Investment Management Project #3

Part 1: Idiosyncratic Volatility and the CAPM

	Beta	CAPM	Alpha				
Microsoft	0.947643	0.009348	0.011693				
JPM	1.11802	0.0104	0.003919				
Gold	1.374855	0.011985	0.000652				
Nike	0.941389	0.00931	-0.00278				
Delta	1.317391	0.01163	-0.00423				
				=VAR.S(A2:A121)	=Q7^2*Q18	=SQRT(T18-U18)	=V18/SQRT(T18)
				Total Risk	Systematic Risk	Idiosyncratic Volatility	% of idiosyncratic Risk
Variance of SP	0.00197		MSFT	0.003742069	0.001768707	0.044422543	0.726185399
Rf rate	0.0035		JPM	0.004814362	0.002461871	0.048502488	0.699028101
	E(r)		Gold	0.006918717	0.003722886	0.056531685	0.67964033
Microsoft	0.021041		Nike	0.00570207	0.001745438	0.06290177	0.83300303
JPM	0.014319		Delta	0.011313046	0.003418184	0.088853035	0.835376952
Gold	0.012637						
Nike	0.006527						
Delta	0.007402						
S&P	0.009672						

- **TASK 1: Idiosyncratic Volatility**
  - To find Idiosyncratic Risk =SQRT(Var(ϵi) = Var(Ri)-βi^2·Var(Rm)) βi^2·Var(Rm) –systematic risk
    - Var(ϵi) – Idiosyncratic Risk
  - % of Risk
    - Idiosyncratic Volatility / Total Risk
- **Task 2 : Analysis**
  - The two stocks that qualify for under 70% idiosyncratic Risk are JP Morgan & Gold

Part 2: Multi-Factor Asset-Pricing Models – Task 1 & 2

- **Task 1 - Average Monthly Return, Standard Deviations, & Sharpe Ratio**

Task 1	SMB	HML	RMW	CMA	MRP
E[R]	-0.165166667	-0.183	0.392	-0.088666667	0.006143
Std	3.021501097	3.782740459	2.110148	2.395217551	0.044756
Sharpe	-0.055822143	-0.04930288	0.18411	-0.038479455	0.059057

- **Task 2 – Covariance, Variance Matrix & Correlation Matrix**
  - Comments
    - Highest Positive Correlation: Value Factor (HML) & Investment Factor (CMA)
    - Highest Negative Correlation: Profitability Factor (RMW) & Size Factor (SMB)

Task 2					
COVARIANCE	SMB	HML	RMW	CMA	MRP
SMB	9.278641	3.998458	-2.46435	0.231533	-0.0064
HML	3.998458	14.42861	1.021344	5.924164	-0.00597
RMW	-2.46435	1.021344	4.496615	0.79032	0.002515
CMA	0.231533	5.924164	0.79032	5.787896	-0.00646
MRP	-0.0064	-0.00597	0.002515	-0.00646	0.002003
CORRELATION	SMB	HML	RMW	CMA	MRP
SMB	1	0.345572	-0.38152	0.031594	-0.04691
HML	0.345572	1	0.126799	0.648268	-0.03512
RMW	-0.38152	0.126799	1	0.154917	0.026499
CMA	0.031594	0.648268	0.154917	1	-0.05999
MRP	-0.04691	-0.03512	0.026499	-0.05999	1

Part 2: Task 3 – Stock Recommendation Based on Five Factor Model Alpha

Task 3						
MSFT	B_SMB	B_HML	B_RMW	B_CMA	B_M-Rf	a
	-0.07186873	0.005133	0.003389	-0.00446	0.004763	0.017769
	0.12647522	0.003206	0.003017	0.002225	0.002296	0.00578
	0.05394079	0.061028	#N/A	#N/A	#N/A	#N/A
	1.27716498	112	#N/A	#N/A	#N/A	#N/A
	0.02378322	0.41713	#N/A	#N/A	#N/A	#N/A
JPM	B_SMB	B_HML	B_RMW	B_CMA	B_M-Rf	a
	-0.03834246	0.001022	-0.00018	-0.00067	0.001143	0.012028
	0.14736427	0.003735	0.003516	0.002592	0.002676	0.006735
	0.00325079	0.071107	#N/A	#N/A	#N/A	#N/A
	0.0730552	112	#N/A	#N/A	#N/A	#N/A
	0.00184692	0.566298	#N/A	#N/A	#N/A	#N/A
Gold	B_SMB	B_HML	B_RMW	B_CMA	B_M-Rf	a
	-0.14858921	0.005204	0.001523	-0.00289	0.002116	0.010903
	0.17451756	0.004423	0.004163	0.00307	0.003169	0.007976
	0.02117511	0.084209	#N/A	#N/A	#N/A	#N/A
	0.48458362	112	#N/A	#N/A	#N/A	#N/A
	0.01718145	0.794217	#N/A	#N/A	#N/A	#N/A

Nike	B_SMB	B_HML	B_RMW	B_CMA	B_M-Rf	a
	-0.100197237	0.002799	0.005641	-0.00368	0.003078	0.001589
	0.158598974	0.00402	0.003784	0.00279	0.00288	0.007248
	0.031190886	0.076528	#N/A	#N/A	#N/A	#N/A
	0.721169779	112	#N/A	#N/A	#N/A	#N/A
	0.021117913	0.655936	#N/A	#N/A	#N/A	#N/A
Delta	B_SMB	B_HML	B_RMW	B_CMA	B_M-Rf	a
	-0.205134345	0.00315	-0.00165	-0.00201	-7.6E-05	0.007465
	0.223940562	0.005676	0.005343	0.003939	0.004066	0.010235
	0.012473547	0.108057	#N/A	#N/A	#N/A	#N/A
	0.282936685	112	#N/A	#N/A	#N/A	#N/A
	0.016518383	1.307755	#N/A	#N/A	#N/A	#N/A

	MSFT_a	JPM_a	Gold_a	Nike_a	Delta_a
Based on this Five Factor Model we would recommend	1.777%	1.203%	1.090%	0.159%	0.746%

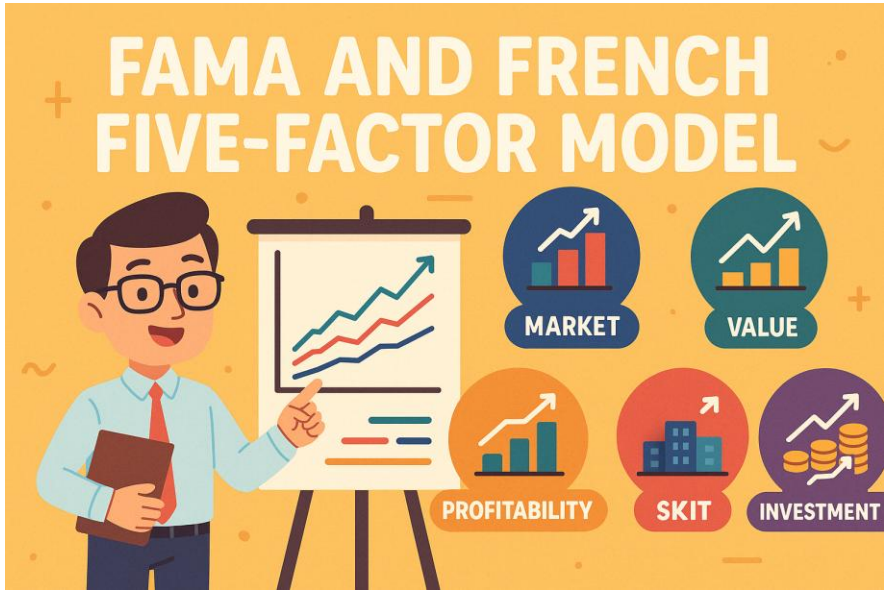
Part 2: Task 4

	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Single Factor	MSFT - Rf	JPM- Rf	Gold-Rf	Nike-Rf	Delta-Rf							RF Rate	0.0035	
2	-0.0115	-0.018778766	0.111597409	0.114868202	0.012754791	0.108400826					ALPHA				
3	0.00058	-0.00813	-0.04358	-0.06257	-0.04286	-0.05552					MSFT	1.81%			
4	2E-05	0.038607	0.12177	0.171822	0.017763	0.111844		MSFT reg			JPM	1.15%			
5	-0.00696	-0.05916	0.048952	0.042308	-0.13099	0.1231		SUMMARY OUTPUT			GOLD	1.02%			
6	-0.00544	0.028048	-0.06551	-0.03317	0.05747	0.19184					NIKE	0.30%			
7	0.03004	-0.00639	0.052891	-0.001103	0.109511	-0.01582		*Regression Statistics*			DELTA	0.58%			
8	-0.0172	-0.06749	0.048611	0.121876	-0.01027	-0.09667		Multiple R	0.04270072						
9	-0.0013	0.073151	-0.00533	-0.0127	-0.21055	-0.07367		R Square	0.00182335						
10	-0.00308	0.062768	0.053296	0.06636	0.026741	0.015473		Adjusted R Square	-0.0067816						
11	0.0121	-0.07811	-0.04624	0.018095	-0.0218	0.042458		Standard Error	0.06159584						
12	-0.01614	0.013616	0.073034	0.070115	-0.09924	0.128982		Observations	118						
13	-0.01632	0.036894	0.063603	0.009625	0.020138	0.076469									
14	0.02172	0.053781	0.021544	-0.00806	-0.06834	-0.03059		ANOVA							
15	-0.0058	-0.01107	0.086326	0.126002	-0.01892	0.085858			*df*	*SS*	*MS*	*F*	*Significance F*		
16	-0.00342	0.117171	0.118893	0.12143	0.069478	0.17826		Regression	1	0.00080394	0.00080394	0.21189517	0.64614776		
17	0.00204	0.067316	-0.0446	-0.06519	0.071275	-0.15891		Residual	116	0.44010949	0.00379405				
18	-0.00672	-0.04014	-0.01245	-0.01613	-0.06338	-0.14063		Total	117	0.44091343					
19	0.0147	-0.02779	-0.07713	-0.08263	-0.08213	-0.07657									
20	0.00432	-0.01707	0.082584	0.099836	-0.003319	-0.03042			*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upp*
21	-0.03358	0.033499	0.068197	-0.0077	0.045046	0.30506		Intercept	0.01806328	0.00567818	3.18117303	0.00188211	0.00681692	0.02930963	0.00681692	0.0
22	0.006	0.065269	-0.0218	-0.06039	-0.17285	0.055375		Single Factor	0.18004156	0.39112199	0.46032073	0.64614776	-0.5946248	0.95470795	-0.5946248	0.9

Part 2: Task 5 step 1

Part 2 Task 5							
COVARIANCE	SMB	HML	RMW	CMA	MRP		
SMB	9.278641199	3.998458366	-2.464349341	0.231532826	-0.00639593		
HML	3.998458366	14.42860598	1.021344061	5.924164168	-0.005970483		
RMW	-2.464349341	1.021344061	4.496614697	0.790319694	0.00251492		
CMA	0.231532826	5.924164168	0.790319694	5.787895994	-0.006459667		
MRP	-0.00639593	-0.005970483	0.00251492	-0.006459667	0.002003125		
CORRELATION	SMB	HML	RMW	CMA	MRP		
SMB	1	0.345571725	-0.381519943	0.031594394	-0.04691454		
HML	0.345571725	1	0.126799355	0.648267932	-0.035119089		
RMW	-0.381519943	0.126799355	1	0.154917189	0.026498868		
CMA	0.031594394	0.648267932	0.154917189	1	-0.059992331		
MRP	-0.04691454	-0.035119089	0.026498868	-0.059992331	1		
Inverted Matrix							
0.16567272	-0.077006336	0.097664644	0.059266818	0.36797062		1	0.613568
-0.077006336	0.155488282	-0.051166693	-0.149304752	-0.199670906		1	-0.32166
0.097664644	-0.051166693	0.28601044	0.009220862	-0.170016025		1	0.171713
0.059266818	-0.149304752	0.009220862	0.322827857	0.773698858		1	1.01571
0.36797062	-0.199670906	-0.170016025	0.773698858	502.5081734		1	503.2802

Scalar Denominator		Final Weights		
504.7594869	SMB	0.001215566		-0.00063725 min
	HML	-0.00063725		
	RMW	0.000340188		
	CMA	0.002012265		
	Market-RF	0.997069236		



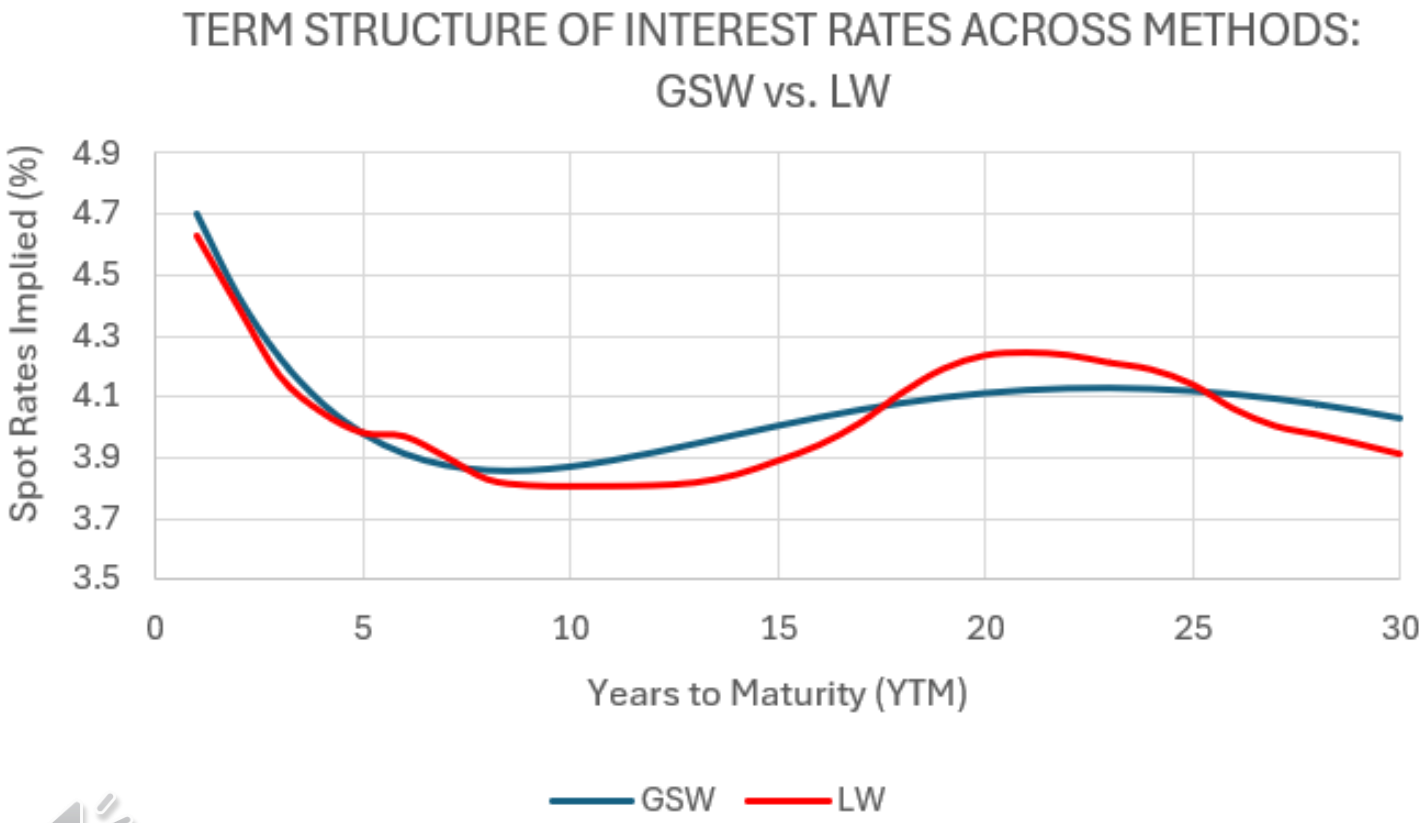
Part 2: Task 5 step 2

	SMB	HML	RMW	CMA	MRP
E[R]	-0.165166667	-0.183	0.392	-0.088666667	0.006143181
Std	3.021501097	3.782740459	2.110148189	2.395217551	
Sharpe	-0.055822143	-0.04930288	0.184110292	-0.038479455	

0.01135278	Microsoft Alpha
0.018543048	JMP Alpha
0.023614032	Gold Alpha
-0.007574313	Nike Alpha
0.015849759	Delta Alpha

Single Factor Return
-0.047625403

Part 3: Bond Pricing with Term Structures of Interest Rates



Correlation between Yields = 0.9145508

Key Differences between Interpolation Methods:

Smoothness: Particularly in long-term rates, LW fluctuates more through maturities with irregular shifts. Compared to GSW with their smoother, more stable expectations.

Mid-Term Rates (5-15 YTM): LW shows lower spot rates than GSW in this age range.

Long-Term Rates (15-30 YTM): LW has a visible hump around the 20-year mark, with GSW continuing steadily.

Volatility/Model Sensitivity: LW appears to be more sensitive to short-term input data changes. GSW looks to be more reliable for long-term investment modeling.

Task 2: 30-year Bond pricing

Calculations for Years 1-29: Coupon Payments
Payment for Year N = Coupon Rate / (1+Spot Rate)^N
Calculations for Year 30: Final Payment
Payment for Year 30 = Face Value + Coupon Rate / (1+Spot Rate)^30

GSW Method Price of Bond = $1,681.95
LW Method Price of Bond = $1,696.68

Key Differences:
- Total Bond price difference = $14.73
- Year 1-29 price difference = $3.17
- Year 30 price difference = $11.55
- LW's method creates higher PVs for majority of years
- Small rate differences between the two lead to magnified pricing differences
- Higher bond price from LW leads to a lower implied yield

Maturity (years)	GSW Payments	LW Payments
1	$76.40667	$76.45846
2	$73.35369	$73.40402
3	$70.65095	$70.77492
4	$68.16778	$68.25266
5	$65.81680	$65.81357
6	$63.54087	$63.33529
7	$61.30572	$61.19637
8	$59.09357	$59.23632
9	$56.89843	$57.15149
10	$54.72115	$55.07048
11	$52.56826	$53.04975
12	$50.44879	$51.09152
13	$48.37263	$49.16207
14	$46.34877	$47.18573
15	$44.38786	$45.13960
16	$42.49639	$43.10301
17	$40.68044	$40.97098
18	$38.94542	$38.72271
19	$37.29384	$36.65736
20	$35.72790	$34.88498
21	$34.24738	$33.40475
22	$32.85244	$32.10115
23	$31.54018	$30.96840
24	$30.30955	$29.86750
25	$29.15654	$29.00627
26	$28.07915	$28.42461
27	$27.07322	$27.71935
28	$26.13595	$26.85332
29	$25.26251	$26.05118
30	$330.06782	$341.62183
Total ($)	**$1,681.95066**	**$1,696.67965**

Task 3: 7-year Bond pricing

Bond Structure chosen: GSW
- Semi-Annual Payment
- Face Value = $1000
- 7-year maturity (14 payments)
- Coupon Rate: 6% Annually; 3% semi-annually

Calculations for Payments 1-13
- PV = Coupon Payment / (1+ Semi-annual %)^N

Caclulation for Payment 14
- PV = Coupon + Face Value / (1+ Semi-annual %)^N

Total of $1,129.48

Years	Semi-annual %	Payment #	Payment
0.5	0.02324435	1	$29.32
1	0.02324435	2	$28.65
1.5	0.02192025	3	$28.11
2	0.02192025	4	$27.51
2.5	0.02092850	5	$27.05
3	0.02092850	6	$26.49
3.5	0.02020831	7	$26.08
4	0.02020831	8	$25.56
4.5	0.01970682	9	$25.17
5	0.01970682	10	$24.68
5.5	0.01938069	11	$24.29
6	0.01938069	12	$23.83
6.5	0.01919282	13	$23.43
7	0.01919282	14	$789.31
		Total ($)	**$1,129.48**