

Economics 215B

(Lecture 3)

Ethan Kaplan

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1 Event Studies

- Used mostly in finance to look at impact of events on asset prices
- Can be used in other contexts. Need:
 - High frequency data on dependent variable
 - Rare large changes in "independent variable" ("event")
- Examples:
 - Impact of Election on Stock Prices
 - Impact of Leader Death on Stock Prices
 - Impact of Unions on Health Care Quality (mortality, wound infections, urinary tract infections, etc.)

- Two Time Periods:
 - Estimation Window (Normal Times): time τ_0 to τ_1
 - Event Window (Special Times): time $\tau_1 + 1$ to τ_2
 - * 0 is date of event
 - * $0 \in [\tau_1 + 1, \tau_2]$

- Estimate a model of outcome in Estimation Window:
 - $Y_{it} = f(X_{it}\beta) + \epsilon_{it}$
 - Assume $\epsilon_{it} \sim N(0, \sigma_{\epsilon_i}^2)$
 - Estimate $\hat{\beta}$

- Compute Abnormal Returns (AR) in Event Window

- $AR_{it} = Y_{it} - f(X_{it}\hat{\beta})$

- Model for Abnormal Returns

- Constant Mean Model: $f(X_{it}\beta) = \mu_i$

- Market Model: $f(X_{it}\beta) = \alpha_i + \beta_i R_{mt}$ (where R_{mt} is the value of a market index)

- Factor Models: $f(X_{it}\beta) = \alpha_i + Z_{it}\beta_i$

- CAPM, APT

- Cumulative Abnormal Returns (CARS)

- $CAR_{it} = \sum_{t=\tau_1+1}^{\tau_2} AR_{it}$ (sum of abnormal returns over event window)

- Estimating CARS (example - market model):

- Regression Method

- * $Y_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i D_t + \epsilon_{it}$

- * where $D_t = 1$ in the event window and 0 in the estimation window

- Summing Up Method

- * Estimate $\hat{\beta}_i$ out of sample and then $CAR_{i\tau} = \sum_{t=\tau_1+1}^{\tau_2} Y_{it} - f(X_{it}\hat{\beta})$

- * Example with market model: $AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$

$$V(AR_{i\tau} | R_{mt}) = \sigma_{\epsilon_i}^2 + \frac{1}{\tau_2 - \tau_1 - 1} \left[1 + \frac{(R_{m\tau} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right]$$

- In-Sample Versus Out of Sample Estimation

- In-Sample: Effect of event can impact estimation. For instance, it can impact estimation of variances $\sigma_{\epsilon_i}^2$.
- Out-of-Sample: Implicitly assume that structure of variances/covariances (higher moments) are the same in and out of sample. Therefore, the null hypothesis is really a more general hypothesis that the distribution is the same.
- Out-of-Sample: Adding covariates always helps with in sample fit. By definition (since one can always set $\gamma = 0$ and achieve the same residual variance:

$$\begin{aligned} & \min_{\beta} \sum_{t=\tau_1+1}^{\tau_2} (R_{it} - X_{it}\beta)^2 \\ & \geq \min_{\beta, \gamma} \sum_{t=\tau_1+1}^{\tau_2} (R_{it} - X_{it}\beta - Z_{it}\gamma)^2 \end{aligned}$$

However, adding Z for out of sample fit can increase prediction error and thus abnormal return variance. From the above expression of variance, we can see that this is less true when there is a large sample size.

- * Consequence: Event studies (which tend to rely on summing up method) tend to use few covariates
- * Interpretation: Essentially the prediction technique does not take into account the variance of the estimate. If I take any variable, it is likely to be correlated in small samples with R_{it} conditional on the other covariates. If it is large in magnitude, even if zero is well within the confidence interval (i.e. the standard errors are huge), it can dominate the predicted returns and thus the abnormal returns. Essentially, one should use some weighting scheme for the estimates (weighting using information on the variance of the estimate). Alternatively, use few covariates.

- Terminology - Excess Returns: $ER_{it} = R_{it} - \bar{r}$
where \bar{r} is the risk free rate.
- Note: Event-study methodology developed in finance
but can be used more broadly.