

The impact of entrepreneurial human capital on initial funding: evidence from Japan

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Introduction

RIETI Research Project (since October 2017)

- **Creation and Development of High-tech Startups** (Program IV: Innovation)

Purpose of this project

- We survey high-tech startups and venture capital, and address issues for the **entrepreneurial (start-up) ecosystem** in Japan.
- In particular, we focus on **high-tech start-ups' linkages** with external organizations and examine the performance of spin-offs and corporate venture capital, while taking into account the role of existing organizations in industries.

Cf. Members of this project

- Academic scholars
- Professional researchers
- Policymakers
- Venture incubators

Introduction

Policy discussions

- How do we construct the entrepreneurial ecosystem in Japan?
- How do we promote innovations through entrepreneurship in Japan?

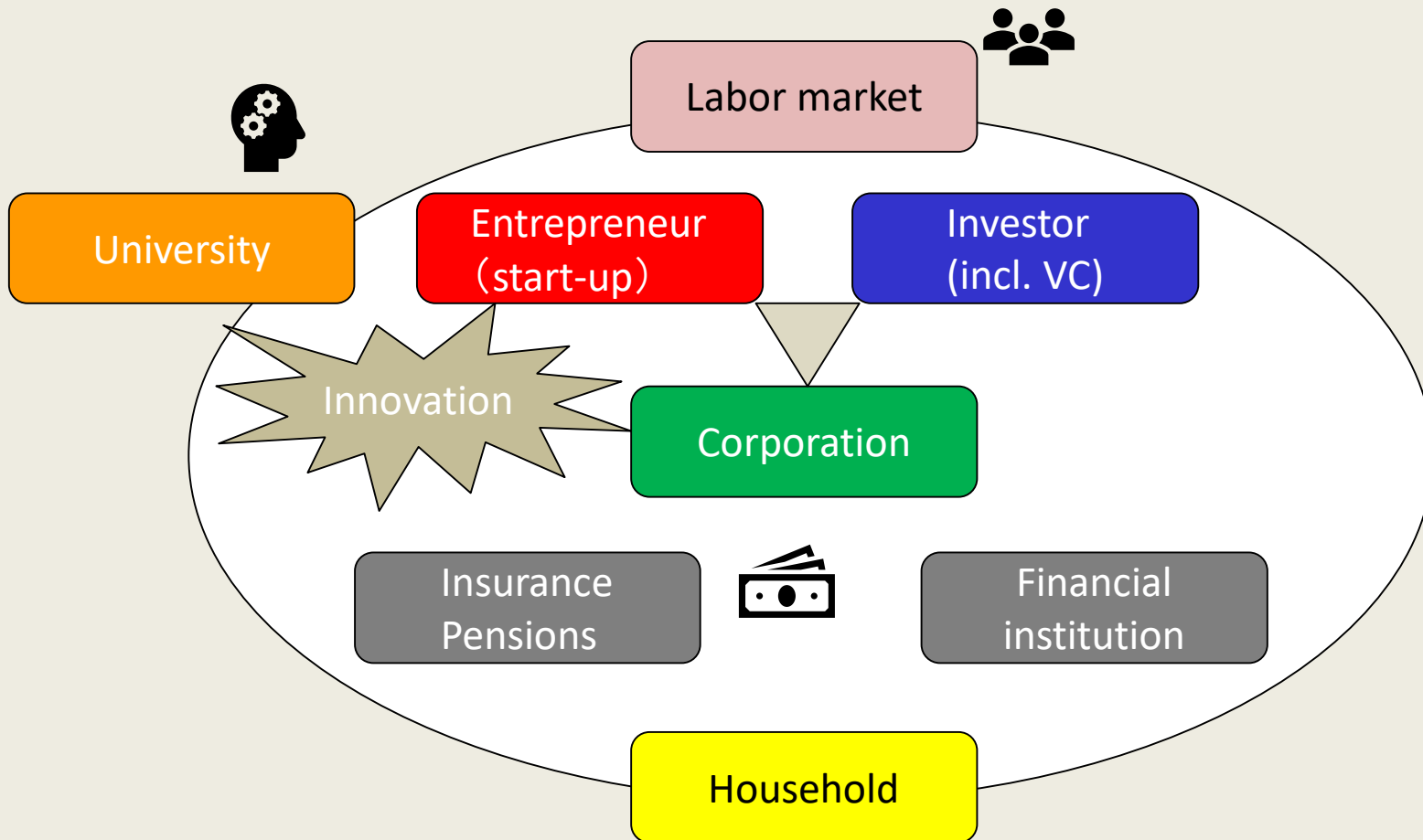
Cf. Entrepreneurial ecosystem

- Entrepreneurial ecosystem is a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory (e.g., Stam and Spigel, 2016).

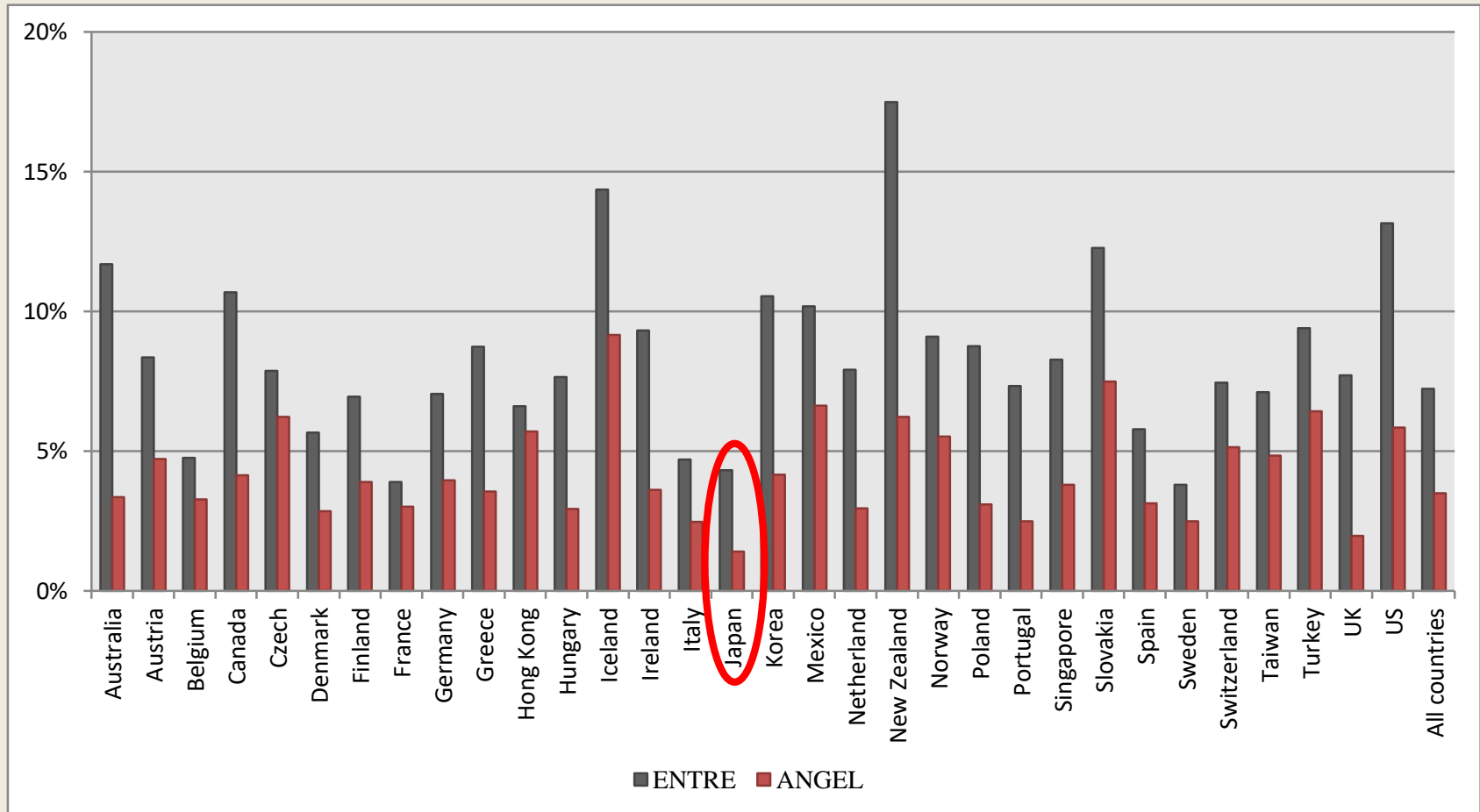
However...

- Indeed, the level of entrepreneurship, including angel investment, is very low in Japan.

Actors and factors in the entrepreneurial ecosystem



Entrepreneurship and angel indices (GEM Report)



Source: APS Global Individual for 2001-2012 (See Honjo (2015))

Note: Targets for individuals aged 18-64

Introduction

Target in the present study

- We highlight the relationship between technology and entrepreneurship.



Research question

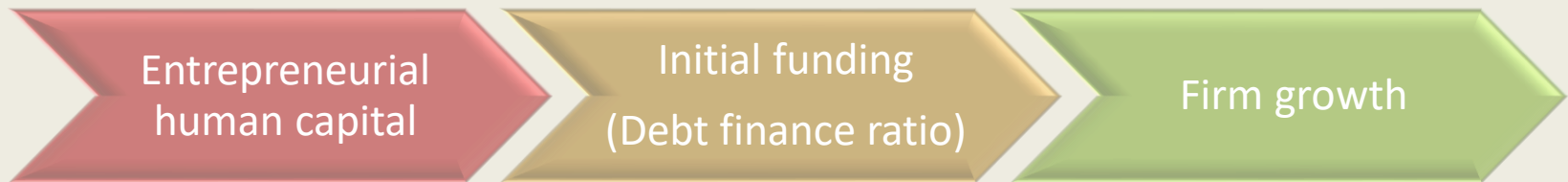
How do inventors raise funds when they become entrepreneurs?

What does this study examine?

- We explore how entrepreneurs, including inventors, raise initial funding.
- We provide evidence that some entrepreneur-specific characteristics are significantly associated with initial funding.

Introduction

Research framework



Major findings

- Start-up firms managed by entrepreneurs with technological skills are more likely to rely on equity financing.
- Start-up firms managed by entrepreneurs with university education are more likely to have significant financing.
- Start-up firms managed by older entrepreneurs are more likely to have significant financing.
- Start-up firms located in entrepreneurs' hometowns are more likely to rely on debt financing.
- Start-up firms relying on debt financing are less likely to grow faster.

Research background 1: Heterogeneity in business start-ups

Individuals' heterogeneous preferences

- The purpose of business start-ups differs across entrepreneurs.
- While some entrepreneurs are inventors, others are not.
- Some entrepreneurs may start businesses according to their own interests.

In our sample

- 107 (approximately 8%) entrepreneurs applied patents before founding their firms.
- 409 (approximately 29%) entrepreneurs started their businesses in their own birthplaces, except for Tokyo, Yokohama, Nagoya, and Osaka cities.

Research background 2: Impact of entrepreneurial human capital

Different demand for financing

- Entrepreneurs with higher human capital tend to seek large-sized businesses.

Signaling effect

- Under information asymmetry, entrepreneurial human capital may be a **signal** to external suppliers of capital.

Cf. Importance of human capital

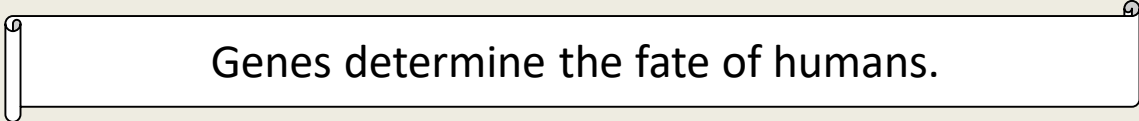
- Cressy (1996) argued that human capital is a true determinant for post-entry performance.

Research background 3:

Do initial conditions determine the fate of firms?

Importance of initial conditions

- Initial conditions determine the fate of firms.



Genes determine the fate of humans.

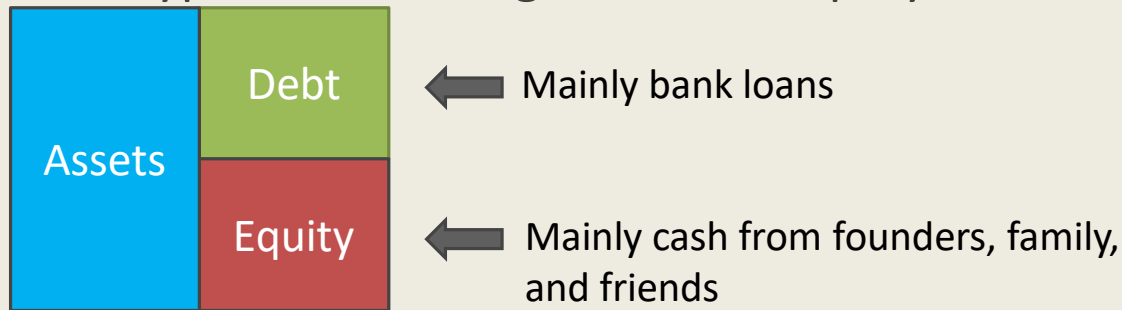
Do initial financial conditions matter for post-entry performance?

- Because start-up firms' capital is limited, post-entry performance depends on initial financial conditions.
- Because information asymmetry between entrepreneurs and external suppliers of capital is more likely to occur during the start-up period, most entrepreneurs cannot easily access capital markets.

Research background 4: Debt finance in Japan

Debt and equity balance

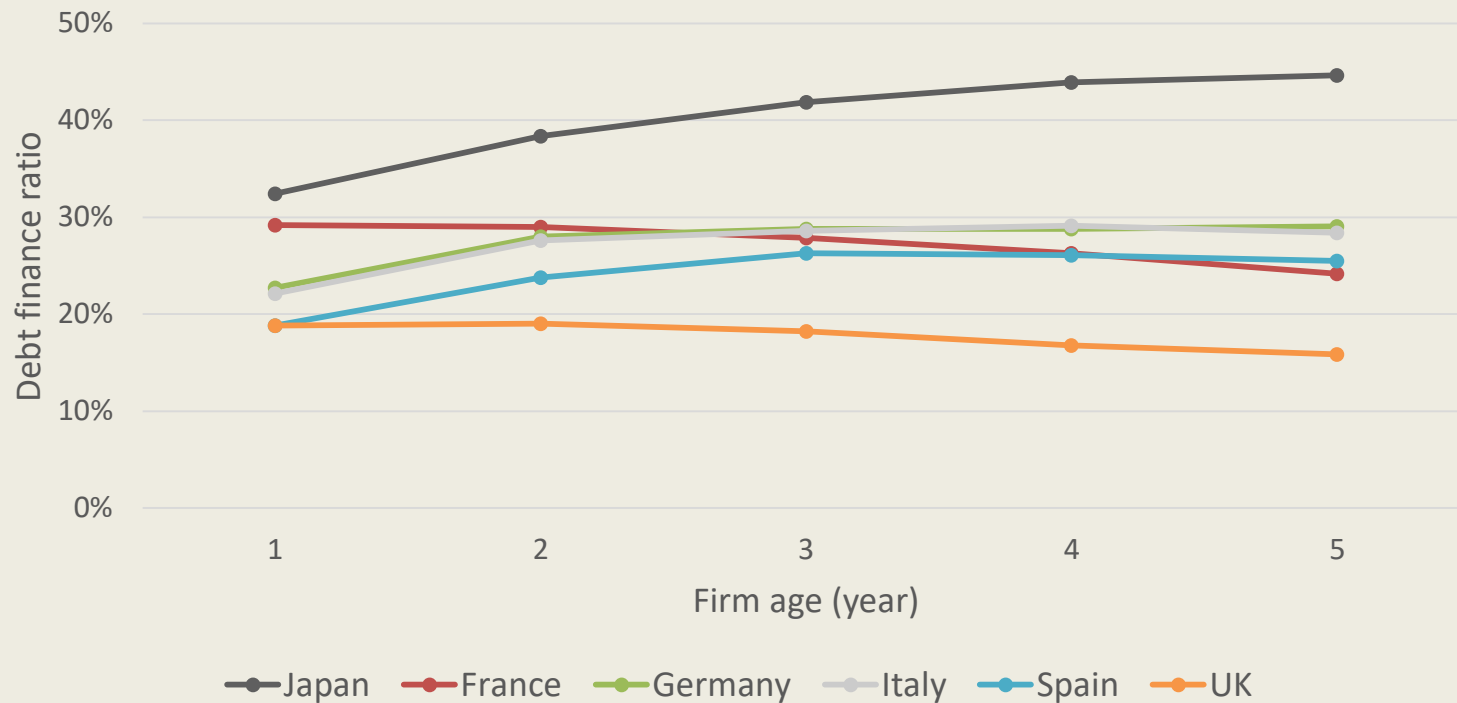
- Two types of financing: debt and equity.



Debt financing

- In Japan, bank loans, including those from government-affiliated financial institutions (i.e., Japan Finance Corporation) are prevailing as initial funding.
- ⇒ Start-up firms tend to rely on debt financing (see the following figure).

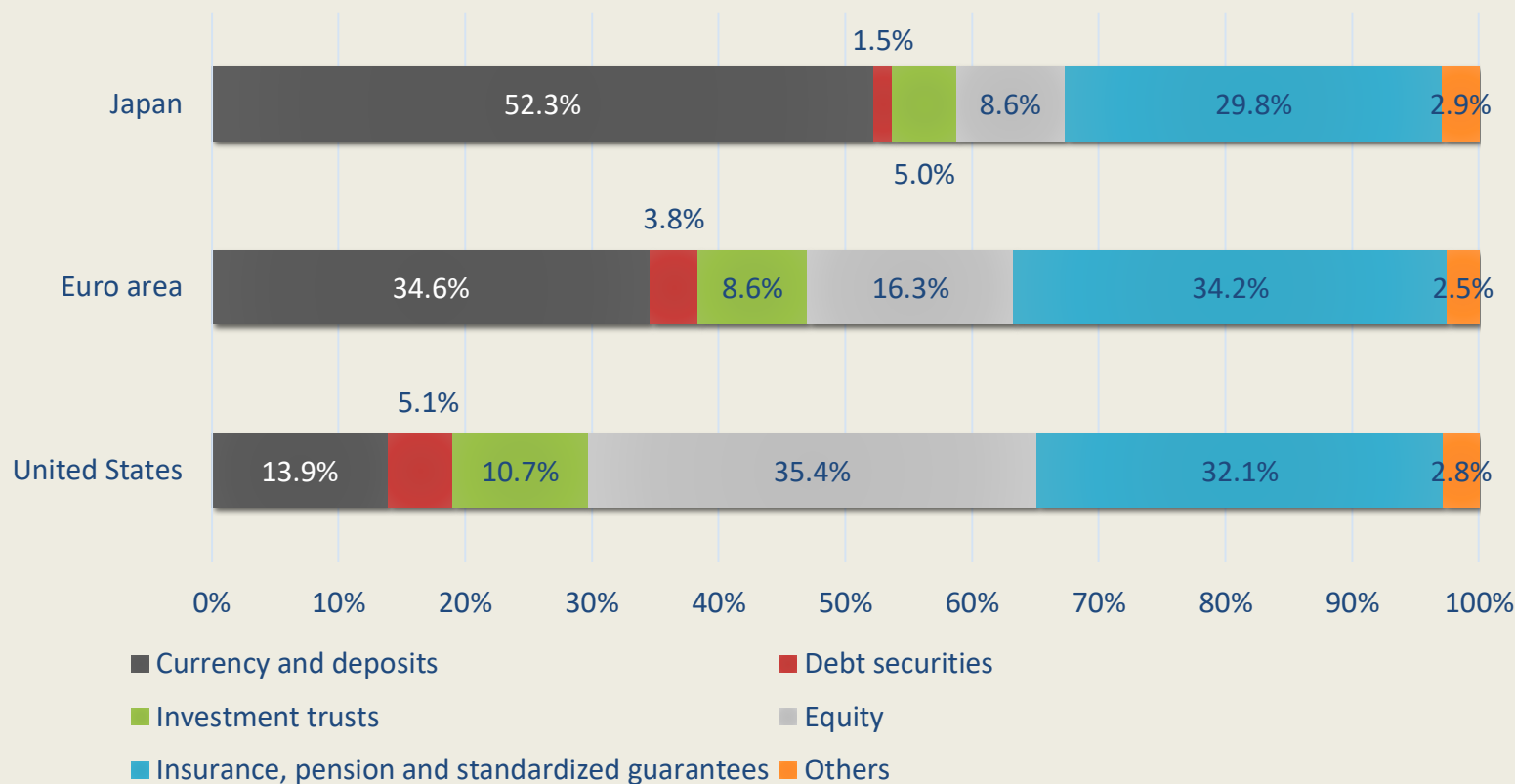
Debt finance ratios of start-up firms: Japan and Euro countries



Source: Honjo (2017). Original data source is Orbis (Bureau van Dijk Electronic Publishing).

Note: The numbers of firms are 4032, 95244, 8571, 42950, 41093, and 2561 for Japan, France, Germany, Italy, Spain, and the UK, respectively. Debt finance ratio is defined as debt finance divided by the sum of equity finance, debt finance, and trade credit. Debt finance is measured by the sum of short-term financial debt plus long-term liabilities, equity finance is measured by issued share capital, and trade credit is measured by debt to suppliers and contractors.

Financial assets held by households: Japan, Euro area, and the US



出所: 日本銀行調査統計局「資金循環の日米欧比較」
注: 2016年12月22日集計分.

Research background 5: Equity finance for high-tech start-ups

Equity financing for high-tech start-ups

- High-tech start-ups tend to seek equity financing, rather than debt financing.
- ⇒ This is due to uncertainty and information asymmetry between entrepreneurs and external suppliers of capital

Equity financing in Japan

- While loan markets are well developed in Japan, private equity markets, including angel investors, seem undeveloped (e.g., Honjo and Nagaoka, 2018).

Is it desirable to improve the financial system for technology-driven entrepreneurship in Japan?

Theoretical argument

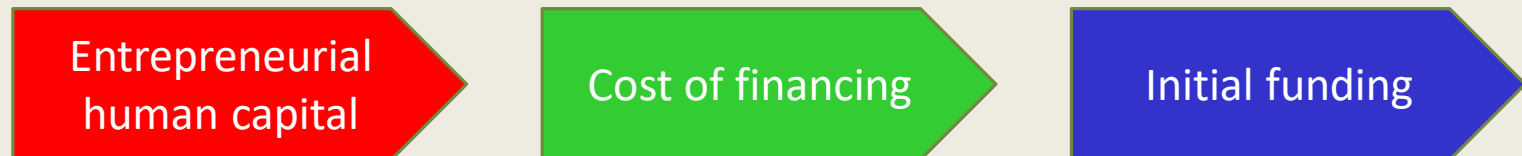
Analytical framework

- We examine the impact of entrepreneur human capital on initial funding.

Theoretical arguments

- Entrepreneurial human capital is significantly related to external financing because of the signaling effect.
- Entrepreneurial human capital has a significant impact on the cost of financing.

Cf. Wealth effect



Theoretical argument

Types of entrepreneurial human capital

- The effects of entrepreneurial human capital on the cost of financing differ from those on equity financing, according to the type of human capital.

Generic and specific human capital (e.g., Colombo and Grilli, 2005, 2010)

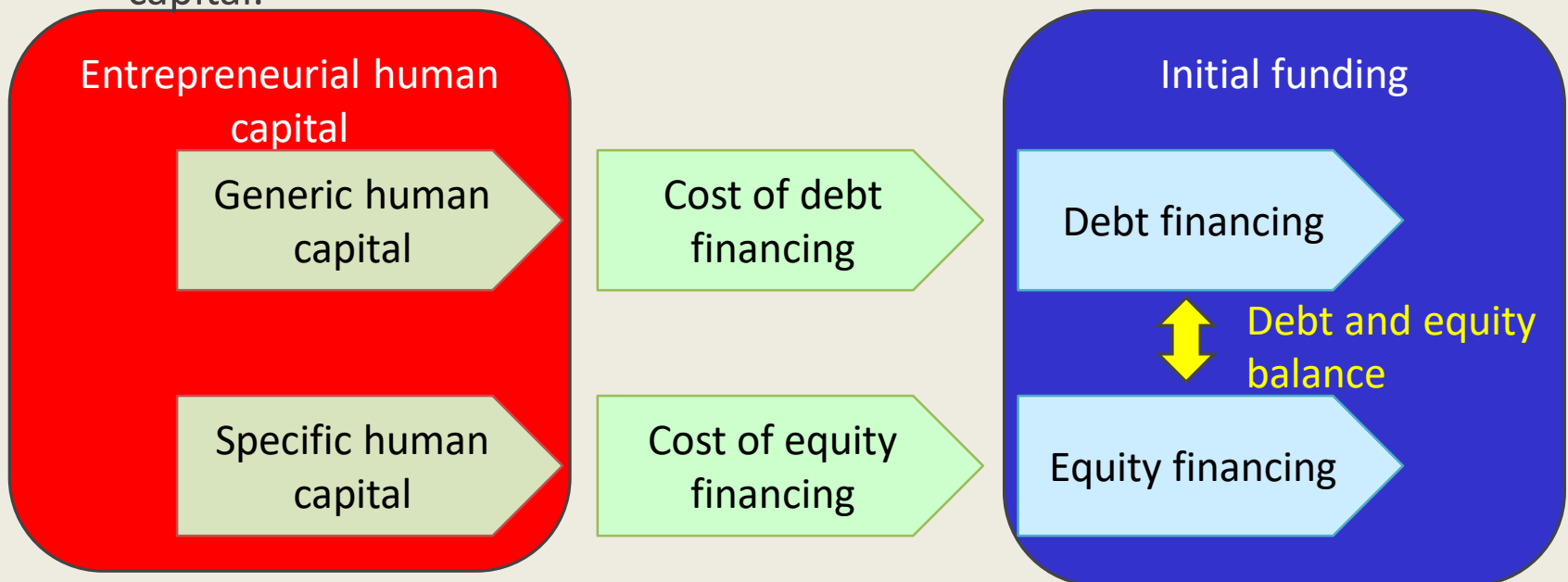
- **Generic human capital**: Fundamental knowledge and skills
→ Measured by education, age, and work experience
- **Specific human capital**: Special knowledge and skills in the field
→ Measured by technological skills

Theoretical argument

Different effects of entrepreneurial human capital

- While generic human capital is associated with the cost of debt financing, specific human capital is associated with the cost of equity financing.

→ Initial funding is determined by the type of entrepreneurial human capital.



Hypotheses

Entrepreneurial human capital

- Specific human capital
- Generic human capital

Specific human capital

- Technological skills (measured by patent applications) = inventor

Generic human capital

- Education
- Age (experience)

Other characteristics and preferences

- Gender
- Local business
- Rural business

Hypotheses

(Initial funding)

- H1: Start-up firms managed by entrepreneurs with **technological skills** are more likely to have significant financing at founding.
- H2: Start-up firms managed by entrepreneurs with **higher educational level** are more likely to have significant financing at founding.
- H3: Start-up firms managed by **older** entrepreneurs are more likely to have significant financing at founding.

(Debt and equity balance)

- H4: Start-up firms managed by entrepreneurs with **technological skills** are **less** likely to rely on **debt** financing.
- H5: Start-up firms managed by entrepreneurs with **higher educational level** are more likely to rely on **debt** financing.
- H6: Start-up firms managed by **older** entrepreneurs are more likely to rely on **debt** financing.
- H7: Start-up firms located in **rural regions** are more likely to rely on **debt** financing.

Data

Data source

- Teikokoku Data Bank Service
- Patent database

Sample

- Joint-stock companies founded during the period from January 2003 to December 2010 in Japan.
- Those firms founded in the manufacturing and ICT sectors of Japan.
- Subsidiaries, affiliated firms, and firms with no less than 100 employees or those with no less than paid-in capital of 1 billion yen in the first accounting year were excluded from the sample.

Observations: Start-up firms

- | | |
|-------------------|------|
| ◦ Total number | 1397 |
| ◦ (Manufacturing) | 511 |
| ◦ (ICT) | 886 |

Variables

Definitions of variables for financial capital

Variables	Definition
Debt finance	Sum of short- and long-term loans payable to inside and outside creditors, commercial paper, and corporate bonds (billion yen).
Equity finance	Sum of paid-in capital, deposits for subscriptions to shares, capital surplus, treasury shares, deposits to subscriptions for treasury shares, share warrants, and convertible and warrant bonds (billion yen).
Total finance	Equity finance + Debt finance
Debt finance ratio	Debt finance divided by total finance

Variables

Definitions of variables for entrepreneurial human capital

Variables	Definition
Technological skills	Dummy variable for the entrepreneur who experience patent application as an inventor before founding the firm
University education	Dummy variable for the entrepreneur who experienced education at university
Age	Logarithm of the entrepreneur's age at founding
Female	Dummy variable for a female entrepreneur

Variables

Definitions of variables (for others)

Variables	Definition
Local business	Dummy variable for the firm in the same prefecture of the entrepreneur's birthplace, except for prefectures in four major metropolitan cities (Tokyo, Yokohama, Nagoya, and Osaka)
Rural business	Dummy variable for the firm located in regions, except for four metropolitan cities (Tokyo, Yokohama, Nagoya, and Osaka), and not in the same prefecture of the entrepreneur's birthplace
Firm size	Logarithm of the number of employees plus one
Industry dummies	Dummy variable for the industry of the firm: chemicals, pharmaceuticals, machinery, electrical machinery, transportation equipment, precision instruments, and ICT.
Entry cohorts	Dummy variable for the year when the firm was founded

Summary statistics

Descriptive statistics of covariates

	Mean	S.D.	25%	Median	75%
Technological experience	0.077	-----	-----	-----	-----
University education	0.503	-----	-----	-----	-----
Age (level)	45.7	11.2	37.0	47.0	54.0
Female	0.044	-----	-----	-----	-----
Local business	0.293	-----	-----	-----	-----
Rural business	0.162	-----	-----	-----	-----

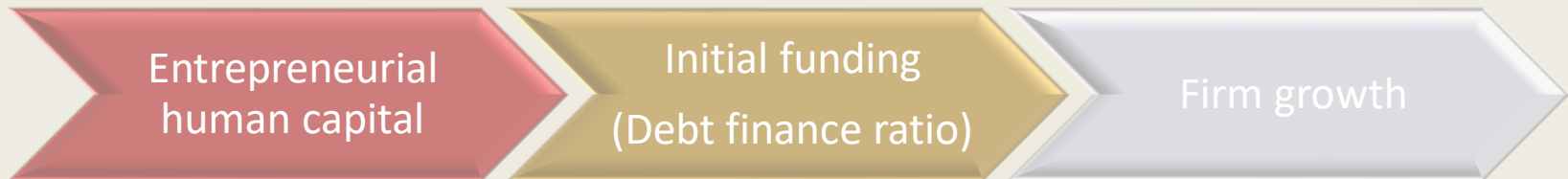
Estimation results

Estimation

- OLS
- Tobit model

Dependent variables

- Initial funding
- Debt finance ratio (debt and equity balance)



Estimation results

Total finance (Table 7): OLS

Variables	Initial funding
Technological skills (inventor)	++
University education	+++
Age (older)	+++
Female	--
Local business	No significance
Rural business	No significance
Pharmaceutical industry	No significance
ICT industry	---

Generic human capital

Estimation results

Debt finance ratio (Table 8): Tobit/OLS

Variables	Debt finance ratio
Technological skills (inventor)	---
University education	No significance
Age (older)	No significance
Female	No significance
Local business	+++
Rural business	+++
Pharmaceutical industry	---
ICT industry	---

Specific human capital

Estimation results

Major findings

- Start-up firms managed by entrepreneurs with technological skills are more likely to rely on equity financing.
- Start-up firms managed by entrepreneurs with university education are more likely to have significant financing.
- Start-up firms managed by older entrepreneurs are more likely to have significant financing.
- Start-up firms located in entrepreneurs' hometowns are more likely to rely on debt financing.

Summary

- Specific human capital is associated with equity finance.
- Generic human capital is associated with debt and equity finance (total finance).
- The start-ups of local businesses depend on debt financing.

Estimation results

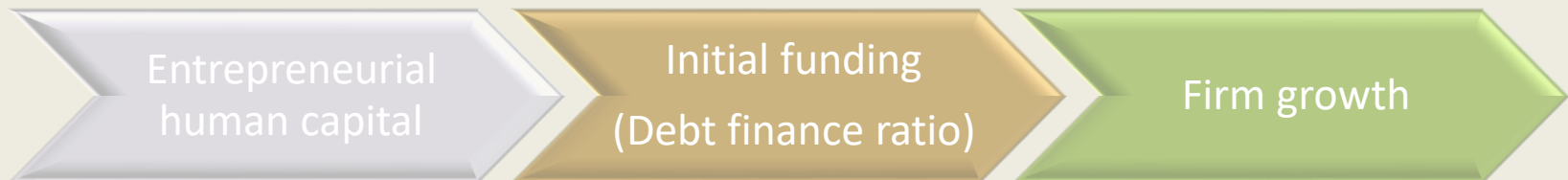
Estimation

- 2SLS (GMM)

Dependent variables

- Total asset growth
- Sales growth

Notes: These variables are defined as differences in the logarithms of total assets and sales between the first and second accounting years, respectively.



Estimation results

Firm growth (Table 9): 2SLS (GMM)

	Firm growth	
Variable	Total asset growth	Sales growth
Debt finance ratio	---	---

Major findings

- Start-up firms relying on debt financing are less likely to grow faster.

Concluding remarks

What did this study explore?

- The results reveal that some entrepreneur-specific characteristics are significantly associated with initial funding.

New evidence

- While generic human capital, measured by education and age, is associated with debt and equity finance, specific human capital, measured by patent applications, is associated only with equity finance.

How do inventors raise funds when they become entrepreneurs?

Inventors do not require debt financing when they become entrepreneurs.

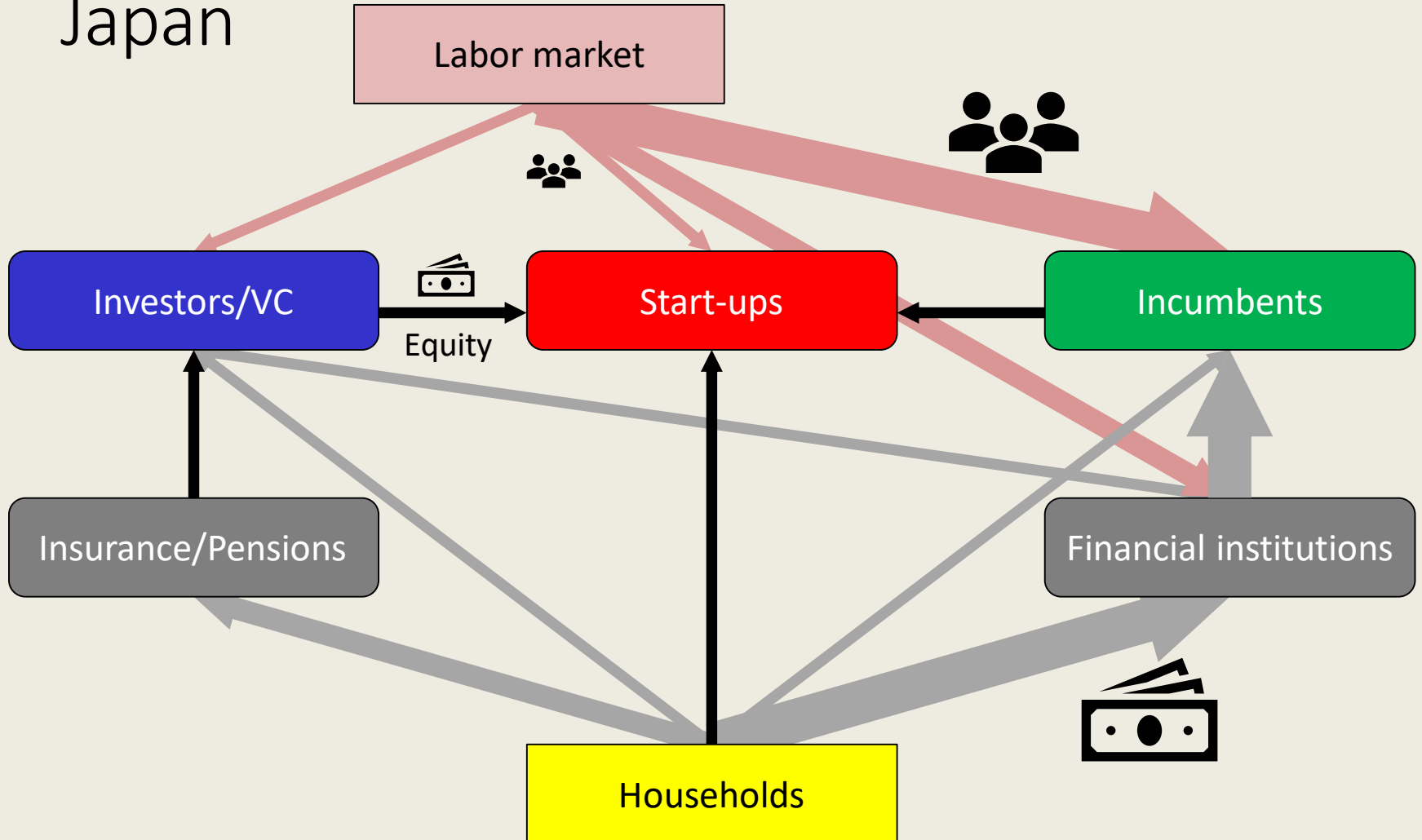
Concluding remarks

Policy implications

- The Japanese financial system's legacy of reliance on debt financing might decrease the proportion of start-up firms with innovation and growth potential, although such legacy helps local businesses to raise funds at founding.
- To promote technology-driven entrepreneurship, policies shifting away from the current financial system that relies heavily on debt financing would be required by inventors.

It would be desirable to shift the flow of funds to equity financing for high-tech start-ups in Japan.

Flow of funds in the financial system of Japan



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