

Assessment Task 2

[MAF900 - Advanced Data Methods](https://d2l.deakin.edu.au/d2l/home/1545525)

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Introduction

Topic: Market Reaction to workforce reductions: A comparative analysis of high vs low R&D intensity firms

Corporate layoffs are one of the most consequential decisions a management team could make. Often, it is presented as a necessary step to streamline processes and enhance shareholder value. The firm’s decision to reduce its workforce sends a powerful and often ambiguous signal to the stock market. Intuitively, reducing the workforce should send a positive signal to the market as it exhibits firms’ commitment to improve productivity, cost-cutting measures, and automation through AI in the modern context. Nevertheless, the reality is far more nuanced. The market reaction is not uniform, and it appears to depend critically on the nature of the firm itself. Therefore, this analysis will examine the key characteristic that shapes this investor response: a firm’s commitment to innovation as measured by its Research and Development intensity.

Research and development intensity is defined as the extent to which an organization devotes its resources, both financial and human, to research and development activities(Milkovich et al., 1991). This distinction is important as investors tend to view the nature of high and low R&D firms through different lenses; consequently, the way they interpret a layoff announcement of one category of these firms will differ from another category. For example, high R&D firms, such as tech or pharmaceutical company investors, will see their primary asset as their human capital. Such firms do not derive their value from factories, machinery, but from the collective knowledge, creativity, and collaborative research efforts. A layoff announcement from such a firm is detrimental and signals that the company is sacrificing its key resources, compromising its future ability to innovate. From this perspective, the market might penalize the stock of the firms because of the negative effect firm’s decision.

On the other hand, low research and development firms, like traditional manufacturers or retailers might not experience the same effect. When these companies announce layoffs, the market interprets the news not as loss of innovative potential but a deliberate effort to cut costs, improve profitability or process automation. In this context, the investors often reward the company stock, viewing the layoffs as a sign of financial discipline and growth.

The central research question of this study is “How does the stock market’s reaction to layoff announcements differ between firms with high and low R&D intensity?”. This RQ leads to two competing hypotheses as stated below.

**H0:** There is no significant difference in the stock market's reaction to layoff announcements between firms with high and low R&D intensity.

**H1A:** Firms with high R&D intensity experience a significantly *more negative* stock market reaction to layoff announcements compared to firms with low R&D intensity.

**H1B:** Firms with high R&D intensity experience a significantly *less negative* stock market reaction to layoff announcements compared to firms with low R&D intensity.

The table below showcases the theoretical lens of the hypothesis.

|  |  |  |
| --- | --- | --- |
| Theoretical Lens | Core Argument for H1A | Core Argument for H1B |
| Resource-Based / Human Capital View | The high R&D firms are penalized more severely is supported by the resource-based view. For high R&D firms, their value lies in the specialized knowledge, creative culture, etc. Thus, a decision to cut highly skilled talent sends a powerful message of deep financial distress, suggesting the company is desperate it must sacrifice its long-term innovation for short-term survival. | Layoffs can be an attempt to reallocate human resources away from unproductive projects, increasing the overall productivity and value of the remaining talent pool. It can signal to the market that management is proactively adapting to new technologies such as AI and automation and is making strategic decisions necessary to secure a competitive advantage. |
| Signaling Theory | Signaling theory assumes layoffs are a powerful negative signal of deep financial distress, forcing the firm to sacrifice future growth. In this narrative, the market penalizes the firm because the signal is one of crisis. | Conversely, a layoff can be a proactive signal of strategic agility, which indicates that management is pivoting away from legacy operations and reallocating resources towards more promising technologies. This acts as a positive signal to the investors. |

This study will add to our understanding of corporate layoffs and their repercussions. It’s evident that the way the stock market reacts to layoffs news is not always clear; therefore, this research suggests that a firm's R&D intensity is a key factor in understanding the reaction. Separation of firms into high and low R&D groups and assessing the stock market reaction to layoffs allows us to understand why investors view these announcements differently. Furthermore, this approach will help to resolve conflicting suggestions by the theories like the resource-based view and signaling theory. It will clarify when the market sees layoffs as a smart strategic shift or a signal of deeper problems.

Methodology

To investigate the research questions, this study employs event study methodology to identify the stock market reaction to corporate layoff announcements. A univariate analysis is conducted to compare the market reactions between firms with high and low R&D intensity.

**Data Sources & Sample Construction**

Research was conducted by drawing from three primary data sources: the Worker Adjustment and Retraining Notification (WARN) consolidated database, the Compustat database for firm financials, the Center for Research in security in Security Prices (CRSP) database for stock market data, and the WRDS event study for abnormal returns.

Figure 1- Data Sources, Source: Author-generated content

The database on the layoffs was obtained via the website layoffdata.com, which tracks layoffs and is cited by numerous researchers and news agencies(Arain, 2025). The federal WARN Act requires large employers to give advance notice of layoffs to state governments and workers. Even though states publish this information, no entity collects these layoff notices across states. Therefore, the utilized database collects standardized notices across the country into a single, comprehensive dataset and makes it freely available for researchers. The initial sample of layoff events spans the period from 2015 to December 2024. After the initial cleaning phase for temporary layoffs and company closures, the sample was left with permanent workforce reduction announcements.

A significant challenge in this process was linking the company names from the WARN database with the WRDS databases, as the records within the layoff database did not include a unique identifier. To overcome this, a systematic approach was implemented. First, details of all firms from Compustat were extracted for our sample period. Then, cleaned the company names in the Compustat and layoff databases by standardizing them (E.g., removing suffixes like” inc.” and “LLC”). Thereafter, the fuzzy string matching algorithm (Stringdist & fuzzyjoin) was employed to pair the companies from the layoff database with Compustat to obtain the gvkeys (UID). This technique intelligently compares the names from the layoff list to the official company names in Compustat and finds the most likely match. With this link established, the researcher managed to gather financial variables, most notably R&D expenditure and sales, which were used to calculate R&D intensity measures.

Next, using the CRSP//Compustat merged database, the researcher linked each firm's gvkey to its corresponding permanent number (permno) from the center from the CRSP (Center for Research in Security Prices (CRSP) database. A company’s life can be complicated, and over time it can undergo acquisitions, mergers, etc. These events can change the relationship between the company(gvkey) and its publicly traded stock(permno). The database that connects these two IDs tracks these changes with a start date and an end date for every link. The researcher took measures to ensure the layoff event falls between the official start and end date of the CRSP/Compustat merged database link.

Finally, WRDS U.S daily event study tool was used to obtain stock market abnormal returns by utilizing the cleaned dataset with permno ids. Market model was adopted to determine expected returns with specifications estimation window- 100 days, Minimum number of valid returns-70, Gap days- 50. Data were extracted for event windows [-1, +1], [-3, +3], [-5, +5], and [-10, +10] days to ensure a wide range of market reactions is captured. The output from this tool was a detailed dataset containing the daily abnormal returns for each firm surrounding its announcement date. To calculate the cumulative abnormal returns for each event window, a custom script was employed across the predefined event window files. The script summed the daily abnormal returns across the predefined windows ([-1, +1], [-3, +3], [-5, +5], and [-10, +10] days) to calculate the cumulative abnormal returns.

**Variable Construction**

Dependent Variable – Cumulative Abnormal Returns

CAR was calculated using a two-step process. First, daily abnormal returns were collected across 4 different event windows. Then, these daily returns were summed over the event windows to compute the CAR. Multiple event windows were employed to capture both immediate and long-term market reactions.

* CAR 1-day window- Market Reaction on the event day
* CAR 3-day window – Short-term reaction around the announcement
* CAR 5-day window – Medium-term market adjustment
* CAR 10-day Window – Extended Market response

Independent Variable – R&D Intensity Classification

R&D intensity was constructed by using annual financial data from the Compustat database. It is calculated by dividing the research and development expenses of a firm by its total sales for a given fiscal year. In particular, the financial data from the most recently completed fiscal year prior to the layoff announcement was taken into account.

* 1-year R&D intensity – Current year R&D intensity.
* 3-year R&D intensity – Three-year average R&D intensity.
* 5-Year R&D intensity – Five-year average R&D intensity.

Data Analysis & Results

**Descriptive Statistics**

This section provides a summary of the final sample used for the analysis.

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| --- | --- | --- | --- | --- |
| Table 1: Summary Statistics by R&D Classification | | | | |
| Classification | R&D Group | Layoff Announcements | Unique Firms | Total Workers |
| 1-Year R&D | | | | |
|  | High R&D | 773 | 442 | 84,978 |
|  | Low R&D | 776 | 335 | 93,711 |
| 3-Year R&D | | | | |
|  | High R&D | 772 | 439 | 84,332 |
|  | Low R&D | 777 | 339 | 94,357 |
| 5-Year R&D | | | | |
|  | High R&D | 772 | 438 | 84,426 |
|  | Low R&D | 777 | 333 | 94,263 |
| *Note: Data sourced from the final\_dataset\_cleaned data frame.* | | | |  |

Table 1 provides a detailed breakdown of the final sample segmented by R&D intensity measured over one, three, and five-year periods. The table reveals key characteristics of the final dataset. As detailed in Table 1, across all classification periods, the number of layoff announcements is almost perfectly split between R&D groups, which were split using the median of RD intensity scores. For example, if a particular firm's R&D intensity is above the median, those falls within the High R&D category, and the rest within the low R&D intensity. A key observation is that for 1-year classification, the high R&D group consists of 773 announcements from 442 unique firms, while the low R&D group has 776 announcements from only 335 unique firms. This observation is consistent across all other groups. This suggests that low R&D firms are likely to announce layoffs multiple times during the sample period ( an average of 2.3 announcements per firm) compared to high R&D groups( an average of approximately 1.75 announcements per firm).

The next key observation is related scale of layoffs. Across all the measurement windows, low R&D groups laid off a greater total number of workers than the high R&D group. For instance, in year 1 classification, the low R&D firms laid off around 280 employees on average (93771/335) compared to 192 employees (84978/442) of high R&D firms. In summary, the data pattern suggests that low R&D group firms announced layoffs frequently and on a larger scale than high R&D group firms.

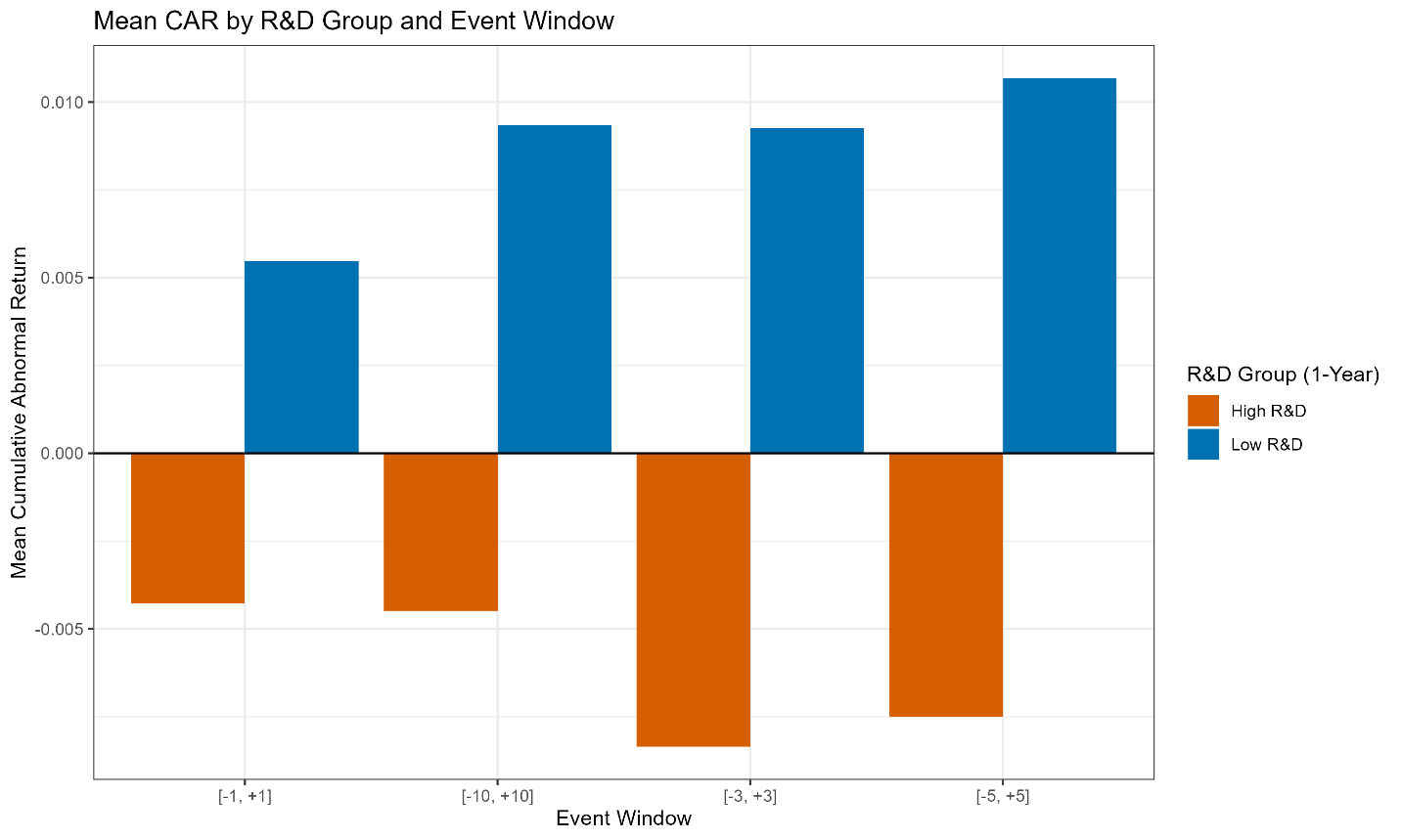


Figure 2- Mean CAR chart

Figure 2 clearly depicts the pattern of mean market reaction to layoff announcements, comparing the high and low R&D groups. The most important finding of this chart is the consistent, but opposing reaction between the high and low R&D intensive firms. For every window of CAR analyzed, the bar representing the high R&D group(orange) remains negative, while the bar for the low R&D group remains positive. This bar chart visually supports the idea that investors penalize innovative firms for layoffs while rewarding less R&D intensive firms.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 2: Summary Statistics for CARs by R&D Group | | | | | | | |
| CAR\_Window | RD\_Group | N | Mean | Mode | Std\_Dev | Min | Max |
| 1-Day CAR [-1, +1] | | | | | | | |
| 1-Day CAR [-1, +1] | High R&D | 755 | -0.0043 | 0.0186 | 0.1159 | -1.8085 | 0.8438 |
| 1-Day CAR [-1, +1] | Low R&D | 762 | 0.0055 | 0.0511 | 0.071 | -0.83 | 0.7509 |
| 3-Day CAR [-3, +3] | | | | | | | |
| 3-Day CAR [-3, +3] | High R&D | 757 | -0.0083 | -0.0236 | 0.1568 | -2.5578 | 0.6756 |
| 3-Day CAR [-3, +3] | Low R&D | 762 | 0.0093 | 0.0945 | 0.0942 | -0.7013 | 0.7127 |
| 5-Day CAR [-5, +5] | | | | | | | |
| 5-Day CAR [-5, +5] | High R&D | 758 | -0.0075 | -0.0447 | 0.1864 | -2.6114 | 0.8169 |
| 5-Day CAR [-5, +5] | Low R&D | 762 | 0.0107 | 0.0809 | 0.1099 | -0.6921 | 0.6081 |
| 10-Day CAR [-10, +10] | | | | | | | |
| 10-Day CAR [-10, +10] | High R&D | 758 | -0.0045 | -0.1003 | 0.2639 | -2.5651 | 2.9439 |
| 10-Day CAR [-10, +10] | Low R&D | 762 | 0.0093 | 0.0622 | 0.1957 | -1.9354 | 0.9538 |

The descriptive statistics table 2 also reveals a consistent divergence in the market reaction to layoff announcements based on the firm’s R&D intensity. It is observed that for the high R&D intensity firms, the mean cumulative abnormal returns is negative across all four event windows. The most significant impact is noticeable in the [\_3,+3] day window. In contrast, the low R&D firms exhibit consistent positive mean CARs, with the highest value reported at 1.07% in the [-5,+5] window. These opposing reactions suggest that investors penalize R&D intensive firms while rewarding low R&D firms for similar actions.

The table also presents a notable difference in the volatility of the market reaction. The standard deviation of CARs is consistently higher for the high R&D group across all event windows. For instance, in the [-3,+3] window, the standard deviation for the high R&D group is 66% larger than the lower R&D group(0.1568 vs 0.0942). This dispersion is also supported by the higher gap in min and max values for high R&D groups. The data patterns suggest that investors face a higher degree of uncertainty in the assessment of layoffs at innovative firms.

In summary, the statistics provide strong support for H1A. The negative market reaction for high R&D firms aligns with the resource-based view, where layoffs are perceived as destruction of valuable human capital, and signaling theory that suggests layoffs are negative signals of internal financial struggles.

**Univariate Analysis Results**

The results presented in table 3 detail the mean CAR breakdown for firms segmented by R&D classification.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 3: Mean CARs by R&D Classification and Event Window | | | | | |
| Classification | R&D Group | Mean CAR [-1, +1] | Mean CAR [-3, +3] | Mean CAR [-5, +5] | Mean CAR [-10, +10] |
| **1-Year R&D** | | | | | |
| 1-Year R&D | High R&D | -0.0043 | -0.0083 | -0.0075 | -0.0045 |
| 1-Year R&D | Low R&D | 0.0055 | 0.0093 | 0.0107 | 0.0093 |
| **3-Year R&D** | | | | | |
| 3-Year R&D | High R&D | -0.0043 | -0.0079 | -0.007 | -0.0034 |
| 3-Year R&D | Low R&D | 0.0055 | 0.0088 | 0.0101 | 0.0082 |
| **5-Year R&D** | | | | | |
| 5-Year R&D | High R&D | -0.0039 | -0.0076 | -0.0072 | -0.0034 |
| 5-Year R&D | Low R&D | 0.0051 | 0.0085 | 0.0103 | 0.0082 |

The primary finding is that all firms classified as high R&D consistently experience negative mean CARs across all four event windows, regardless of whether R&D intensity is calculated over 1 year, 3 years, or 5 years. On the other hand, the low R&D firms reflect consistent positive mean CARs across all observation windows. It is evident that investors, on average, penalize layoffs at R&D intensive firms while rewarding the low R&D firms for similar actions.

The stability and consistency of this finding across the different R&D classification periods is a key result. Furthermore, the magnitude of the mean CARs for both high and low R&D groups remains consistent across all R&D intensity measures. For example, the mean CAR for the [-5,5+] window is 1.07%,1.01% and 1.03% respectively. This observed robustness strongly suggests that the observed phenomenon is not a short-term fluctuation; instead, it is linked to the firm’s more stable, long-term commitment to R&D investment. This result provides a strong foundation for hypothesis testing to follow.

**Hypothesis testing outcomes**

The T-test results are presented in Table 4. It provides strong statistical support for the primary alternative hypothesis H1A – “Firms with high R&D intensity experience a significantly *more negative* stock market reaction to layoff announcements compared to firms with low R&D intensity” and allows for the rejection of the null hypothesis of no observed difference between low and high R&D firms. The analysis provides evidence that stock market’s reaction to layoff announcements differs between high and low R&D firms, and the difference is statistically significant.

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| --- | --- | --- | --- | --- | --- | --- |
| **Table 4: T-Test for Difference in Mean CARs by R&D Classification** | | | | | | |
| Classification | Event\_Window | Mean CAR (High R&D) | Mean CAR (Low R&D) | Difference | t-statistic | p-value |
| **1-Year R&D** | | | | | | |
| 1-Year R&D | [-1, +1] | -0.0043 | 0.0055 | -0.0097 | -1.9727 | 0.0487\* |
| 1-Year R&D | [-3, +3] | -0.0083 | 0.0093 | -0.0176 | -2.6506 | 0.0081\*\* |
| 1-Year R&D | [-5, +5] | -0.0075 | 0.0107 | -0.0182 | -2.3141 | 0.0208\* |
| 1-Year R&D | [-10, +10] | -0.0045 | 0.0093 | -0.0138 | -1.1596 | 0.2464 |
| **3-Year R&D** | | | | | | |
| 3-Year R&D | [-1, +1] | -0.0043 | 0.0055 | -0.0098 | -1.9902 | 0.0468\* |
| 3-Year R&D | [-3, +3] | -0.0079 | 0.0088 | -0.0168 | -2.5203 | 0.0119\* |
| 3-Year R&D | [-5, +5] | -0.007 | 0.0101 | -0.0171 | -2.1722 | 0.0300\* |
| 3-Year R&D | [-10, +10] | -0.0034 | 0.0082 | -0.0116 | -0.9696 | 0.3324 |
| **5-Year R&D** | | | | | | |
| 5-Year R&D | [-1, +1] | -0.0039 | 0.0051 | -0.0091 | -1.833 | 0.067 |
| 5-Year R&D | [-3, +3] | -0.0076 | 0.0085 | -0.0161 | -2.426 | 0.0154\* |
| 5-Year R&D | [-5, +5] | -0.0072 | 0.0103 | -0.0175 | -2.2309 | 0.0259\* |
| 5-Year R&D | [-10, +10] | -0.0034 | 0.0082 | -0.0116 | -0.9725 | 0.331 |
| *Note: Significance levels: \* p < 0.05, \*\* p < 0.01* | | | | | | |

The findings are consistent over multiple event windows. Focusing on the 1-year R&D classification, it's evident that the negative difference in mean CARs for high R&D firms is statistically significant for [-1, +1] (p < 0.05), [-3, +3] (p < 0.01), and [-5, +5] (p < 0.05) windows. The magnitude of this effect is well evident in the -3, +3 window, where the mean CAR for high R&D firms was 1.76 % lower than for low R&D firms, indicating the market significantly punishes the R&D intensive firms for cutting down staff.

Other alternative measures of R&D intensity are in line with the core findings. A similar pattern of statistically significant differences is observed for 3-year and 5-year classifications. This further confirms that core findings are highly robust. Moreover, the effect appears to be applicable only medium term as the pattern loses statistical significance in the longest window of -10,+10 across all classifications.

In conclusion, the hypothesis tests confirm that the stock market penalizes high R&D firms in R&D intensive firms for layoff announcements compared to less R&D intensive firms. This effect is mostly observed in the weeks immediately following the announcement and holds true across various measures of R&D intensity. Furthermore, the findings support the resource-based view where layoffs are considered to be a value-destroying activity for innovative firms. On the other hand, findings are also consistent with the signaling theory that states layoff as a powerful signal of negative private information, which suggests the company is under financial distress or facing other issues.

Conclusion

This study was conducted to determine how stock market reactions to layoffs announcements differ between firms with high and low R&D intensity. The results from the descriptive statistics, univariate analysis, and hypothesis testing provide clear and robust answers to the research question. The findings show a statistically significant and different market reaction for firms with high and low R&D intensities. Investors penalize R&D-intensive firms for announcing workforce reductions, resulting in negative abnormal returns. In contrast, firms with low R&D intensity experience positive abnormal returns for the same action. These findings are consistent across multiple event windows and R&D intensity measures.

The findings also support the resource-based view, where layoffs are perceived as a destructive act that affects innovative human capital, and signaling theory, where layoffs are interpreted as a response to financial distress experienced by R&D-intensive firms.

Several limitations of this study present opportunities for future research. Due to limited computing power, the researcher had to settle for less efficient fuzzy join parameters, which resulted in only a 14.06% match rate between the Compustat database and the layoff database. With more advanced computing resources, the researcher could have improved the fuzzy join algorithm by incorporating additional matching parameters. Also, Future research could employ multivariate regression to control for firm-specific variables and more precisely isolate the R&D effect. The sample is based on U.S. firms and publicly announced layoffs that meet WARN Act criteria; therefore, the findings may not be generalizable to small firms or to different international contexts.

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