Interdependence in Multinational Production Networks: Restructuring of Japanese MNEs' foreign Affiliates

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Aim of this study

- To examine how MNEs shut down foreign affiliates by exploiting data on Japanese foreign direct investment
  - This paper is the first attempt to explore MNEs' exit strategy of their affiliates.
- To highlight the effect of MNEs' existing production network on the decision to be shut down of the foreign affiliates.
  - By exploring strategies on restructuring of MNE' network, we'll introduce some implications for those developing countries that try to keep and attract foreign affiliates.

Outline

- Introduction
- Empirical Framework
- Data Issues
- Overview of Exit
- Empirical Results
- Concluding Remarks

Introduction

- By setting up and shutting down their overseas affiliates, MNEs have established their production and distribution networks in the world.
- Japanese MNEs' overseas affiliates in 2009
  - Entry: 82 manufacturing affiliates
  - Exit: 305 manufacturing affiliates
- Improving the production and distribution networks through the reallocation of overseas affiliates
- **ENTRY**: Location Choice Analysis
  - E.g. Head and Mayer (2004); Mayer, Mejean, and Nefussi (2007); Basile, Castellani, and Zanfei (2008)
  - Various kinds of location factor; Substitution across locations
- **EXIT**: Comparison between foreign-owned plants and indigenous plants
  - Gibson and Harris (1996); Görg and Strobl (2003); Bernard and Jensen (2007); Bandick (2010)
  - Survival rate of foreign plants is lower than that of domestic plants.

Introduction

- It has remained unknown how MNEs decide the shutdown of their overseas affiliates.
- With Japanese FDI data, this paper investigates how different the exit is across MNEs' affiliates in the world.
  - Affiliate characteristics such as employment
  - Host country characteristics such as GDP, Inflation, or Wages
  - This is the **first** paper that presents the evidences on the effects of these kinds of characteristics on the exit of MNEs' affiliates.
- Taking into account the existence of multiple plants within a firm
  - Baden-Fuller (1989), Deily (1991), Dunne et al. (2005): examining the effect of the existence of the **domestic plant network** in the same firm on **the plant survival**
  - Chen (2011): Examining interaction among **overseas affiliates** within the same MNE in the context of affiliates' **ENTRY**
  - This is the **first** paper that examines interaction among **overseas affiliates** within the same MNE in the context of affiliates' **EXIT**

Empirical Framework

- Specifying the current profit of a firm *j*'s plant *i* in country *r* at year *t*
- $\pi_{ijrt}(\mathbf{x}_{it}, \mathbf{m}_{rt})$
- Row Vectors
  - **x**: plant specific elements (e.g. plant's employment)
  - **m**: country specific elements (e.g. wages)
- A plant makes a decision to continue operating in a country at the start of each year prior to observing the values of **x** and **m** for that year.
- Decision
  - Stay $(Y_{ijrt+1} = 0)$ iff $\mathrm{E}(V_{ijrt+1}) \geq F$
  - Exit $(Y_{ijrt+1} = 1)$ iff $\mathrm{E}(V_{ijrt+1}) < F$
  - $\mathrm{E}(V_{ijrt+1})$: Expected discounted sum of profits from operating
  - F: Fixed exit cost or scrap value
- Discrete exit variable in year *t*+1 as a function of state variables, i.e. $Y_{ijrt+1}(\mathbf{x}_{it}, \mathbf{m}_{rt})$

Empirical Framework

- How to measure the MNEs affiliates network
  - Number of affiliates in the same region in the same MNE
  - Number of affiliates in the same country in the same MNE
  - Network variable proposed in Chen (2011)

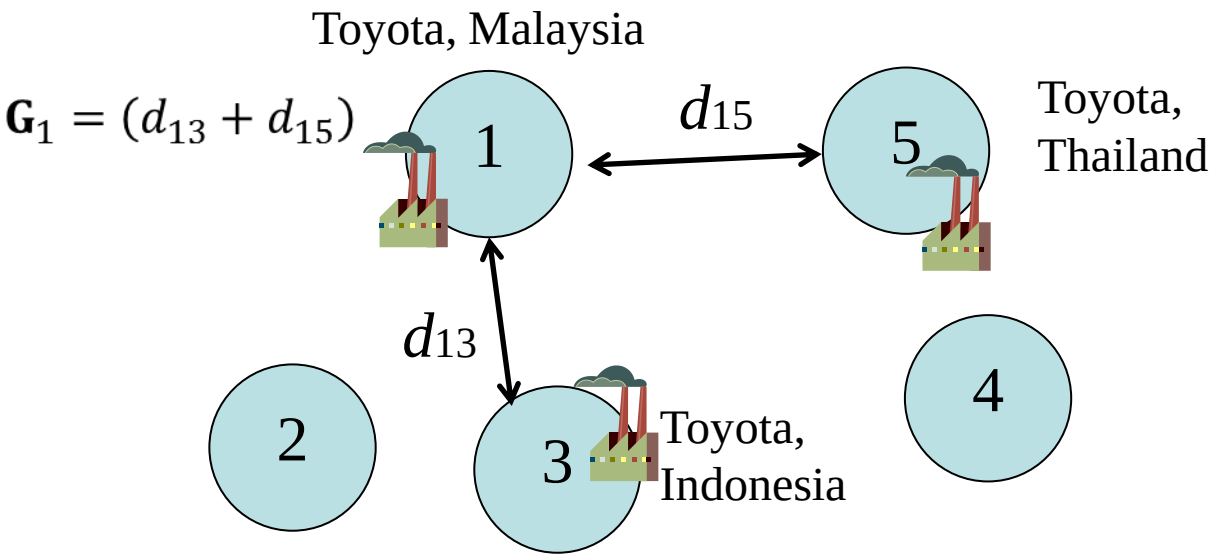
- Chen's network variable, **G**

$$\mathbf{G}_{\mathrm{ijrt}} = (\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{D}r} \quad \mathbf{E}_{jt}\mathbf{W'}_{\mathrm{T}rt}),$$
$$\text{where } \mathbf{W}_{\mathrm{D}r} = (d_{r1} \quad \dots \quad d_{rc}), \mathbf{W}_{\mathrm{T}rt} = (\tau_{r1t} \quad \dots \quad \tau_{rct}), \mathbf{E}_{jt} = (e_{j1t} \quad \dots \quad e_{jct}).$$

  - c is a total number of sample countries.
  - d_{rl} and τ_{rlt} are the (logged) geographical distance between countries *r* and *l* and tariff rates of country *r* for country *l* in year *t*, respectively.
  - e_{jlt} is an indicator variable taking unity if firm *j* has affiliates in country *l* in year *t* and zero otherwise. Also, e_{jlt} sets zero if *l* = *i*.

Empirical Framework

- Example of network variable
  - Suppose that automobile mfg firm *j* has three affiliates in countries 1, 3 and 5.
  - Distance based network variable for affiliate in country 1 ($\boldsymbol{G}1 = \mathbf{E}_{jt}\mathbf{W}_{D1}$) is consisted of (0 0 1 0 1) and $(d_{11}\ d_{12}\ d_{13}\ d_{14}\ d_{15})'$, as a result, it becomes $(d_{13} + d_{15})$.



Empirical Framework

- How dose the existence MNEs' affiliates network affect the survival of MNE affiliate?
  - Horizontal network, Export platform FDI (Ekholm et al., 2007)
    - Suppose that there are two oversea affiliates in different country and they produces the same product.
    - When trade cost is reduced between two country, a firm has incentive to concentrate their foreign production in one country.
    - The better access to plant *i* the other plants have, the more likely plant *i* is to be shut down.
  - Vertical network, Complex VFDI (Hayakawa & Matsuura, 2010)
    - Suppose that there are two oversea affiliates in different country and one affiliate produces parts and components and the other engages in assembling.
    - If trade cost is reduced, both affiliates enjoy benefit of trade liberalization.
    - As a result, both affiliates are less likely to be shut down.

Empirical Framework

- How dose the existence MNEs' affiliates network affect the survival of MNE affiliate? (cont.)
  - Sign of the coefficients for ***G***
    - Since we cannot distinguish the details of the product each affiliate produces, we expect the coefficient will be positive or negative depending on which of horizontal network or vertical network is dominant.
    - **[−]**: horizontal network is dominant.
    - **[+]**: vertical network is dominant.
- Limitation
  - Our empirical analysis does not take into account the number of exit plants and the simultaneous decision on entry and exit.
  - The generalization and detailed examination of this framework are quite complicated (Whinston, 1988).

Empirical Specification

- $\text{Prob}(Y_{ijrt+1}=1) = \Phi(\mathbf{x}_{it}, \mathbf{m}_{rt}, \mathbf{G}_{ijrt})$
- **x**: affiliate specific elements
  - Number of employment
  - A share of parent's capital
  - Age
- **m**: country and industry specific elements
  - GDP
  - GDP growth
  - GDP per capita
  - the number of Japanese affiliates with the same industry as a concerned affiliate
  - Inflation
  - Exchange rate volatility
  - Regulation
  - (Industry specific factor) Minimum efficient scale

Two Kinds of Data for Japanese FDI

- Main Data source: Oversea Japanese Companies Data (OJCD)
  - Compiled by a private company, Toyo Keizai INC.
  - Only basic information, such as location, entry year, parent firm, composition of capital, and employment
  - List of exiting affiliates: we can differentiate purely exiting affiliates with those stopping the response

cf. Basic Survey of Oversea Business Activity (BSOBA)

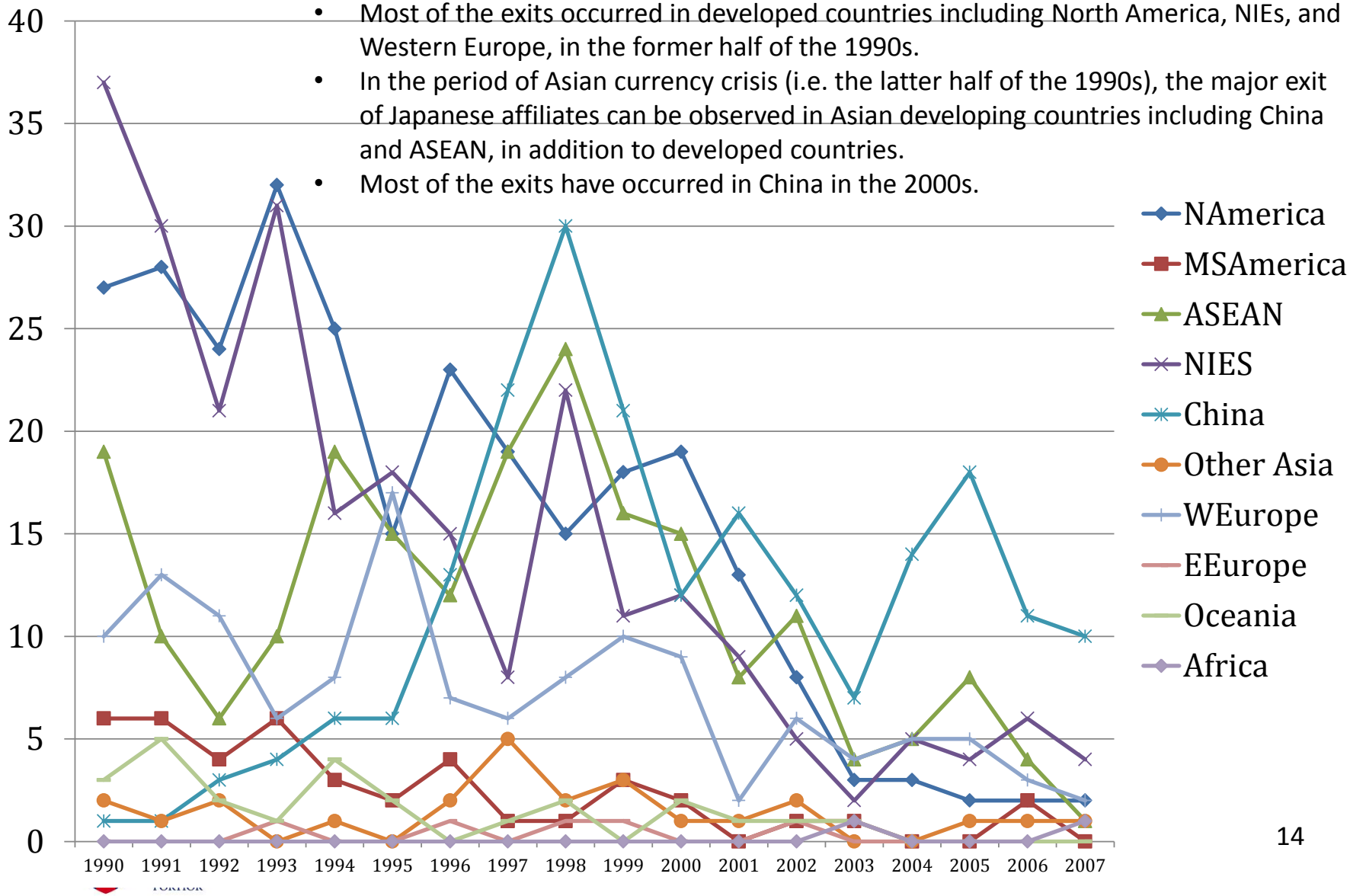
  - Compiled by Ministry of Economy, Trade and Industry
  - Rich information on Japanese overseas affiliates' characteristics, such as affiliates' sales, profit, and cost structure
  - Despite that the response rate is only around 60%, exiting affiliates in BSOBA data include the affiliates that are still active but stop responding the survey.

Data Sources & Issues

- Data Sources
  - Obtained from OJCD: Number of affiliates' employment, A share of parent's capital, Affiliates' age, and Number of Japanese affiliates
  - WDI: GDP, GDP per capita, GDP deflator, and Inflation
  - CEPII: Distance between home and host countries
  - WITS/TRAINS: Bilateral tariff rates
  - Economic Freedom of the World: 2010 Annual Report: Regulation Index on the regulation of credit, labor, and business
  - Volatility: standard deviation of the first-difference of the monthly natural logarithm of bilateral real exchange rates in the five years preceding period *t*.
    - International Financial Statistics (International Monetary Fund)
  - Minimum Efficient Scale: Average value of shipment
    - 1995 Census of Manufacturer (METI)
- Data Issues
  - Sample years of affiliates' exit: 1991- 2008.
  - Independent variables: one year lagged
  - Restricting sample affiliates only to those in manufacturing industry

Overview of Exit: Japanese Affiliates' Exit by Region

- Most of the exits occurred in developed countries including North America, NIEs, and Western Europe, in the former half of the 1990s.
- In the period of Asian currency crisis (i.e. the latter half of the 1990s), the major exit of Japanese affiliates can be observed in Asian developing countries including China and ASEAN, in addition to developed countries.
- Most of the exits have occurred in China in the 2000s.



Overview of Exit

- Exit by Industry
  - Exit rate is higher for Wood, Printing, Electric Machinery, Transport Equipment, and precision machinery.

	Food	Textile	Wood	Paper and Paper products	Printing	Chemicals	Petroleum	Rubber	Non-Metalic Mineral products
1990s	1.30%	1.50%	1.60%	1.50%	1.70%	0.90%	0.00%	0.90%	1.20%
2000s	1.25%	1.75%	2.75%	1.13%	2.50%	1.38%	0.13%	1.13%	1.75%
	Iron and Steel	Non-ferrous Metal	Metal Products	General Machinery	Electric Machinery	Transport Equipment	Automobile	Precision Machinery	Other Manufacturing
1990s	1.20%	0.90%	1.40%	1.30%	1.50%	1.20%	0.90%	1.10%	1.40%
2000s	1.00%	1.63%	1.25%	1.38%	2.38%	2.00%	0.75%	2.13%	1.88%

Probit Results (Marginal effect)

	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Employment	-0.002***	-0.0024***		
Relative Employment			-0.005***	-0.005***
Control Share	-0.008***	-0.009***	-0.007***	-0.009***
Age	-0.00003	0.00012	-0.00114**	-0.0014***
Country characteristics				
GDP	0.0008**	0.0008**	0.0006**	0.0007**
GDP Growth	0.02*	0.017	0.021*	0.018
GDP per capita	0.003***	0.003***	0.004***	0.004***
Number of Japanese affiliates	-0.0008*	-0.0008*	-0.0004	-0.0005
Inflation	-0.0002	-0.0002	-0.0002	-0.0002
Volatility	0.003	0.003	0.003	0.003
Regulation	0.0003	0.0007	0.0001	0.0004
Minimum Efficient Scale (MES)	-0.002***		-0.002***	
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	No	Yes	No	Yes
Log-likelihood	-5878	-5824	-5891	-5853
Number of observations	82712	82712	82712	82712
Pseudo R-squared	0.0346	0.0435	0.0324	0.0388

Network Effects (Marginal effect)

	(I)	(II)	(III)	(IV)	(V)	(VI)
Affiliate characteristics						
Relative Employment	-0.005***	-0.005***	-0.007***	-0.007***	-0.007***	-0.007***
Control Share	-0.009***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
Age	-0.001**	-0.001***	-0.001	-0.001	-0.001	-0.001
Country characteristics						
GDP	0.0007**	0.0006**	0.0007**	0.0007**	0.0009**	0.0007**
GDP Growth	0.018	0.016	0.015	0.014	0.013	0.015
GDP per capita	0.004***	0.004***	0.003***	0.003***	0.003***	0.003***
Number of Japanese affiliates	-0.0005	-0.0006	-0.0012***	-0.0011***	-0.0014***	-0.0011***
Inflation	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
Volatility	0.003	0.003	0.004	0.003	0.005	0.004
Regulation	0.0004	0.0004	0.0006	0.0005	0.0009	0.0007
Network effects						
Number of affiliates in the same region	-0.0001					
Number of affiliates in the same country		0.0005**	0.0011***	0.0011***	0.0011***	0.0011***
Network effects through distance			-0.0009***			
Network effects through distance (excl. jpn)					-0.0009***	
Distance from Japan					-0.001	
Network effects through tariff				-0.0017***		
Network effects through tariff (excl. jpn)						-0.0017***
Tariff rates for Japan						0.00096**
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-5853	-5851	-5821	-5823	-5821	-5820
Number of observations	82712	82712	82712	82712	82712	82712
Pseudo R-squared	0.0388	0.0391	0.0439	0.0437	0.044	0.0442

Robustness: Machinery / Asia

	Machinery Industries		Asia	
	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Relative Employment	-0.009***	-0.009***	-0.006***	-0.006***
Control Share	-0.007***	-0.007***	-0.006***	-0.006***
Age	-0.001	-0.001	0.001	0.001
Country characteristics				
GDP	0.001**	0.001**	0.0006	0.0007
GDP Growth	0.018	0.017	0.009	0.008
GDP per capita	0.003***	0.003***	0.003***	0.003***
Number of Japanese affiliates	-0.0015**	-0.0013**	-0.0013	-0.0012
Inflation	0.0001	0.0001	-0.0061	-0.0064
Volatility	0.009	0.009	0.011	0.009
Regulation	0.001	0.0009	-0.0003	-0.0003
Network effects				
Number of affiliates in the same country	0.0012***	0.0012***	0.0009***	0.0009***
Network effects through distance	-0.001***		-0.0009***	
Network effects through tariff		-0.0019***		-0.0015***
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Log-likelihood	-2846	-2847	-3466	-3466
Number of observations	39249	39249	57265	57265
Pseudo R-squared	0.0511	0.0507	0.0449	0.0449

Including those affiliates that stop responding

Controlling unobservable affiliate specific factor

Robustness: Exit / Fixed Effect

	Other Definition of Exit		Fixed Effect	
	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Relative Employment	-0.018***	-0.018***	-0.014***	-0.014***
Control Share	-0.038***	-0.038***	-0.007	-0.007
Age	-0.002**	-0.002**		
Country characteristics				
GDP	0.003***	0.003***	-0.029	-0.027
GDP Growth	0.011	0.011	0.005	0.005
GDP per capita	0.007***	0.006***	0.06***	0.057***
Number of Japanese affiliates	-0.0049***	-0.0047***	-0.0138***	-0.0139***
Inflation	-0.00016	-0.00015	0.00005	0.00006
Volatility	0.012	0.011	0.005	0.005
Regulation	0.002**	0.002**	0.001	0.001
Network effects				
Number of affiliates in the same country	0.002***	0.002***	0.001*	0.001
Network effects through distance	-0.003***		-0.001***	
Network effects through tariff		-0.005***		-0.002***
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	No	No
Affiliate dummy	No	No	Yes	Yes
Log-likelihood	-15098	-15097	72392	72392
Number of observations	85426	85426	82712	82712
Pseudo R-squared	0.0419	0.042		
R-squared (Overall)			0.0012	0.0013

Concluding Remarks

- Summary
  - Empirically examining the exit of MNE's production affiliates by exploiting data on Japanese foreign direct investment.
  - Exploring how the exit of affiliate is affected by the existence of the other affiliates belonging to the same parent firm.
- Our results imply…
  - As trade liberalization proceeds, the distribution of foreign affiliates in each MNE will be dispersed.
  - The affiliates locating in countries without the large agglomeration will be more likely to be shut down.
  - Those developing countries that try to keep and attract FDI need to pay attention to the formation of agglomeration.

Things to be done

- Dealing with endogeniety issue on the existing MNEs' network
  - As following Chen (2011), we will use instrumental variable technique.

- Distinguishing the differences of HFDI and VFDI
  - We will link OJCD database with METI government survey and utilize detailed industry classification and identify input-output relationship among affiliates.