



APARC

Milestones to University-Based Startup Success: What Is the Impact of Academic Inventor Involvement?”

Kanetaka M. Maki, Ph.D.

Stanford University

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Joint Work with Vish Krishnan (UC San Diego) and Martin Kenney (UC Davis)

Supported by University of California Office of President

My Background: Kanetaka Maki



Stanford | **APARC** Walter H. Shorenstein
Asia-Pacific
Research Center







SFC Incubation
Village



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National Institute of Science and Technology Policy

UC San Diego

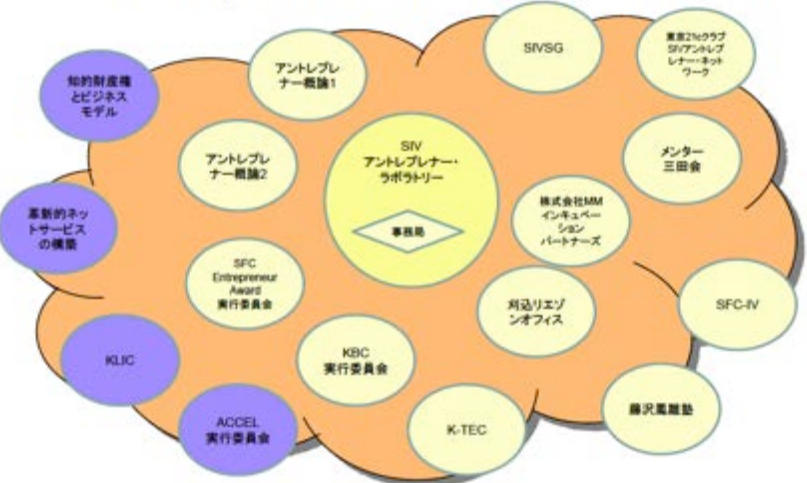


Rady | UC San Diego
School of Management

日本創生ビレッジ
Entrepreneur Group for Growing JAPAN
IGG JAPAN
東京21cクラブ
インキュベーションオフィス

First Career: Founding Chief Officer of SFC Incubation Village at Keio University

SIV Entrepreneurial Ecosystem: Jan. 2008



経済産業省
平成18年度大学発ベンチャーに関する基礎調査報告書の概要

平成19年9月3日
経済産業省
産業技術環境局
大学連携推進課

(1) 大学による支援

- 大学の知財資産を活用し、社会に貢献するという意味で、大学によって大学発ベンチャーを支援することは重要な役割の一つである。具体的にはアントレプレナーシップ教育の実施による人材育成、学部(専攻)による最先端の知財の創出によるシーズの創出、大学内外の組織を活用したインキュベーション環境の提供等がある。
- 研究開発段階にある大学発ベンチャーが、大学において関与することは、「公費」「専任支援(研究開発費・出費)」、「人材供給(研究開発人材)」等が挙げられている。

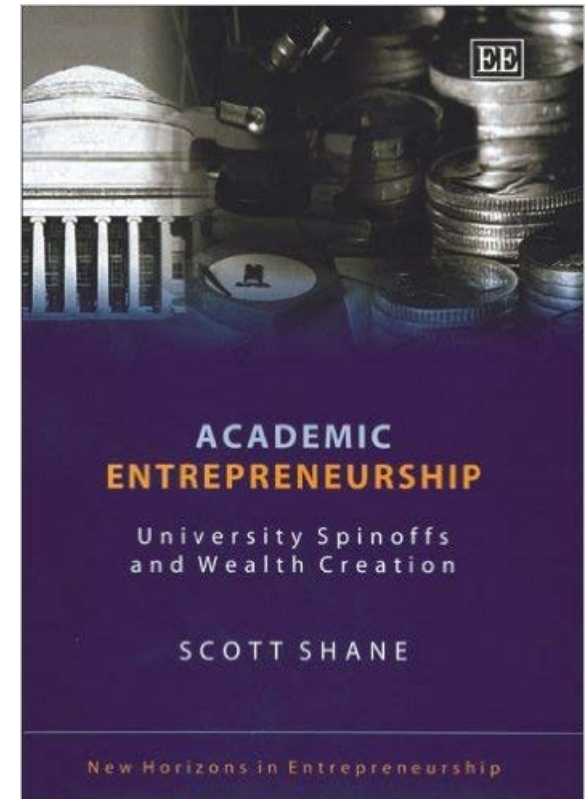




University-based Startups

University Startups:

- are high performing companies.
- enhance the commercialization of technologies that would otherwise go underdeveloped.



Shane (2004)

Google

CISCO



Larry Page



Sergey Brin



Sandy Lerner



Leonard Bosack

Does inventor involvement assists or distracts the success of startup?

For university-based startups, one of the most controversial question has been the importance of inventor involvement as a founding team.



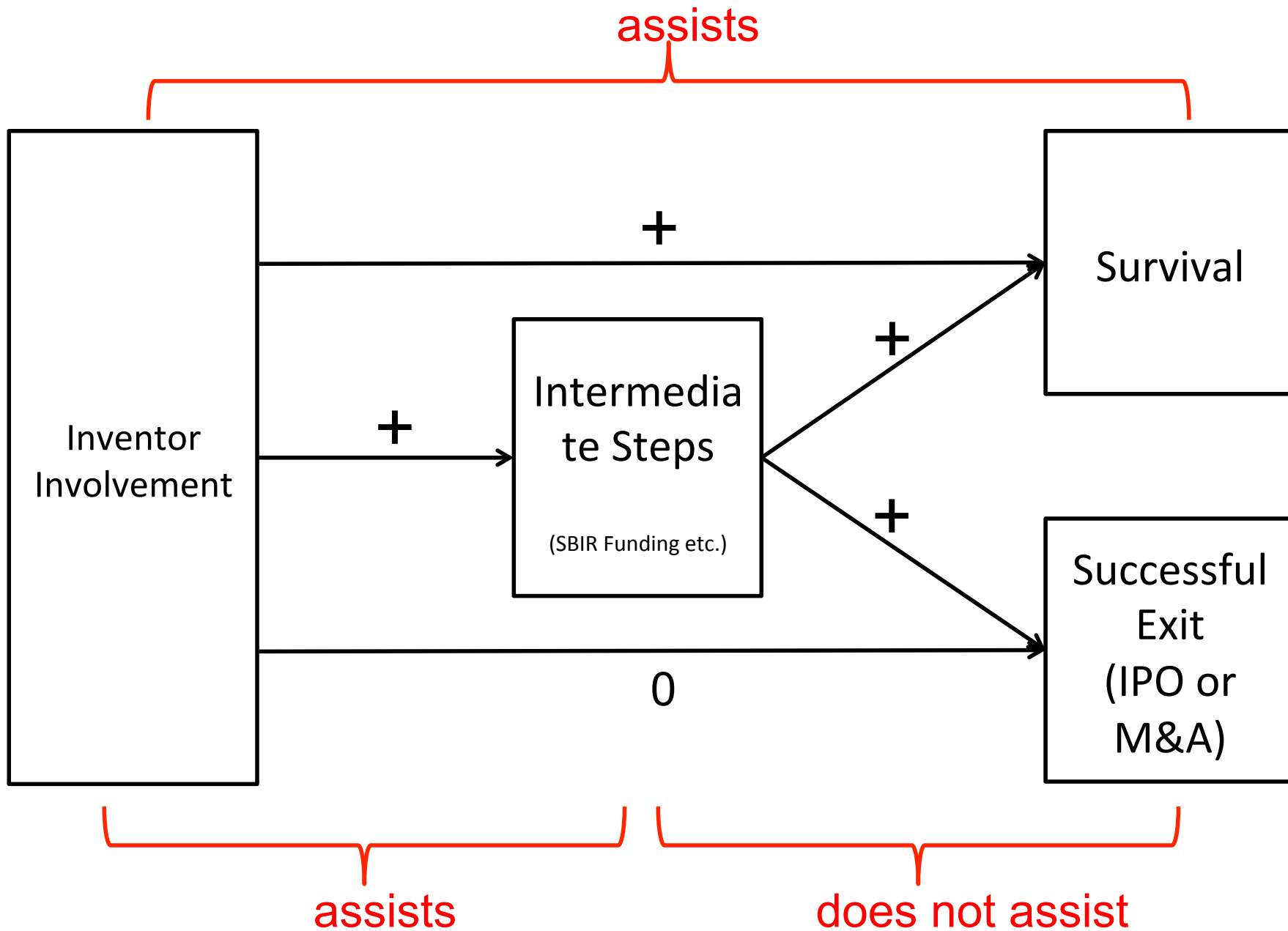
“Inventor involvement increases the knowledge transfer.”



“Damn academics! Their involvement retards the success.”

I aim to reconcile two contradicting views of inventor involvement by analyzing the intermediate steps.

The Findings



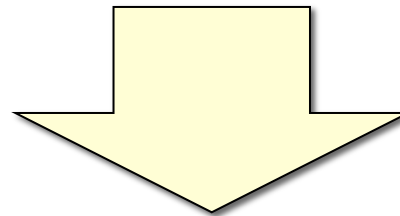
Previous Research

1. Small sample sizes
2. No comprehensive datasets
(few variables)
3. “Success” bias



Case study approach

(Ruef et al. 2003, Shane 2004, Rothaermel et al. 2007)



University of California Startup Dataset, which includes the entire population of startups based upon on University of California licensed technology (patent) after 2000.

1. Research Hypothesis

2. Dataset

3. Analysis of Survival Rate

4. Analysis of Successful Exit

5. Disentangling the Underlying Mechanism

6. Conclusion

1. Research Hypothesis

2. Dataset

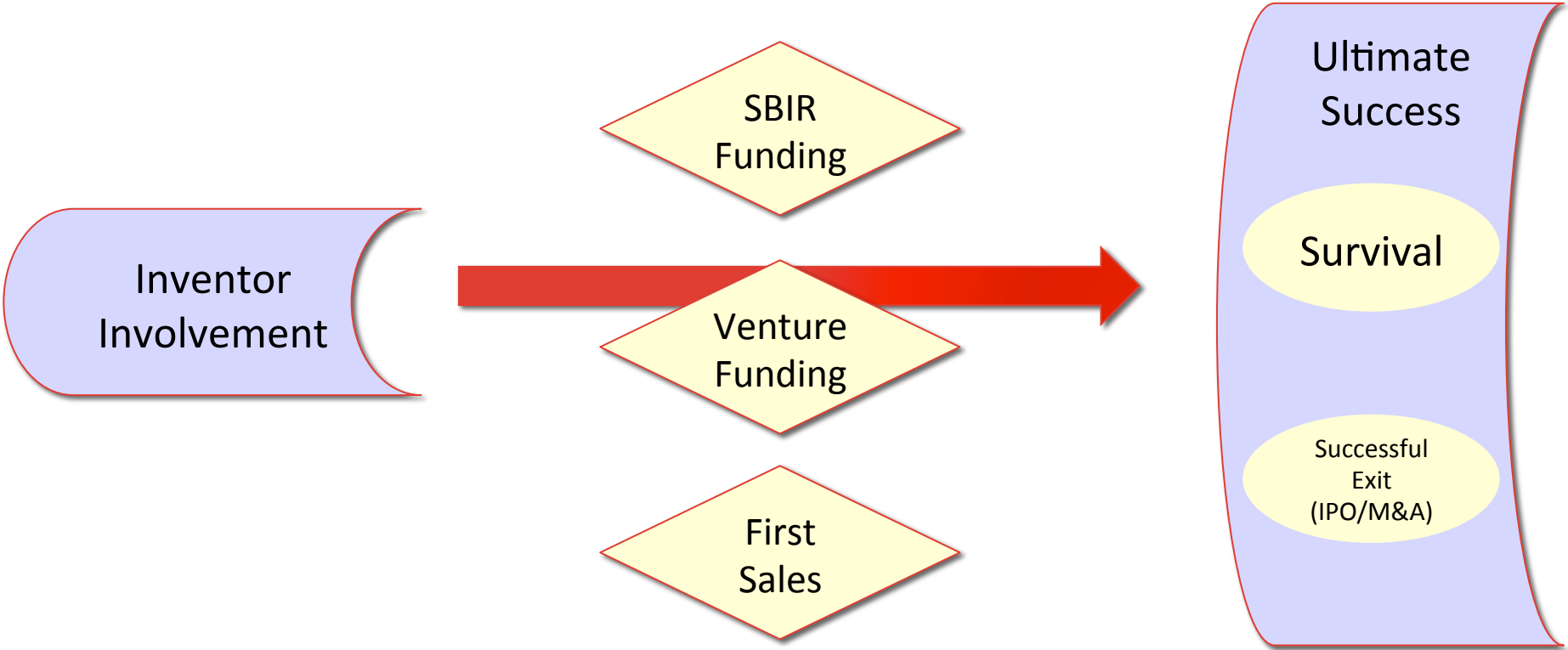
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Intermediate Steps / Ultimate Success



(Ndonzuau et al. 2002, Clarysse and Moray 2004, Druilhe and Garnsey 2004, Vohora et al. 2004)



- The Small Business Innovation Research (SBIR) program is a highly competitive program that **encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D)** that has the potential for commercialization.
- Each year, Federal agencies with extramural research and development (R&D) budgets that exceed \$100 million are **required to allocate 2.8 percent of their R&D budget** to these programs.

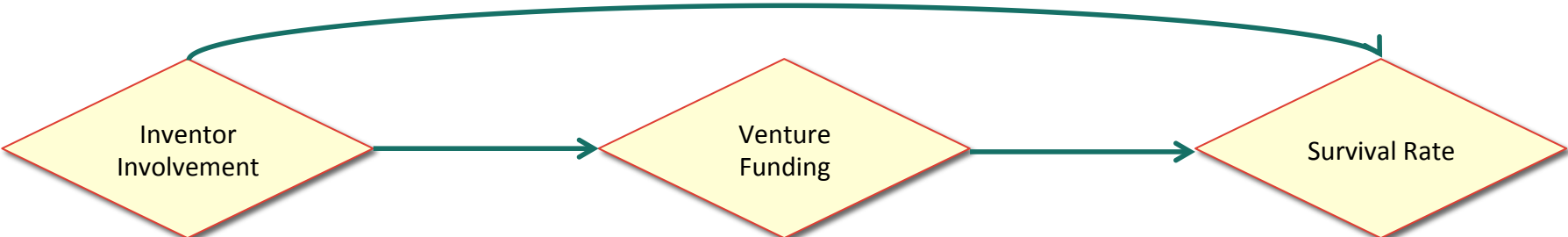


Hypothesis 1

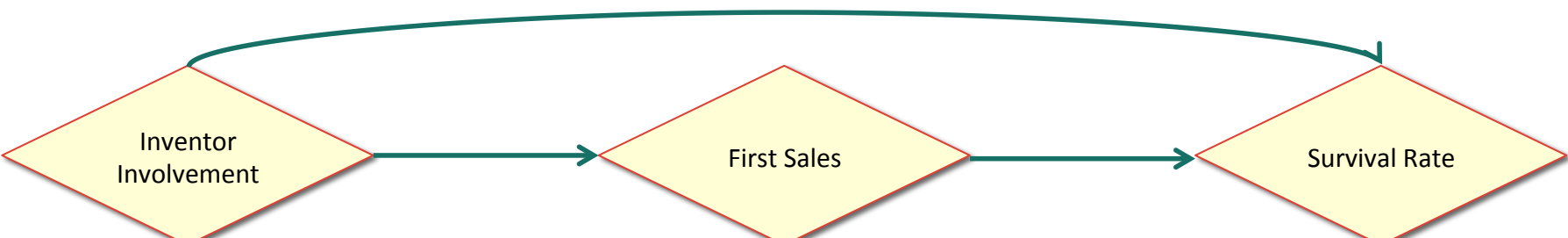
1a



1b



1c



Hypothesis 1

(H1a) The receiving of an SBIR grant mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's survival.

(H1b) The receiving of venture funding mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's survival.

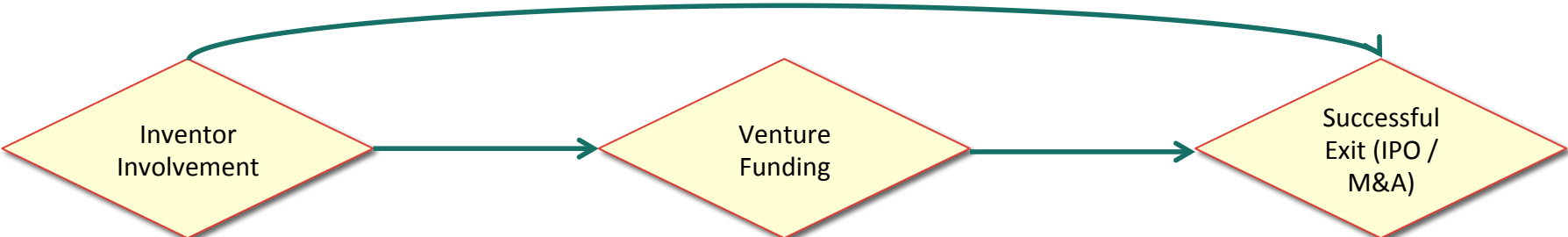
(H1c) The product launch mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's survival.

Hypothesis 2

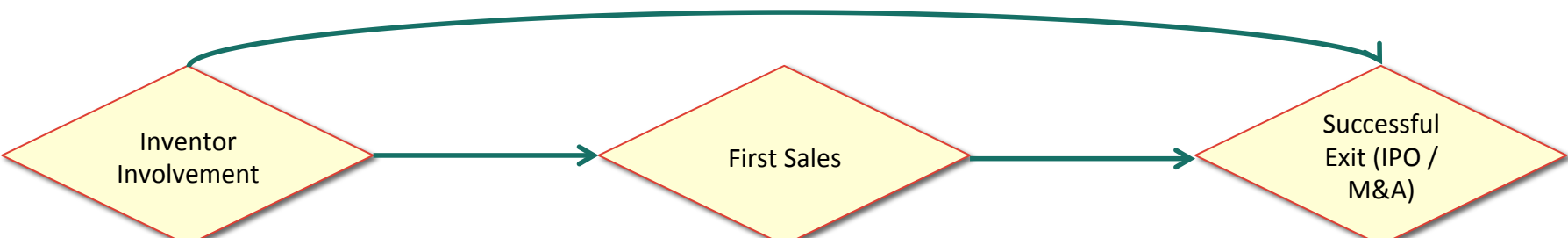
2a



2b



2c



Hypothesis 2

(H2a) The receiving of an SBIR grant mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's successful exit (IPO or M&A).

(H2b) The receiving of venture funding mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's successful exit (IPO or M&A).

(H2c) The product launch mediates the impact of inventor involvement as a startup founder increases the likelihood of a firm's successful exit (IPO or M&A).

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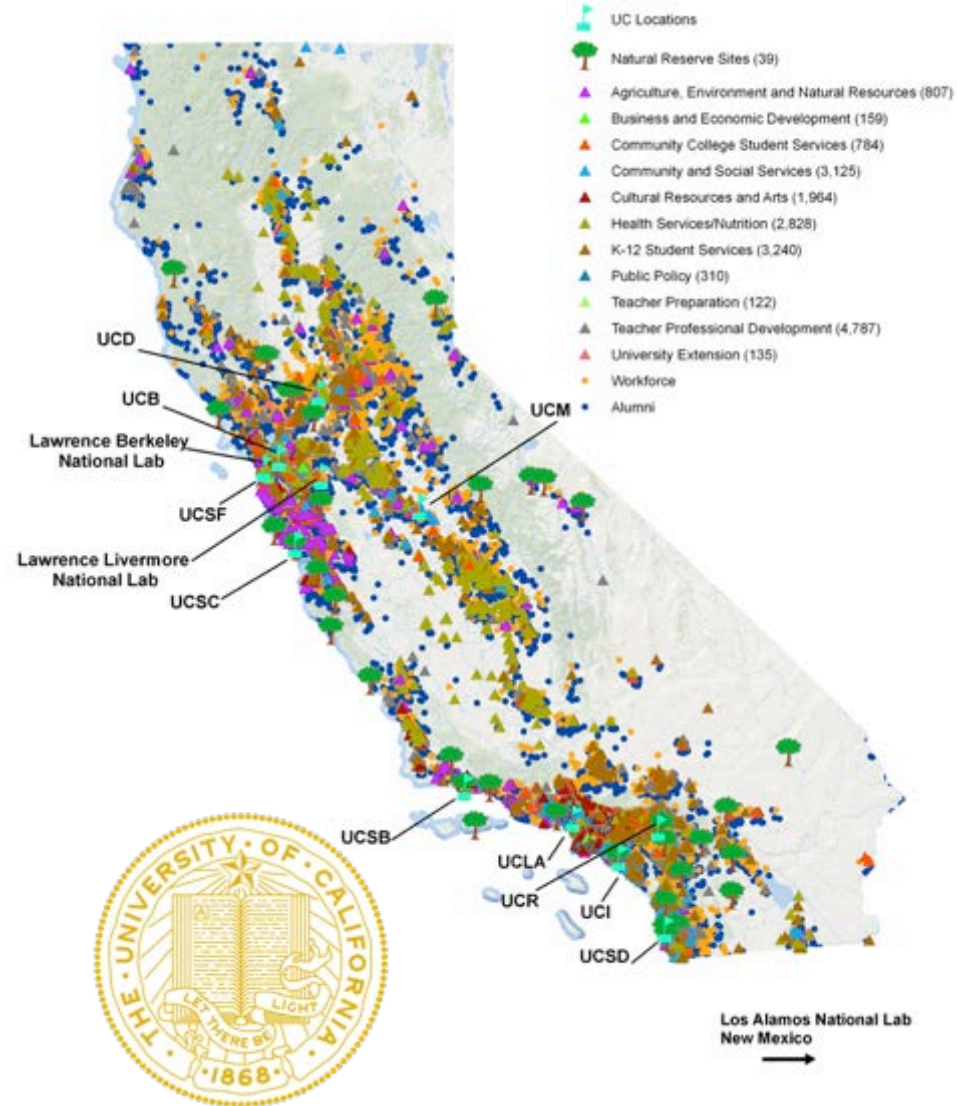
6. Conclusion

The University of California System

- 10 campuses
- 5 medical centers
- 3 national laboratories
- 150 academic disciplines
- 600 graduate degree programs

- Six of the campuses are listed among top 50 universities in the world.

Established	1868
Type	Public university system
Endowment	\$11.227 billion (2013)
Budget	\$22.7 billion (2011)
Academic staff	18,896 (Fall 2011)
Admin. staff	189,116 (Fall 2011)
Students	236,691 (Fall 2012)
Undergraduates	184,562 (Fall 2012)
Postgraduates	52,129 (Fall 2012)



Global Top 50 Universities

UC System (6)

- 4: UC Berkley
- 12: UC Los Angeles
- 14: UC San Diego
- 18: UC San Francisco
- 41: UC Santa Barbara
- 47: UC Irvine
- 55: UC Davis
- 93: UC Santa Cruz
- 101-150: UC Riverside
- 500: UC Merced

California (8)

Japan (2)

Shanghai Jiaotong University AWRU 2014
<http://www.shanghairanking.com/ARWU2014.html>

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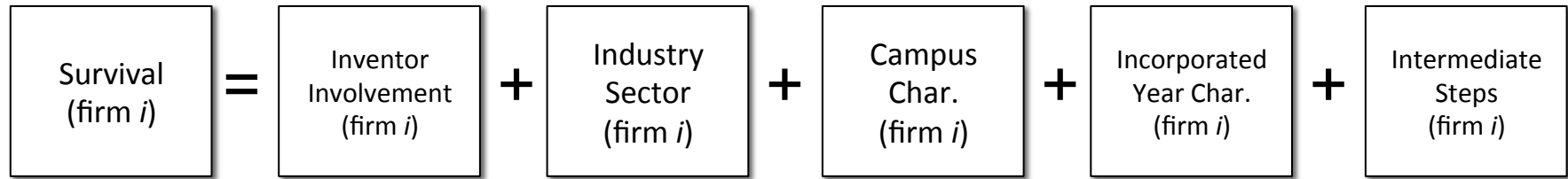
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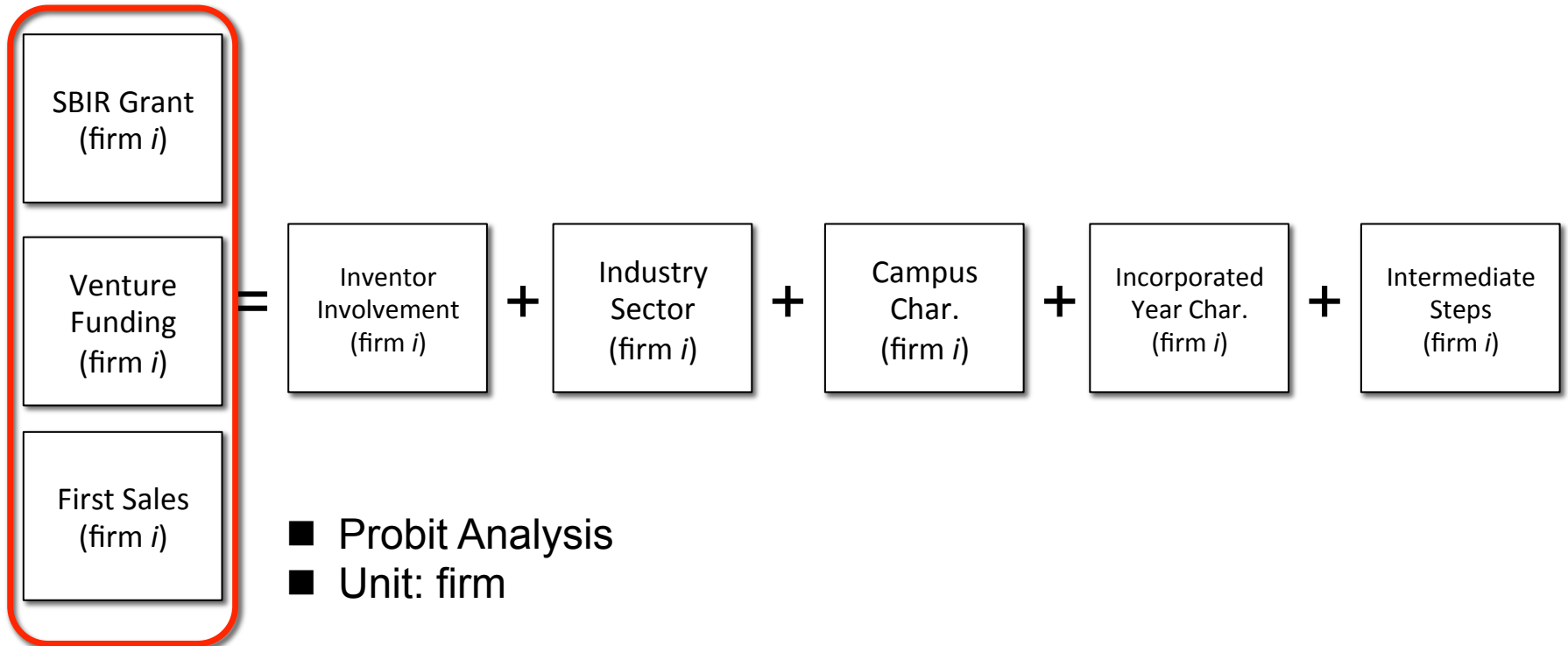
Analysis of Survival Rate



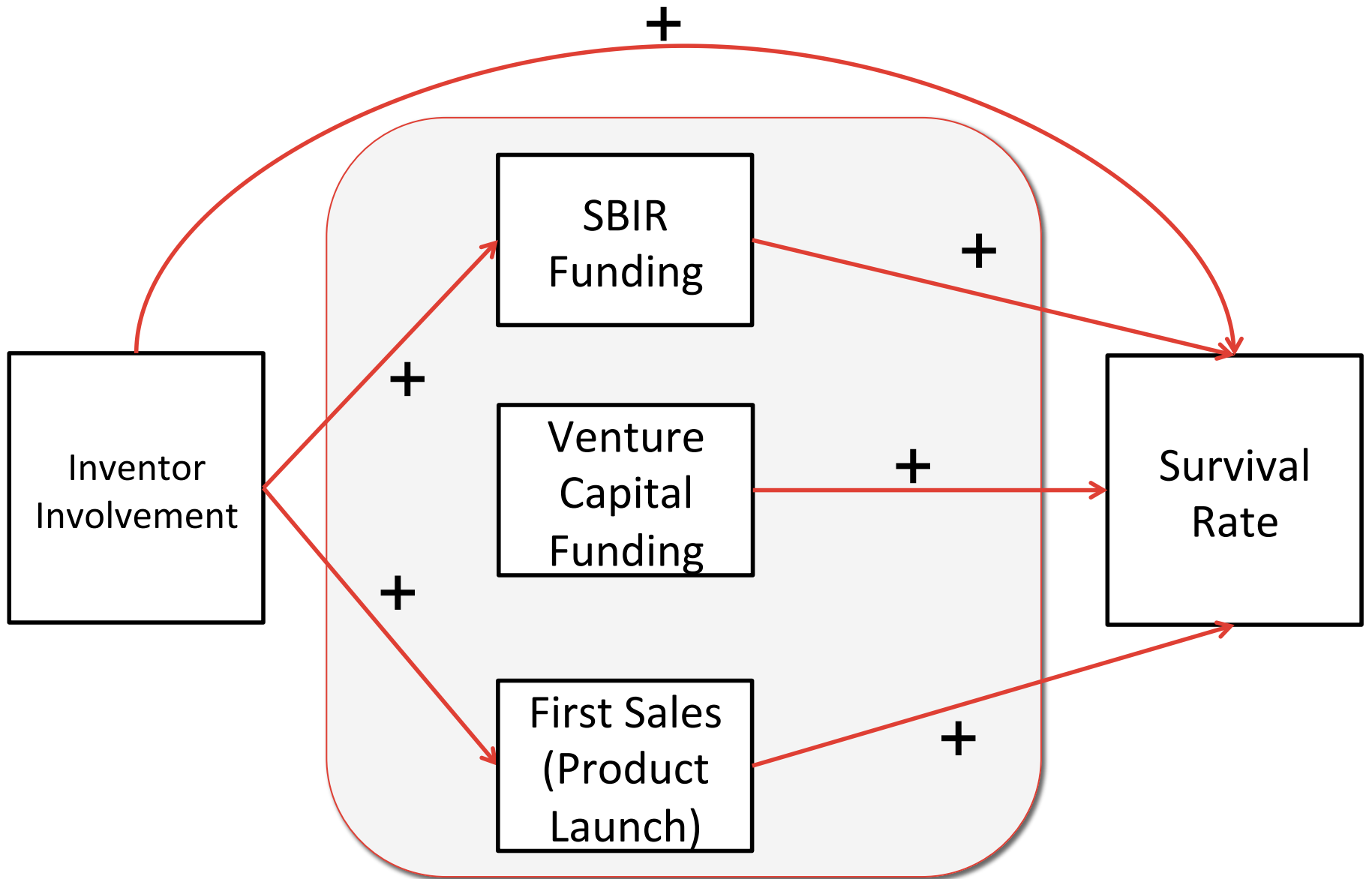
$$\text{Inventor Involvement (Proportion)} = \frac{\text{Total Number of Inventors Became Founders}}{\text{Total Number of Inventors}}$$

- Probit Analysis
- Unit: firm
- Survival: dummy variable (survive=1; bankruptcy=0)
- Inventor Involvement: proportion of inventors became founders
- Industry Sector: dummy variables for IT, biomedical, and other sectors
- Campus Characteristics: dummy variables for individual campuses
- Incorporated Year Characteristics: dummy variables for incorporated year
- Intermediate Steps: dummy variables for SBIR, venture funding, and first sales

Intermediate Variables



- Probit Analysis
- Unit: firm
- SBIR Grant: dummy variable (received=1; not received=0)
- Venture Funding Grant: dummy variable (received=1; not received=0)
- First Sales: dummy variable (received=1; not received=0)



1. Research Hypothesis

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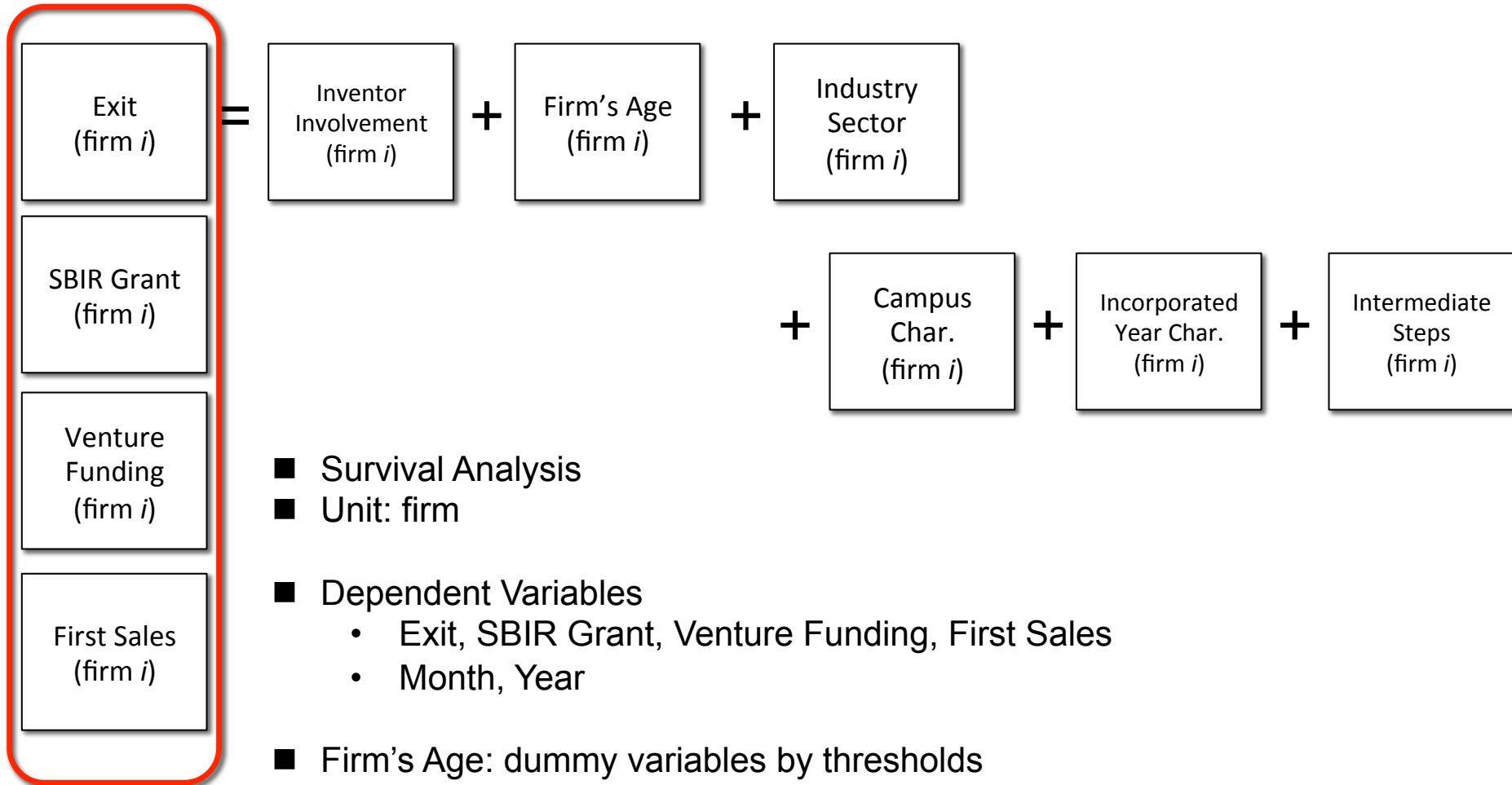
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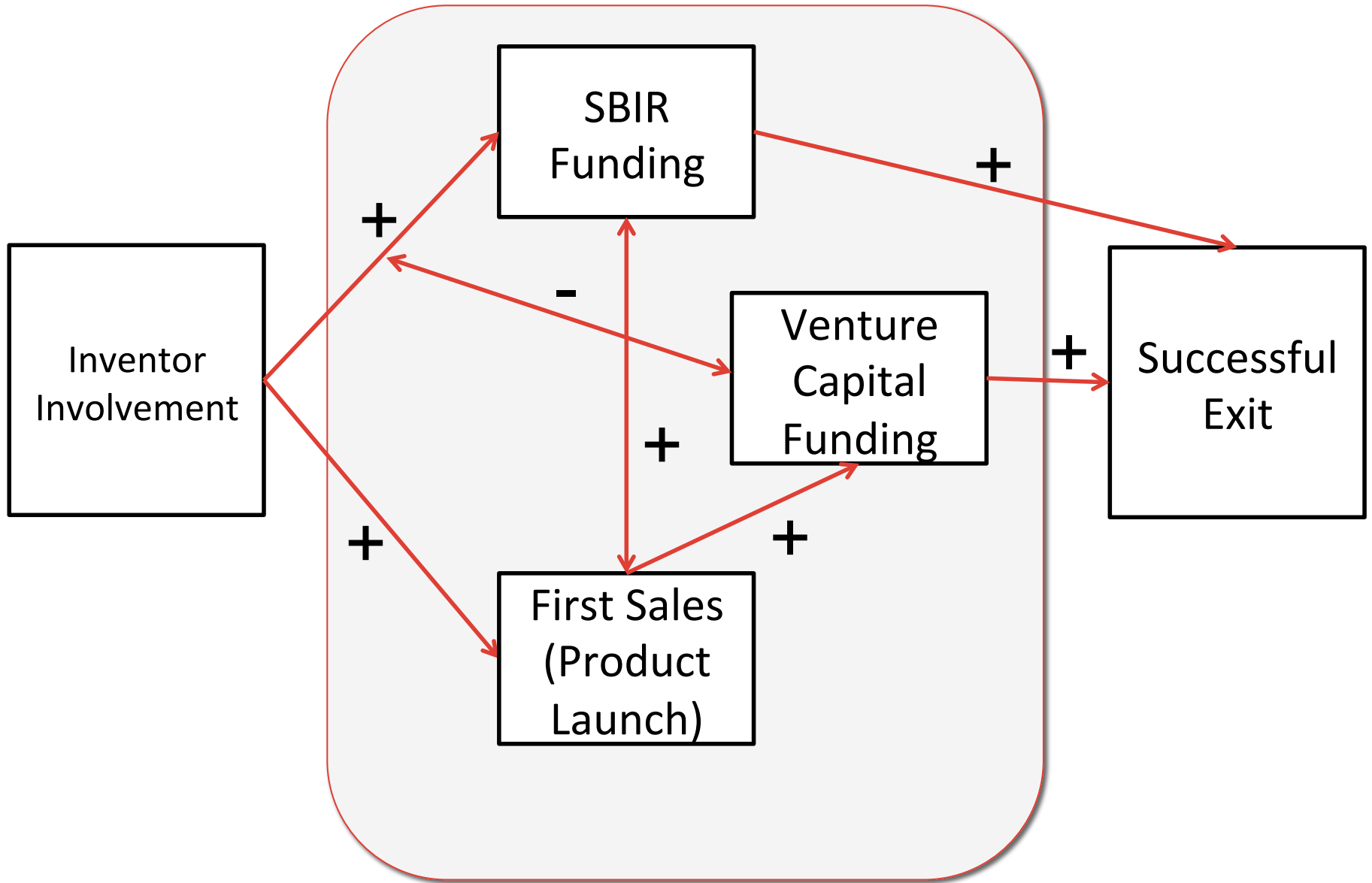
5. Disentangling the Underlying Mechanism

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Analysis of Successful Exit



- Survival Analysis
- Unit: firm
- Dependent Variables
 - Exit, SBIR Grant, Venture Funding, First Sales
 - Month, Year
- Firm's Age: dummy variables by thresholds
 - Exit: 4 and 7 years
 - SBIR funding, venture funding, and first sales: 2 and 3 years



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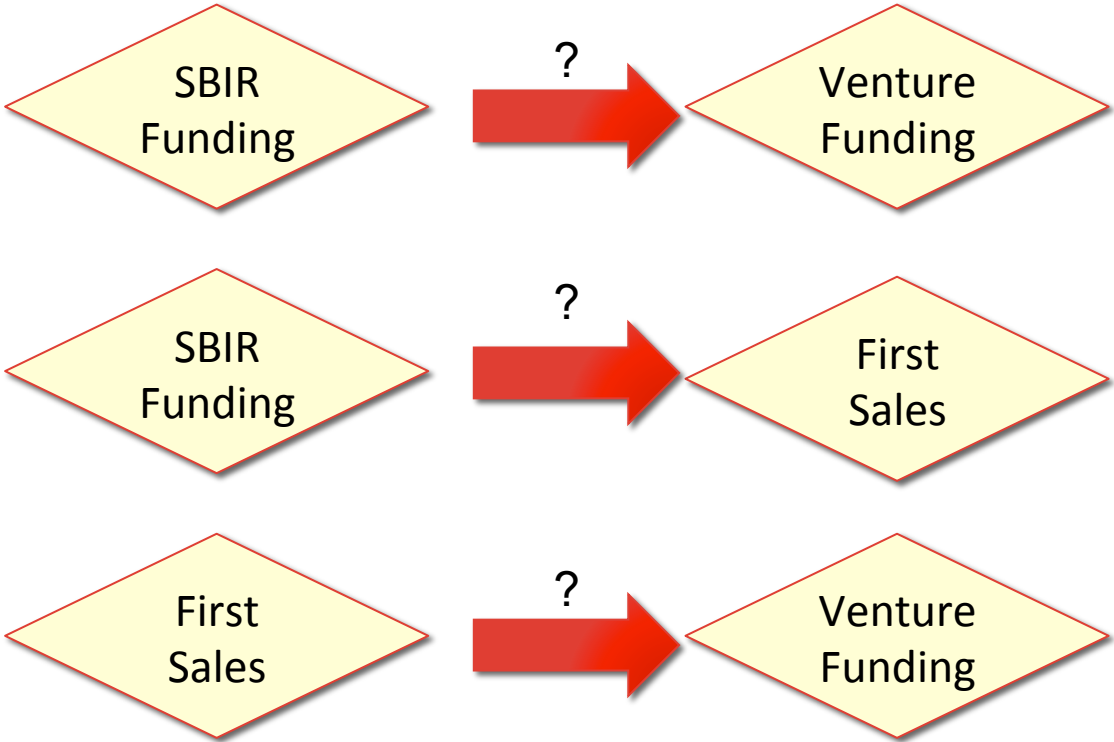
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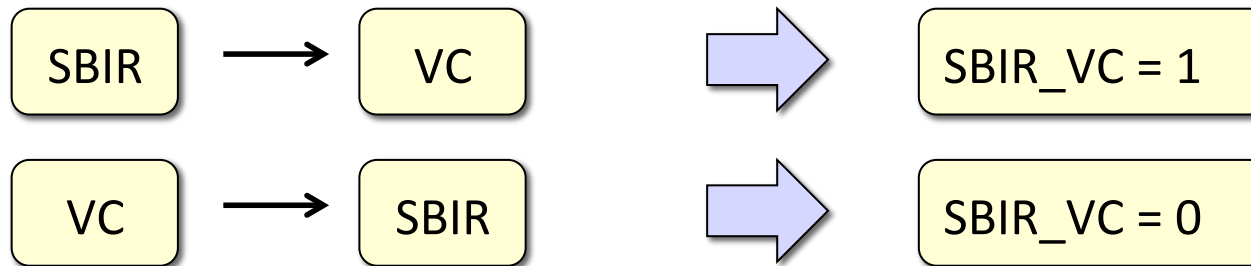
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Chronological Order



Binomial Test

Chronological Order Variables



Binomial tests

- the null hypothesis: event occurs randomly (the expected value of the order comparison dummy variable would be 0.5)

$$E[\text{SBIR_VC} = 1] = 0.5$$

$$E[\text{SBIR_FS} = 1] = 0.5$$

$$E[\text{FS_VC} = 1] = 0.5$$

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Conclusion

Inventor involvement does matter for the success of startups.

- Direct effects: SBIR, first sales, and survival
- Partial effect on venture funding

No direct effect on successful exit.



- Inventor involvement matters until intermediate steps, but not for the successful exit.
 - Potentially, turnover of top management team may be effective for the successful exit.

The results reconcile the two contradicting views of inventor involvement.

New Research Question

The negative moderation effect of venture funding on inventor involvement and SBIR funding is puzzling.

Compliments vs Substitutes

Potential Explanation: Two Types of Startups

- Low-growth startups
 - More inventor involvement → SBIR funding → Survival
- High-growth startups
 - Less inventor involvement → Venture Funding → Successful Exit

Practical Implications for Practitioners

- Entrepreneurs & Inventors' Perspective
 - Inventor involvement matters until intermediate steps.
 - The turnover of top management team may be effective.
 - appropriate timing: after the SBIR funding or product launch
- Investors' Perspective
 - Distinguish high / low growth firms
 - SBIR Funding & venture funding are potentially substitutes

Future Research

- New dataset: date of bankruptcy
- Characteristics of the founding team
 - Student vs Faculty
 - Gender and Ethnicity
- High-growth vs Low-growth Firms
- The impact of regional city-level characteristics impact
- Analyzing the impact of the federal research grants (DoD, NSF, NIH)
- New dataset: Non-patent based university-based startups
- Can we generalize our results?
 - › Other universities, states, or countries?
 - › Public vs Private Universities

Thank you.



kanetaka@kanetaka-maki.org