Supply Chain Risk: Changes in Supplier Composition and Vertical Integration

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Overall

- Use what management says about supply chains during conference calls to measure both supply chains and risk.

- My opinion: A very good start on an important topic

Structure

1. Supply chains are complex
2. Organizing theory and exogeneity?
3. Supply chains and talk
4. Notions of risk
5. Comparison firms?
6. Firm actions

1. Supply chains are complex

- "large companies have thousands of suppliers" (page 9)

- This ought to be taken more seriously
- The level of complexity in real-world supply chains is far beyond what most finance academics realize

EXAMPLE 1: TESLA SUPPLIERS

- Model 3 is said to have about 10,000 distinct parts.
- Seem to be at least 100 suppliers
  - **Key suppliers**: 1) BHP: nickel, 2) Ganfeng Lithium Co.: lithium, 3) Glencore: cobalt, 4) Modine Manufacturing Co.: battery chiller, 5) Rohm And Haas Company: specialty materials
  - **Alleged suppliers**: ABC Group, ADAC, Affinia Group Intermediate Holdings Inc., Angell-Demmel, Argent, Burlington Northern Sante Fe Corp., Clarcor, Inc., Cooper Industries, Ltd., Dana Corporation, Danaher Corp., Delphi Corporation, Emerson Electric, Flowserve Corp., Garmin Ltd., Gentex, Harada, Harman International Industries Inc., Hitachi Cable America, Hope Global, Lightwave Logic, Inc., Lithium Exploration Group, Inc., MacLean-Fogg, Magna International, Metaldyne Performance Group Inc., Methode Electronics, Molex Inc., Multimatic, NextEra Energy, Inc., Niocorp Developments, Ltd., Nortek, Inc., Nucor Corporation, Panasonic, Plastomer, PSM International, Rare Element Resources, Ltd., Riviera, Searchlight Minerals Corp., T1 Automotive, TXU Corp., Universal Logistics Holdings, Inc., U.S. Lithium Exploration Group, Inc., Zanini Auto Group
  - **Rumored suppliers**: a list of about 50 firms.
  - Source: https://www.investopedia.com/ask/answers/052815/who-are-teslas-tsla-main-suppliers.asp

MORE EXAMPLES

- Microsoft works with more than 58,000 different suppliers.
  - Source: https://www.microsoft.com/insidetrack/blog/transforming-how-microsoft-connects-with-its-58000-suppliers/

- "The fast-moving consumer goods company Proctor and Gamble states that it has over 75,000 suppliers. Retailing giant Walmart counts over 100,000 suppliers. French oil company Total buys from over 150,000."
  - Source: https://www.forbes.com/sites/jwebb/2018/02/28/how-many-suppliers-do-businesses-have-how-many-should-they-have/?sh=77016ec9bb72

Complements or Substitutes?

- "since inputs are highly complementary in most production processes, …" (pages 9 and 10)
- Is this claim generally true? Not obvious.

- Tesla has supply agreements with four major lithium suppliers
  - 2 in USA and 2 in China. More are being added gradually.
  - Also get lithium indirectly through other parts suppliers

- "One buyer for a major retailer spoke to me of having over 1,000 suppliers for a single lasagne line."
  - Source: https://www.forbes.com/sites/jwebb/2018/02/28/how-many-suppliers-do-businesses-have-how-many-should-they-have/?sh=77016ec9bb72

HOW MANY SUPPLIERS?
EVEN TOP MANAGERS MAY NOT KNOW

- "Most [firms] simply do not know the number of their suppliers. Dozens of deals are made daily across the enterprise in various geographies and business units. Rarely are these deals documented beyond basic contractual terms. Over a course of a week, a business can buy from hundreds of new suppliers and not have the slightest idea as to details beyond corporate names."

    - Source: https://www.forbes.com/sites/jwebb/2018/02/28/how-many-suppliers-do-businesses-have-how-many-should-they-have/?sh=77016ec9bb72

OBSERVATION

- In the paper the **mean number of suppliers is 8.2** with reported P25 of 1, and P75 of 10. (Table 1)

- In real world supply chains it is common to have well over 10,000

- The distance from 8.2 to 10,000 is a big gap.
  - Are there really any firms with fewer than 10 suppliers?
  - How do the reported number of suppliers relate to the actual number? Is this a source of bias?

IS THE GAP IMPORTANT? 1

- A large number of lasagne suppliers presumable implies risk mitigation for any one supplier disruption (firm-specific risks)

- Focusing on the small number of suppliers make the system seem risker than it might really be

- Does not hedge aggregate shocks like say COVID

IS THE GAP IMPORTANT? 2

- The paper measures suppliers that are in managerial discussions
- What causes a supplier to be discussed?
  - We are not told
  - Certainly, not a random sample of the suppliers

- A potentially important source of bias
  - How does this kind of endogeneity affect the meaning of the results?
  - This needs to be taken seriously
    - Borrow from the missing data literature (Little and Rubin, 2019): Missing Completely at Random (MCAR), Missing at Random (MAR), Missing Not at Random (MNAR)
    - Borrow from a series of papers by Gentzkow and Shapiro on the news industry, what gets reported, and how that affects equilibrium

Observed part versus unobserved?

- What is the connection between the huge number of unobserved supplier relations and the part being studied?

  - Independent noise?

  - Correlated in some manner?

  - Trade secrets?

- How similar are these things across firms or about the same size, in the same industry?

NORMAL INSTABILITY?

- There is a normal amount of volatility from one year to another
  - Much like job separations and unemployment
  - From one year to another the number and identity of suppliers will fluctuate
  - How much supplier fluctuation is normally observed?
  - What does that depend on? (firm, industry, aggregate factors)

- Can we distinguish "normal risk" and "abnormal risk" levels of managerial concern about supply chains?
  - Some firms "always" talk about supply chains, but others "just a little".
  - How do these firms differ from each other? From industry peers?
  - How does that affect the measure of risk?

2. An Organizing Theory?

- The paper does not use a consistent theory to organize the evidence.

- What is exogenous? What is endogenous? Not clear.
  - How are supply relations established? How are they ended? How do the answers to these questions affect the interpretation of the evidence?

- Possible source of an organizing intellectual framework.
  - Firms also hire labor. We have a rich literature on labor search and matching.
  - How different is the firms use of suppliers from the firm's use of labor?
  - Turnover, bargaining, etc
  - Can we adopt such a model? If not, what is fundamentally different?

3. SUPPLY CHAINS AND TALK

- This paper does not measure supply chains directly.

- It measures what managers say. This has both plusses and minuses.

- How does managerial talk connect to the actual supply chains?
  - Not identical
  - Not a random sample of what is happening
  - The authors ought to think about this sampling process and it's implications

- Talk about things that are "material". Do not talk about things that are trade secrets. Talk about things you believe your audience will be interested in.
  - **If things are going badly find credible sounding excuses.**
  - **If things are going well take credit for the great results.**
  - **If you plan to do something that may be controversial, say things to get people ready**

4. NOTIONS OF RISK

- We have a rich literature on defining and measuring risk.

- How does this verbal definition connect to the established risk notions?
  - Many definitions: https://en.wikipedia.org/wiki/Risk
  - Aggregate, idiosynchratic, volatility, sensitivity to a pricing kernel, financial, operational disruptions, etc.
  - Is there anything predictive? Or, is it mainly just about making excuses for poor performance?

- The paper does not even connect their measure to say a CAPM beta.

- The connection between their measure of risk and the usual definitions is unclear

5. COMPARISON FIRMS?

- The paper is murky about the precise comparisons
- Please match firms by say: industry, size, and profits. Then look at how firms with "riskier supply" perform relative to a well-defined comparison set
  - How stable are the risk measures across time? Across market conditions?
  - The use of fixed effects is not a satisfactory substitute
  - These are not just "intercept issues"
- Causality concern
  - Japan earthquake, Thailand floods (2007 to 2010 treated) may affect firms with suppliers in those places.
  - Generalizable?
  - Most Tables provied descriptive statistics

6. Firm actions

- Evidence that in the year following an "increased supply chain risk" firms do more M&A with suppliers and customers

- Is this causal? Or is it managers letting the markets know about decisions that they have taken for other reasons?

- **Need to think seriously about the incentives of managers to say some things, but not others. Affects interpretations.**

CONCLUSION

- Good start on an interesting topic

- Greater acknowledgment of the complexity might alter perspective
  - More concept validation would help
  - What makes managers talk about some things and not others?
  - How do the observed supply links relate to the massively larger population of supply links for a firm? Biases created? How should we control for them?