

Final Exam

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Question 1

Panel A							
	mean	alpha	beta(mkt)	beta(smb)	beta(hml)	beta(umd)	r2
me	0.2556	0.1673	0.1705				0.0619
	1.9777	1.3266	6.0913				
		0.0356	0.0250	0.9758	0.1843		0.9324
		1.0360	3.1189	84.9114	15.1562		
		0.0073	0.0314	0.9756	0.1960	0.0314	0.9342
IA		0.2118	3.8884	85.9875	15.8479	3.9388	
	0.3704	0.4473	-0.1486				0.1293
	4.7523	6.1047	-9.1367				
		0.2829	-0.0734	-0.0290	0.3935		0.4915
		4.9798	-5.5431	-1.5260	19.5697		
ROE		0.2375	-0.0631	-0.0293	0.4122	0.0505	0.5045
		4.1400	-4.7237	-1.5605	20.1466	3.8245	
	0.5415	0.6022	-0.1173				0.0424
	5.0401	5.6848	-4.9870				
		0.7047	-0.0890	-0.3207	-0.2022		0.2040
		7.1917	-3.8942	-9.7866	-5.8294		
		0.4637	-0.0343	-0.3223	-0.1029	0.2682	0.3964
		5.3118	-1.6848	-11.2838	-3.3067	13.3465	

Panel B							
	IA	ROE	MKT-RF	SMB	HML	mom	
ME	-0.1079	-0.3165	0.2489	0.9511	-0.0221	-0.0008	
	0.0103	0.0000	0.0000	0.0000	0.6006	0.9842	
IA		0.0585	-0.3596	-0.2129	0.6756	0.0167	
		0.1652	0.0000	0.0000	0.0000	0.6914	
ROE			-0.2059	-0.3822	-0.1140	0.4889	
			0.0000	0.0000	0.0067	0.0000	
MKT-RF				0.2674	-0.2693	-0.1471	
				0.0000	0.0000	0.0005	
SMB					-0.1915	-0.0034	
					0.0000	0.9357	
HML						-0.1911	
						0.0000	

Question 2

Connect to WRDS using Python package wrds to download all the data sets: Compustat annual data, Compustat quarterly data, CRSP, and linked table.

Create investment-to-assets, I/A, as the annual change in total assets (Compustat annual item AT) divided by 1-year-lagged total assets.

ROE, which is income before extraordinary items (Compustat quarterly item IBQ) divided by 1-quarter-lagged book equity.

Construct the q-factors from a triple 2-by-3-by-3 sort on size, I/A, and ROE.

2. (40 points) Replicate the 4 factors from Hou, Xue and Zhang (2015). Explain the replication procedure step-by-step.

(a) For each of the factors, report the following statistics for both original factor and replicated factors: annualized average returns, annualized volatility, annualized Sharpe ratio, monthly skewness, and monthly kurtosis. The outcome should be similar to Panel A of Table 3 of this exam (see last few pages of this exam).

	mkt-rf		ME		IA		ROE	
	original	replication	original	replication	original	replication	original	replication
Average	6.71	6.89	3.17	2.57	4.14	4.41	6.4	6.56
volatility	15.72	15.95	10.43	10.6	6.01	6.75	8.64	8.79
sharpe ratio	0.5	0.52	0.59	0.16	0.59	0.24	0.24	1.03
skewness	-0.19	-0.07	0.43	0.89	0.26	0.19	-0.93	0.37
kurtosis	2.28	1.63	5.77	6.54	2.19	1.48	4.99	4.8

(b) For each of the factors, compute the difference in basis points and report the following statistics: average, standard deviation, minimum and maximum difference, and quartiles. The outcome should be similar to Panel B of Table 3 of this exam (see last few pages of this exam).

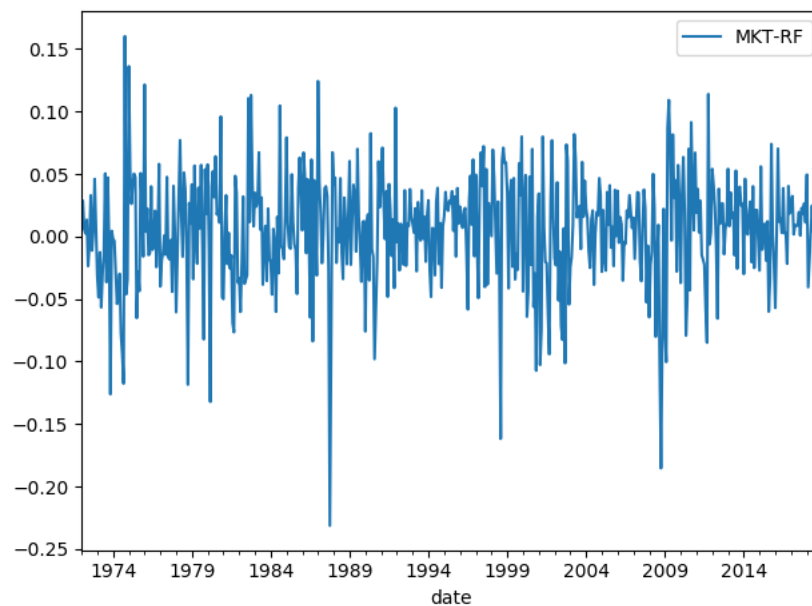
index	mkt-rf	me	ia	roe
mean	15.780	32.140	40.650	42.230
std	17.820	27.710	33.120	36.530
min	0.011	0.058	0.073	0.181
25%	5.252	10.687	15.140	16.319
50%	10.340	21.817	31.064	34.400
75%	22.375	49.471	56.326	50.542
max	182.840	236.251	205.961	210.804

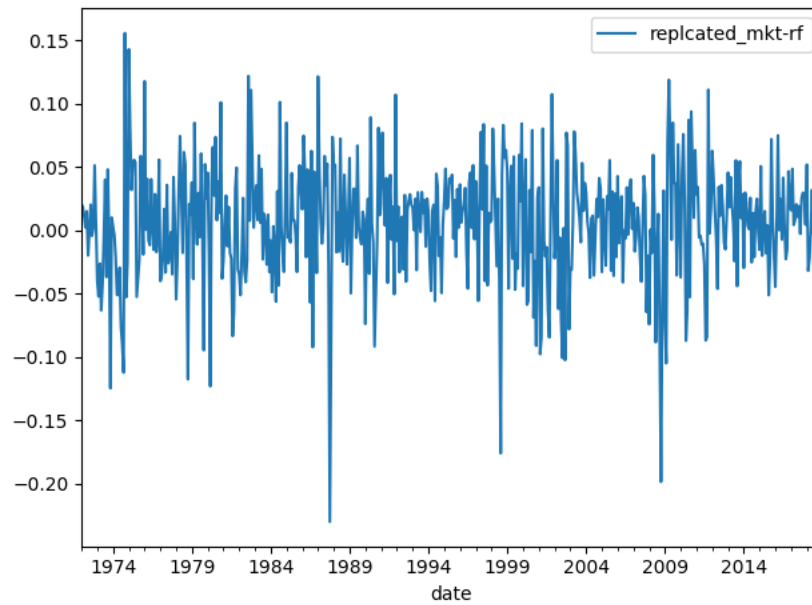
(c) For each of the factors, compute the correlation between the original series and the replicated one (report 4 decimal digits). The outcome should be similar to Panel C of Table 3 of this exam (see last few pages of this exam).

Statistic	MKT-RF	ME	IA	ROE
Correlation	0.9713	0.9017	0.8534	0.7108

(d) For each of the factors, plot three time series: the original factor, the replicated factor, and the difference. Report the factors in percent (i.e. multiplied by 100) and the difference in basis points. The outcome should be similar to Figures 1, 2, 3, 4, 5, 6, 7, and 8 of this exam (see last few pages of this exam).

Original mkt-rf factor





Question 3.

	mean	alpha	beta(mkt)	beta(smb)	beta(hml)	beta(umd)	r2
me	0.2359	0.1840	0.1472				0.0704
	2.2526	1.5442	6.1156				
		0.0397	0.0257	1.0860	0.1970		1.0312
		1.0090	2.5668	75.4013	13.1102		
		0.0072	0.0347	1.1131	0.2109	0.0332	1.0977
		0.2256	4.0401	93.1245	18.6054	4.3957	
IA	0.3782	0.4630	-0.1780				0.1245
	4.1583	5.0486	-9.9042				
		0.3236	-0.0831	-0.0309	0.4714		0.3996
		4.3673	-6.2970	-1.4223	23.1314		
		0.2073	-0.0741	-0.0299	0.4279	0.0466	0.5075
ROE		3.5479	-4.6481	-1.2889	20.7107	3.5682	
	0.4343	0.5799	-0.1400				0.0366
	5.0106	5.4404	-4.9122				
		0.7033	-0.0968	-0.3031	-0.2034		0.2191
		6.2424	-3.2556	-11.5481	-5.9635		
		0.4215	-0.0327	-0.3072	-0.0946	0.2242	0.4261
		5.4765	-1.4254	-10.7084	-3.2273	10.9041	

Panel B

	IA	ROE	MKT-RF	SMB	HML	mom
ME	-0.0914	-0.3703	0.2192	0.9644	-0.0244	-0.0008
	0.0109	0.0000	0.0000	0.0000	0.6841	0.9025
IA		0.0529	-0.4283	-0.2188	0.7573	0.0186
		0.1631	0.0000	0.0000	0.0000	0.5808
ROE			-0.1904	-0.3241	-0.1020	0.5099
			0.0000	0.0000	0.0060	0.0000
MKT-RF				0.2476	-0.3189	-0.1635
				0.0000	0.0000	0.0004
SMB					-0.1739	-0.0040
					0.0000	0.8384
HML						-0.2089
						0.0000

Question 4

Question 5

We can do robust test by using different market or different time period, such as international market, or other product market: FX futures and so on.

Pros: