Data:

1. Eikon Refinitiv Deal Scanner (formerly known as Thomson SDC):

- Merger and acquisition data for North American firms between 1980 and 2020 is retrieved from this database. The data is used to analyze M&A events and their impact on innovation and performance outcomes .

2. CRSP/Compustat Merged Dataset:

- Annual financial data from this dataset on North American firms is used to measure operational performance and financial constraints. The dataset provides information on firm-level financial variables such as sales, assets, R&D expenses, equity, return on assets, cash flows, investments, Tobin's Q, market to book ratio, tangibility, and leverage , .

3. Pre-constructed dataset by Kogan et al. (2017):

- This dataset provides data on the number of patents, patent value, and patent citations. It is extended to 2020 and includes information on U.S. patent applications and measures the value of the firm's patents by capturing the number of forward-citations of the patent. The dataset also offers a PERMNO identifier, which enables straightforward matching with the financial firm data from Compustat .

These data sources are essential for conducting the analysis and drawing conclusions regarding the impact of M&A events on innovation, operational performance, and financial constraints within the specified timeframe.

Financial Constraints:

The data for financial constraints is taken from the CRSP/Compustat Merged Dataset on North American firms. The paper uses several proxies to estimate a firm's financial constraints, including:

1. Cash flow sensitivity of investments (CFSI):

- This measure is computed using the equation proposed by Hovakimian and Hovakimian (2009). The CFSI measure captures the extent to which a firm's investment decisions are sensitive to its cash flow. A higher CFSI value indicates that a firm is more financially constrained .

2. Age and size index:

- This index is based on the work of Hadlock and Pierce (2010) and is constructed using the age and size of the firm. The index is a simple and effective measure of financial constraints and is found to be a better predictor of financial constraints than other composite measures such as the KZ index and the WW index .

3. Quintile-based ranking system:

- This system is used by Williamson and Yang (2021) and is based on the WW index, the HPSA index, and the firm's credit rating. The ranking system allows for equal weighting of multiple indices, resulting in a more robust proxy for financial constraints. The credit rating of firms is included since it is shown to reduce financial constraints .

The paper ranks the financial constraints by terciles to construct a proxy variable for financial constraints. The financial constraint variable is used as an independent variable in the regression analysis to assess the impact of financially constrained acquisitions on the operational performance of acquiring firms , , .

Hypothesis 1:

**Hypothesis 1 : Financially constrained firms that complete a takeover will experience a decrease in investments and cash flows in the three years following the acquisition.**

Dependent Variables: Operating Cashlfow & R&D expenditure

Control Variables for Hypothesis 1:

Leverage: Ratio of Debt to Equity

Total Assets: natural logarithim

R&D intensity: This variable measures the proportion of R&D expenditures relative to total sales or assets and is included to control for the baseline level of R&D investment intensity across firms.

Tobin’s Q.

Hypothesis 2:

**Hypothesis 2: Do financially constrained acquisitions impact innovation output overall, measured by the number and value of patent applications? Is there a specific positive effect in high-tech industries, suggesting a moderating role of technological intensity in the relationship between financial constraints and innovation outcomes?**

Dependent Variables for Hypothesis 2:

2. Market Value of Innovation: This measure captures the economic importance of a specific innovation. It is typically calculated by assessing the stock market returns in the days following a patent application and normalizing this by the number of patent applications per firm.

3. Citation-Weighted Innovation: This measure captures the technological value of innovation by considering the total forward citations divided by patent applications for a specific firm in a given year. Forward citations represent the total number of citations a patent receives after application, and this measure provides insight into the impact and influence of a firm's innovation within the broader technological landscape.

Control Variables for Hypothesis 2:

1. Leverage: This variable captures the level of debt financing relative to equity financing and is often used to control for the impact of a firm's capital structure on innovation output.

2. Market-to-Book Ratio: This ratio compares the market value of a company to its book value and is used to control for the market valuation of the firm.

3. Total Assets: The natural logarithm of total assets is frequently included as a control variable to account for the size of the firm, as larger firms may have different innovation output patterns compared to smaller firms.

4. Tobin's Q: This variable measures the relationship between the market value of a firm and the replacement cost of its assets and is used to control for the investment opportunities available to the firm.

5. Research and Development (R&D) Intensity: This variable captures the proportion of R&D expenditures relative to total assets or sales and is included to control for the baseline level of innovation investment intensity across firms.

Hypothesis 3:

Proposed Hypothesis 3:

**Hypothesis 3: The positive effect of financially constrained acquisitions on the operating performance, cash flows, and patent value of firms is stronger for firms in the tech industry compared to a representative industry comparison group.**

Possible representative comparison firms:

When comparing innovation, operating performance, and cash flows of financially constrained firms in the tech industry after mergers and acquisitions, it's beneficial to look at industries that share certain characteristics or dynamics with technology. Here are a few industries that you might consider for comparison:

1. \*\*Biotechnology and Pharmaceuticals:\*\*

- Similarities: Both industries are research-intensive and require significant investments in R&D.

- Differences: Biotech and pharmaceutical companies often face long development cycles and regulatory challenges.

2. \*\*Telecommunications:\*\*

- Similarities: Both industries may require substantial capital expenditures for infrastructure and technology upgrades.

- Differences: Telecom companies often have more regulated business models and face unique challenges in terms of spectrum acquisition and network expansion.

3. \*\*Semiconductor Manufacturing:\*\*

- Similarities: Like tech firms, semiconductor companies invest heavily in research and development for new technologies.

- Differences: Semiconductor companies may have a more capital-intensive production process and may be subject to cyclical demand.

4. \*\*Healthcare Technology:\*\*

- Similarities: Both industries are becoming increasingly technology-driven with the adoption of digital health solutions.

- Differences: Healthcare tech may face specific regulatory challenges and longer sales cycles due to the complexity of the healthcare ecosystem.

5. \*\*E-commerce and Retail Tech:\*\*

- Similarities: Both industries rely on technological advancements for operations and customer engagement.

- Differences: E-commerce and retail may have different business models and supply chain dynamics.

6. \*\*Clean Energy and Renewable Resources:\*\*

- Similarities: Both tech and clean energy sectors require innovation and substantial capital for research and development.

- Differences: Clean energy companies may be more influenced by government policies and global commodity prices.

7. \*\*Aerospace and Defense:\*\*

- Similarities: Both industries may involve cutting-edge technology development and long-term project timelines.

- Differences: Aerospace and defense firms often have government contracts, which can impact their business dynamics.

Dependent Variables:

1. Return on Assets: This is a measure of a company's profitability in relation to its total assets. It indicates how efficiently the company is using its assets to generate earnings. (Helps to capture Operating Performance)

2. Operating Cash Flows: This represents the cash generated from a company's normal business operations. It provides insight into the company's ability to generate cash through its core operations.

3.Patent Value.

Control Variables:

Leverage

Market-to-book ratio

Total assets

Tobin’s Q

R&D intensity.

Maybe also current ratio.

Equations used in the paper:

Hypothesis 1: Financially constrained firms that complete a takeover will experience an increase in investments and cash flows in the three years following the acquisition.

Regression equation: γit = α + β1 After \* Treated \* FC + β2 After \* Treated + β3 After \* FC + β5 After + β6 Treated + β7 FC + β8 Control + μit

Hypothesis 2: Financially constrained firms that complete a takeover will experience an increase in innovation activities in the three years following the acquisition.

Regression equation: γit = α + β1 After \* Treated \* FC + β2 After \* Treated + β3 After \* FC + β5 After + β6 Treated + β7 FC + β8 Control + μit

Hypothesis 3: Financially constrained firms that complete a takeover will experience an improvement in operating performance in the three years following the acquisition.

Regression equation: γit = α + β1 After \* Treated \* FC + β2 After \* Treated + β3 After \* FC + β5 After + β6 Treated + β7 FC + β8 Control + μit

In each of these regression equations, γit represents the dependent variable for firm i in year t, which can be either a measure of investments, innovation activities, or operating performance. After is a dummy variable that takes a value of 0 for all firms before an acquisition is announced and a value of 1 for all firms 1-year post-announcement. Successful is a dummy variable that takes a value of 1 if a firm belongs to the treated group that completes an acquisition and 0 otherwise. FC is the third indicator that takes a value of 1 if a firm is considered financially constrained. Control denotes a set of control variables that are used to reduce omitted variable bias. The interaction terms capture the average treatment effect of successful acquisitions and the average treatment effect of successful acquisitions when either the target or acquirer is financially constrained.