Sure, let's break down these steps into more detailed formulas and explanations:

Yes, the above formula can be modified to include time fixed effects in the event study analysis. Time fixed effects are used to control for factors that vary across time but are constant across entities (in this case, stocks) during the period of study. They are particularly useful in accounting for macroeconomic factors or market-wide shocks that might influence all stocks similarly during the estimation and event windows.

To include time fixed effects, you would modify the regression model used in estimating the parameters of the benchmark model. The modified model might look something like this:

\[ R\_{it} = \alpha\_i + \beta\_{iM} R\_{Mt} + \beta\_{iI} NI\_{it} + \beta\_{iC} TC\_{it} + \beta\_{iD} TD\_{it} + \gamma\_t + \epsilon\_{it} \]

Where:

- \( R\_{it} \) is the return of stock \( i \) at time \( t \).

- \( \alpha\_i \) is the stock-specific intercept.

- \( \beta\_{iM} \), \( \beta\_{iI} \), \( \beta\_{iC} \), \( \beta\_{iD} \) are coefficients for the market return (\( R\_{Mt} \)), net income (\( NI\_{it} \)), total cash (\( TC\_{it} \)), and total debt (\( TD\_{it} \)), respectively.

- \( \gamma\_t \) represents the time fixed effects, capturing factors that affect all stocks at time \( t \) but do not vary across stocks.

- \( \epsilon\_{it} \) is the error term.

This model would require a dummy variable for each time period in your estimation and event windows (except one to avoid the dummy variable trap). The regression would then provide you with the coefficients that include the adjustment for time-specific effects.

### 2. Calculate Expected Returns

Using the estimated parameters, you calculate the expected returns for each stock during the event window:

\[ \hat{R}\_{it} = \hat{\alpha}\_i + \hat{\beta}\_{iM} R\_{Mt} + \hat{\beta}\_{iI} NI\_{it} + \hat{\beta}\_{iC} TC\_{it} + \hat{\beta}\_{iD} TD\_{it} \]

Where \( \hat{R}\_{it} \) is the expected return, and \( \hat{\alpha}\_i \), \( \hat{\beta}\_{iM} \), \( \hat{\beta}\_{iI} \), \( \hat{\beta}\_{iC} \), \( \hat{\beta}\_{iD} \) are the estimated coefficients from the regression.

### 3. Calculate Abnormal Returns (AR)

Abnormal returns are calculated as the difference between the actual returns and the expected returns:

\[ AR\_{it} = R\_{it} - \hat{R}\_{it} \]

### 4. Aggregate and Analyze Abnormal Returns

- Average Abnormal Return (AAR) for each day \( t \) across all stocks \( N \):

\[ AAR\_t = \frac{1}{N} \sum\_{i=1}^{N} AR\_{it} \]

- Cumulative Abnormal Return (CAR) over a period from \( t\_1 \) to \( t\_2 \) for each stock:

\[ CAR\_{i, t\_1 \rightarrow t\_2} = \sum\_{t=t\_1}^{t\_2} AR\_{it} \]

Or aggregated across all stocks:

\[ CAR\_{t\_1 \rightarrow t\_2} = \frac{1}{N} \sum\_{i=1}^{N} CAR\_{i, t\_1 \rightarrow t\_2} \]

### 5. Statistical Testing with Controls

To test the significance of the abnormal returns, you can use statistical tests such as the t-test. The null hypothesis typically is that the mean abnormal return is zero. For a more comprehensive analysis considering control variables, you might perform a multiple regression analysis where ARs are regressed on control variables to see if ARs remain significant after controlling for these factors.

It's important to note that conducting an event study, especially with multiple control variables, requires a robust understanding of econometrics and access to detailed financial data. The interpretation of results should be cautious, considering the model's assumptions and limitations.

<https://gist.github.com/kafkasl/078f2c65c4299d367b57c9835b34c333>

<https://datahub.io/core/s-and-p-500-companies-financials#readme> no year info

 API key is: T93CUDNTXS8JQUGE

BUSINESS/CONSUMER SERVICES

Business Services

Computer Services

Consumer Services

Diversified Holding Companies

General Services

Shell companies

TECHNOLOGY

Computers/Consumer Electronics

Emerging Technologies

Internet/Online

Networking

Semiconductors

Software

Sp500 equals 1: 17 too small

Change the combined\_data3 name

Change historical\_data into stock\_data

Snake or camel? Remember to check

Drop stock\_high..etc

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Description automatically generated

1. **OOTC (Over-the-Counter)**: Stocks on this exchange are typically from smaller companies that don't meet the requirements to be listed on larger exchanges. Trading over-the-counter stocks can be riskier due to less stringent regulatory requirements, potentially lower liquidity, and less public information.
2. **XNYS (New York Stock Exchange)**: This is one of the largest stock exchanges in the world, known for stringent listing requirements. Companies here are usually well-established with a large market capitalization.
3. **XNAS (NASDAQ)**: The NASDAQ is known for technology and biotech companies and is recognized as a more tech-heavy exchange. Like the NYSE, it has robust listing requirements and features many large-cap stocks.
4. **XETR (Frankfurt Stock Exchange)**: Representing the 'XETR' code, the Frankfurt Stock Exchange is one of the world's largest trading centers for securities. German regulations and the economic environment will be more influential for companies listed here.
5. **XASE (NYSE American)**: This exchange, formerly known as the American Stock Exchange (AMEX), includes a range of small to mid-sized companies and offers options and ETFs. It is known for having more relaxed listing requirements than the NYSE and NASDAQ.

When considering the effect of a U.S. regulation like the CCPA, exchanges such as 'XNYS' and 'XNAS' might show a more direct impact since they are U.S.-based and the companies listed there are likely to have a significant number of California consumers. On the other hand, companies listed on 'XETR' might not be as directly affected by CCPA unless they have a large presence or consumer base in California.