

FN 312
Quiz 3

Consider the following single index model for asset returns

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{Mt} - r_{ft}) + \varepsilon_{it}$$

where $i=1, \dots, n$ assets and $t=1, \dots, T$ time periods.

- a) (1 point) What does the residual term ε_{it} in the single index model represent?

Firm-specific or idiosyncratic risk.

- b) (6 points) Suppose you use the above equation to test CAPM for Google and Microsoft stocks. According to the single index model, what is an important assumption on the residual terms between these two assets? Is it realistic? Why is this assumption important?

We assume that the error residual terms of the two assets are uncorrelated, $\text{Cov}(\varepsilon_{it}, \varepsilon_{jt})=0$ ie. there are no industry effects.

This is not realistic as in the real world there could be shocks that only affect technology stocks (in this case Google and Microsoft) beyond shocks that affect the broad market.

However, this assumption helps us simplify the portfolio optimization problem in terms of reducing the number of parameters to be estimated in the large correlation matrix among all stocks. With this assumption, any given two stocks are only correlated through one common factor which is driven by market-wide risk.

- c) (3 points) You estimate the single index model and obtain the following results from the regression:

Asset	α_i	$\text{SE}(\alpha_i)$	β_i	$\text{SE}(\beta_i)$
Google	0.0053	0.0130	0.0579	0.1882
Microsoft	0.0033	0.0035	1.2155	0.1268

Does CAPM hold for both assets? Explain why or why not.

Yes, for both cases, alpha is not statistically different from zero at the 5% level

Tstat_google = 0.0053/0.013 = 0.407 < 1.96.

Tstat_msft = 0.0033/0.0035 = 0.945 < 1.96.