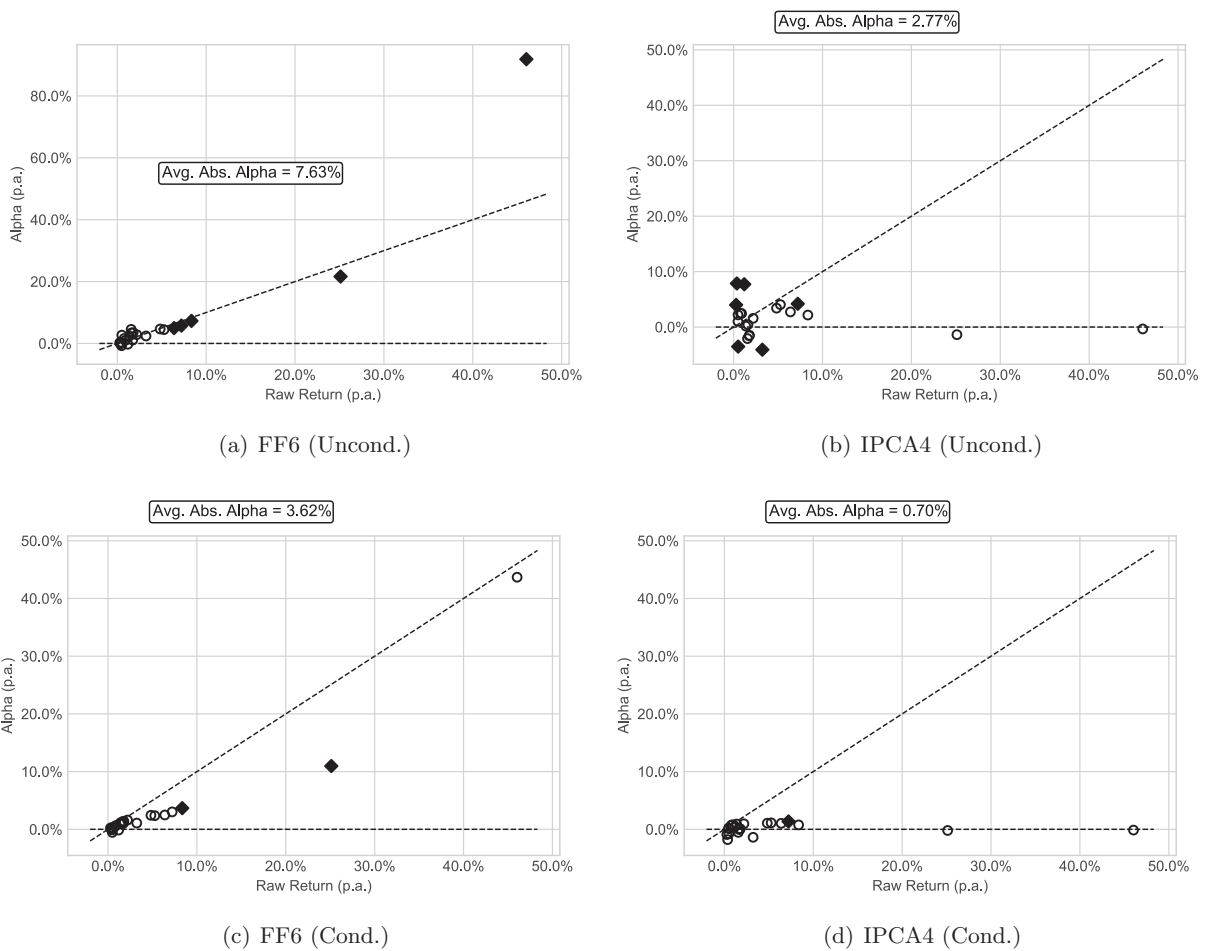
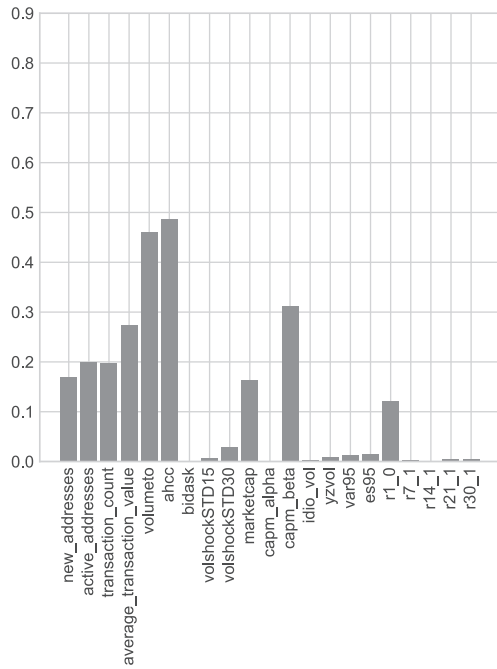
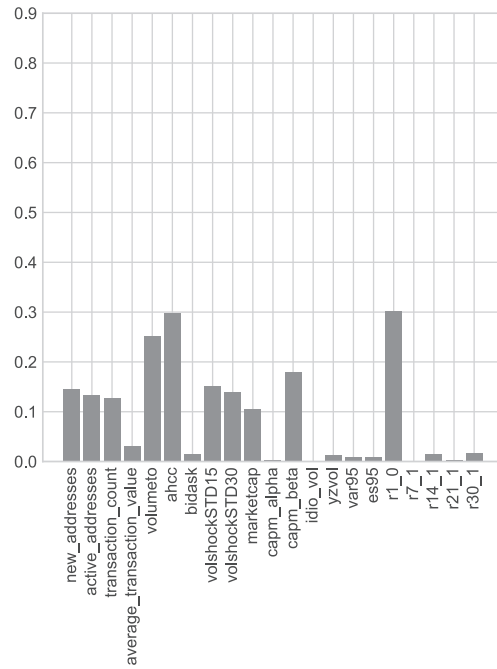


Figure 9: Marginal R^2 for IPCA factors: Weekly returns

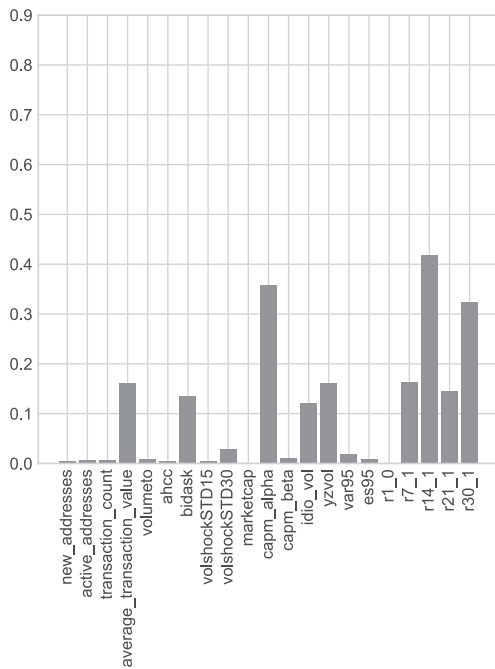
This figure shows the marginal R^2 for the IPCA factors from the restricted ($\Gamma_\alpha = 0$) $K = 4$ specification estimated based on the weekly data. The marginal R^2 is the R^2 statistic from regressions of each of characteristic-managed portfolios onto each IPCA factor, one at a time.



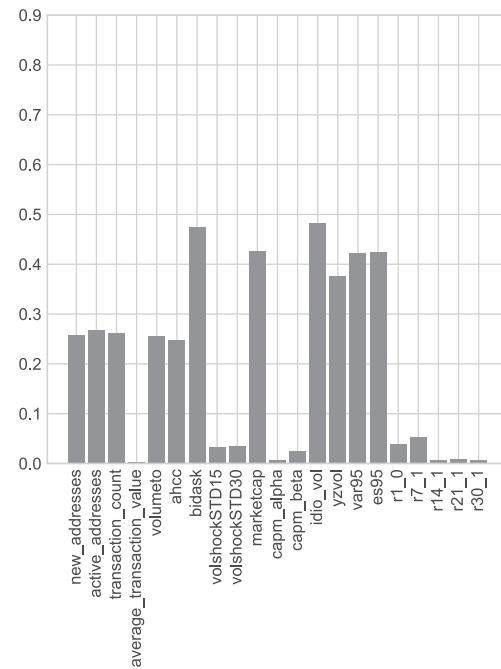
(a) Factor 1



(b) Factor 2



(c) Factor 3



(d) Factor 4