Research Methodology 02 -The Research Process-

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0. Outline of Today's Lecture

STAGES IN RESEARCH PROCESS
HYPOTHESIS
LITERATURE REVIW

Today's Case:

"Aging and Real Estate Prices-Evidence from Japanese and US Regional Data-"

From Lec03. 90 min

- Part1: Research Methodology
- Part2: Review of Statistics :
- Statistics is the grammar of science. Karl Pearson
- Part3: Case

1. STAGES IN RESEARCH PROCESS

- Today's Lecture
- Step1: Find research topic
- Step2: Hypothesis and Research Design
- Step3: Literature Review
- Step4: Data Collection / Lecture 3
- Step5: Analyzing Data / Lecture 4
- Step6: Interpretation of results / Lecture 5
- Step7: Validation of results / Lecture 5
- Step8: Writing the thesis or report with conclusion / <u>Lecture6</u> and Tutorial
- R.Cauvery et al (2000), "Research Methodology" Chapter 3.

(1) What is a research problem?

- All progress is born of inquiry. Doubt is any day better than over confidence. *Doubt leads to inquiry and inquiry leads to invention.*
- Thus invention is the out come of research. Research may be motivated by <u>the desire to know</u> for the sake of knowing or by <u>the desire to solve</u> the practical problems.
- In research process, the first and foremost step is <u>selecting</u> <u>and defining a research problem</u>.

What is a Research Problem?

- Conditions:
- 1. It must be *worth studying*. In other words it must have viability or potentiality to stand as a research problem.
- 2. The study of the problems *must be socially useful*. It must be able to catch the attention of the experts, policy makers, academicians etc. who are familiar with the subject.
- 3. There must be a felt <u>need for research over the problem</u>. It should be a problem untouched by other researchers or even if touched must be in need of further research possibility.
- 4. A research problem should <u>come out with pragmatic</u> <u>solutions to the issue</u>.
- 5. As far as possible the research problem <u>should not be stale</u>. It should be up to date and relevant to the current social happenings.

Additional Conditions:

- 1. The researcher should be very sure of the topic chosen. It should <u>be neither too vague nor too broad in scope</u>.
- 2. To make the problem clearer and more understandable it should be stated in a question form requiring <u>specific and</u> <u>definite answer</u>.
- 3. The limitations of the problems, the factors which are not included in the study should be carefully eliminated and should not be considered in the study.
- 4. All the special terms that are used in the statement of the problem should be clearly defined.

(2) Selection of Research Problems

- The right selection of the topic has unlimited advantages and it boosts the moral of the researcher.
- A right selection of a research problem helps you to proceed with your work methodically and step by step.
- This will help the researcher to finish the project within stipulated time and that too with a minimum cost.

Should take into consideration the following factors:

- 1. *<u>Researcher's interest</u>*: You should select a topic in which you are familiar or has in depth understanding.
- •
- 2. *Topic of significance*: You should select a topic which in socially significant.
- •
- 3. *Novelty of the idea* : A novel problem may lead to new ways of looking at the problem.

- 4. *<u>Researcher's resources</u>*: The resources of researcher are your intelligence, training and experience and other facilities such as funds, clerical and technical assistance, library facilities and availability of time.
- 5. *<u>Time-bound programme</u>*: A research problem should be time bound.
- 6. *Availability of data* : In the absence of adequate data no research is purposeful. The researcher has to examine whether the data for the project are available in plenty

- 7. *Feasibility of the study*: You should never be in a hurry in choosing a problem. Spending considerable time for selecting a topic would not be a waste at all.
- •
- 8. <u>Benefits of the research</u>: The results of a research study give intellectual satisfaction to you. You must get recognition for your work. You should write an UNDERGRADUATE DISSERTATIONS.

My research fields: Jan 2016

- (a) Property Price Indexes
- - Topic of significance + Availability of data + Researcher's interest
- (b) Green Building
- - Topic of significance
- (c) International Investment Flows and Local Bubbles
- - Availability of data
- (d) Amenity and City agglomeration
- - Researcher's interest
- (e) Aging and House Prices
- - Topic of significance + Researcher's interest

How can you get "*research topic*" or "*inquiry*", "*doubt*"?

- Radar or antenna is important.
- -TV: CNN, ABC, BCC, NHK
- -Newspaper: Business Times, Wall Street Journal, Financial Times, New York Times, Nikkei
- -Journal: ECONOMIST or Real Estate Journals
- -University's Real Estate website

Today's Case: Aging and Housing Prices.



The Economist:

Into the Unknown: A special report on Japan (Nov.20th 2010)

"Japan is aging faster than any country <u>in history</u>, with vast consequences for its economy."

2050 All Japan =2010 Yubari-city

Land prices in Japan will be one-third in 2040.



Topic: Singapore property may face ageing threat

- Study says home prices could fall 30 per cent by 2040, but analysts say investment and immigration flows will support prices, mitigate effect of ageing, less dynamic population
- By Lee Meixian leemx@sph.com.sg @LeeMeixianBT Older population, cheaper homes? SEP 8, 2015 5:50 AM Singapore
- The Business Times SEP 8.2015

The Business Times SEP 8.2015

- A recent study by the National University of Singapore's Institute of Real Estate Studies predicts that Singapore home prices could fall by about 30 per cent by 2040 as <u>the society</u> <u>ages and the old-age dependency ratio rises</u>. But economists and real estate consultants argue that *this scenario may not come to pass because of investment and immigration flows*.
- They say that the study by and large approaches residential property as a <u>consumption good</u>, ignoring <u>the investment</u> part of the equation, which should not be the case, given Singapore's status as a global city.
- The working paper by a team led by *Chihiro Shimizu*, to be published next week, covered 12 Asian, five South and Central American and 18 European economies.

- It forecasts that, in ageing European and Asian economies including Singapore - housing prices will drop as a result of demographic changes in the next 30 years.
- This conclusion is not new; it has been much debated in US academic literature, but not many such studies have been done in the Asian context, noted DTZ regional head of research *Lee Nai Jia*, who was formerly an assistant professor in the Department of Real Estate at NUS' School of Design and Environment.

- The researchers behind the study expect the old-age dependency ratio defined as the proportion of the elderly to the working-age population in Singapore, Korea, Hong Kong and Thailand to rise from between 10 and 20 per cent to between 40 and 60 per cent in the next 30 years; in China, the proportion of the aged is expected to grow from 11 per cent to 35 per cent.
- The expanding ranks of the aged could in turn send home prices down by 50 to 60 per cent by 2040, it said. However, Singapore will buck the trend, in that its home prices could fall by less 30 per cent.

- The reason for this disparity comes from the study's *assumption* that the populations in other countries would stay somewhat stagnant, while Singapore's total population is expected to grow 36 per cent from 2010 to 2040, culminating in a population of 6.9 million the figure used by the Singapore government for infrastructure planning purposes.
- The projected growth in Singapore's population would have the effect of offsetting some of the housing demand lost from a more aged population, it said. While the study focused primarily on Japan, where the population is greying and declining faster than anywhere else, it found that the empirical model continues to yield similar trends when extrapolated to other countries. (Case study)

- The paper explained that working-age people tend to trigger demand for housing because they typically build up assets during their prime years, and then consume their savings when they enter their senior years. "During the assetformation period, housing assets are considered to be a safe asset for people since they lose little value due to inflation, compared with savings. Houses may eventually be passed onto one's offspring or sold and the profits allocated to expenses in one's old age."
- It added: "In an economy comprising these two generations, if life expectancy continues to increase without the social welfare system developing to accommodate it, working-age people will act to reduce their current consumption in preparation for post-retirement life."

- This is how a longer life expectancy can cause a fall in the consumption level of society as a whole; in addition, because the elderly depend on those who work for a living, a larger elderly population would make the overall economy less active.
- DBS economist Irvin Seah said the research debunks the misconception that property prices are a one-way bet: "That assumption essentially forgets that demographics do have a significant impact and can eventually take a toll on residential prices." But other observers believe that immigration and offshore demand will create new demand to fill the gap left behind by the aged. (In fact, the report recommends that Japan start accepting more immigrants to arrest price declines.)

- Mizuho economist Vishnu Varathan said the report underaccounts for Singapore's position as an investment hotspot. He added that Singapore does not have very many cheaper housing alternatives such as cheaper rural farmland, so prices will tend to be stickier and better supported.
- He also pointed out that it is slightly tricky to predict where the dependency ratio will be in 30 years because a large part of Singapore's population is inorganic. Permanent residents and non-residents make up about two-fifths - nearly half - of Singapore's population, for instance, which makes simple extrapolation from the current population make-up difficult.

- The study, referring to economies outside Asia, predicts that the dependency ratio will rise from about 20 per cent to 40 per cent in Oceania and North American countries.
- But the impact on residential prices are "not as serious" in these countries because their populations are expected to grow 20 to 30 per cent.
- In European countries, the dependency ratio is expected to rise from between 20 and 30 per cent to between 30 and 50 per cent, leading home prices to fall. The declines are mostly capped at 20 per cent, but could be deeper in Germany, the population of which is ageing and shrinking; prices there could plunge more than 40 per cent.

2. HYPOTHESIS and THEORY

- Walter R. Borg has firmly believed that a <u>hypothesis reflects</u> <u>the research worker's guess</u> as to the probable outcome of his experiment and they play clear and specific goals before the researcher and provides him with <u>a basis for studying</u> <u>samples and research procedures to meet these goals</u>".
- R.Cauvery et al (2000), "Research Methodology" Chapter 4 & 5.

(1) Hypothesis

- The term *hypothesis* has several meanings.
- →It may be taken to mean a *possibility*, a *supposition* or an *assumption*. In general it is taken as a proposal to accept something as true. It may prove to be correct or incorrect.
- A hypothesis is not the same as *theory* though it is very closely related to theory.

- As William H. George has rightly put it <u>theory is elaborate</u> <u>hypothesis</u>. The hypothesis actually emerges from the theory.
- A hypothesis if verified becomes a theory. It is a **generalisation drawn from the theory itself** and when it has been tested and found correct it becomes a part to the theory itself.
- Thus <u>theory itself in its early stages forms a hypothesis</u> and the two are interdependent upon each other. Origin of Hypothesis The changes in socio economic relations, human behavior, values and attitudes provide simple scope for identification of hypothesis.

(2) The use of theory and theoretical concepts

- Although real estate studies emphasizes practical business problems, you must incorporate into the study some <u>theoretical ideas and concepts</u>.
- \rightarrow In theory-driven research you pay a lot of attention to theoretical concepts right at the beginning of the study.
- In *data-driven research* you build the relationship between theoretical concepts and your data at later stages of the project. It is often helpful to make a distinction between theory (theoretical ideas and concepts) and prior research (studies dealing with empirical data).

- The first view emphasizes the relevance of <u>'grand' theory</u>, which is both consistent and stable and widely known and adopted among researchers.
- \rightarrow This type of theory development takes place through small steps and setting of <u>hypothese</u>s and <u>propositions</u>.
- The other conception of theory emphasizes the social nature of all scientific activity. Here, theory is defined in a more flexible way; it consists of preliminary and changing *assumptions* that direct the way of doing research.



R.Cauvery et al (2000), "Research Methodology" Chapter 5.



R.Cauvery et al (2000), "Research Methodology" Chapter 5.



R.Cauvery et al (2000), "Research Methodology" Chapter 5.



R.Cauvery et al (2000), "Research Methodology" Chapter 5.

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R.Cauvery et al (2000), "Research Methodology" Chapter 5.










3. LITERATURE SURVEY

- Novice researchers sometimes think that making a quantitative or qualitative research project is an excuse to be ignorant about what other researchers have said about the issues under study. Some may even think that, when making a quantitative or qualitative study, you do not need to use theoretical concepts to inform your study.
- This is not true. For any researcher, it is impossible to say anything of scholarly interest if you do not relate your findings, ideas and conclusions to what was already known prior to your study.
- P.Eriksson and Anne Kovalainen (2016), "Qualitative Methods in real estate studies" 2nd edition. Chap 4

- The terms '*research literature*' or just '*literature*' refer to the body of research, both theoretical and empirical, that you must consult in order to develop, understand, investigate and evaluate your research ideas and the finished product.
- \rightarrow At least 10 papers at Tutorial 1.

(1) Positioning the study through literature

- Find and read other's work throughout your research process →The idea is to clarify and sharpen your research questions during the research process.
- Theories, theoretical concepts, and research findings that you read about will assist you with *positioning your study in relation to prior knowledge*.

 \rightarrow This positioning takes place with the help of prior research and through the development of your own research questions.

(2) The relevance of a literature review

- This literature is published in *books, scholarly journals, electronic databases, and other outlets* and you can have access to it through the library and the Internet.
- In order to generate, develop and refine your research idea, you need to know what <u>other researchers have written</u> <u>about the topic of your research project</u>.
- Additionally, to be able to perform good research, you must be **aware of the current knowledge** in your topic area.

(3) The purpose of a literature review

- The purpose of a literature review is to explore, <u>summarize</u>, <u>compare, and critically analyze</u> what has been written by other researchers about the topic of your research.
- In writing the literature review, the purpose is to explore what knowledge and ideas have been established on a topic, what approaches and viewpoints have been adopted, and what are their <u>strengths and weaknesses</u>.

→See. Paper

(4) Identifying keywords

- To be able to effectively search for the literature you need to generate '*key words*' that are related to your research topic and research questions.
- If you find one particularly <u>relevant and recent article or</u> <u>research book</u> on your topic, then you can find <u>a long list of</u> <u>good references</u> from this single source. This is why the best method for literature search is to start from the most recent sources and work backwards.

 \rightarrow Two basic search strategies, identifying either key words or citations, help you in making a literature search.

• \rightarrow At least 5 keywords at Tutorial 1.

Green Luxury Goods? The Economics of Eco-Labels in the Japanese Housing Market

FRANZ FUERST * and Chihiro Shimizu †

30.DECEMBER, 2015

Key Words :Green building; green label; hedonic approach; offer price; bid price; market price function; omitted variable bias.

JEL Codes : G51; M14; D92

Fuerst, F and C. Shimizu (2014), "The Rise of Eco-Labels in the Japanese Housing Market," RERC(Real Estate Research Center) Working Papers No. 04/2014, Department of Land Economy, Environment, Law & Economics, Cambridge University. Journal of Japanese and International Economy, forthcoming..

Find literature with keywords





(2) NUS Library- Method 1: Simple search

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... Abstract As interest grows in environmentally friendly buildings, or "green buildings," the real estate industry is expected to play an increasingly active...

Journal Article: Full Text Online



3. Low impact building: housing using renewable materials

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NUS: Research Methodology

(2) NUS Library: Method 1

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	As interest grows in environmentally friendly buildings, or "green buildings," the real- realization of a low-carbon society. Various efforts toward such a society are current socially desirable level of green buildings via the market mechanism the economic v	estate industry is expected to play an increasingly active role in the tly being promoted vigorously within an international framework. To supply a value of oreen buildings (as measured by the market) must be commensurate	U 添加至州选亲日 Library FAQs
	with the required investment. Many remain sceptical, however, about the true econo	mic value of green buildings. A thorough analysis has yet to be conducted to	包含共享参考文献的文档 (272)

cshimizu@nus.edu.sg

(2) NUS Library- Method 2: by Databases

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(2) NUS Library: Method 2

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	 Green Luxury Goods? The Econ Journal of the Japanese and Internation Franz Fuerst, Chihiro Shimizu Abstract Research highlights 	omics of Eco-Labels in the Japanese Housing M nal Economies, In Press, Accepted Manuscript, Available	larket Original Research Article online 15 January 2016	
	 Pitfalls in the Economic and Economic and Economic Article <i>Measures</i> Original Research Article <i>Energy Procedia, Volume 78, November</i> W. Ott, R. Bolliger Abstract PDF (313 K) 	logical Evaluation of Energy Related Building Rel er 2015, Pages 2340-2345	novation Strategies and	Open Access 🧮
	 The nascent market for "green" r European Economic Review, Volume 5 Siqi Zheng, Jing Wu, Matthew E. Ka Abstract Graphical abstract 	eal estate in Beijing Original Research Article 56, Issue 5, July 2012, Pages 974-984 ahn, Yongheng Deng DPF (437 K)		
	Economic returns to residential g Regional Science and Urban Economic Yongheng Deng, Jing Wu	green building investment: The developers' persp cs, Volume 47, July 2014, Pages 35-44	ective Original Research Article	

There are too many issues and methods to be covered within one lesson, but any other concerns?

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Macroeconomic Dynamics, 19, 2015, 1659–1714. Printed in the United States of America. doi:10.1017/S1365100514000042

RESIDENTIAL PROPERTY PRICE INDICES FOR TOKYO

ERWIN DIEWERT University of British Columbia and University of New South Wales

CHIHIRO SHIMIZU Reitaku University and University of British Columbia

Diewert, E. and C. Shimizu (2015), "Residential Property Price Indexes for Tokyo," *Macroeconomic Dynamics*, 19, 1659-1714.

Asian Economic Journal 2015, Vol. 29 No. 4, 325-345

Semiparametric Model of Hedonic Housing Prices in Japan*

Koji Karato, Oleksandr Movshuk and Chihiro Shimizu

Received 27 August 2013; accepted 26 May 2015

Karato, K, O. Movshuk and C. Shimizu (2015), "Semiparametric Estimation of Time, Age and Cohort Effects in An Hedonic Model of House Prices," *Asian Economic Journal*, 29(4), 325–345.

Journal of Property Research, 2015 http://dx.doi.org/10.1080/09599916.2015.1059875



Estimating quality adjusted commercial property price indexes using Japanese REIT data

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Shimizu, C., W. E. Diewert, K. G. Nishimura and T. Watanabe (2015), "Estimating Quality Adjusted Commercial Property Price Indexes Using Japanese REIT," Journal of Property Research, 32(3), 217-239.

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- \rightarrow Diewert and Shimizu (2015)
- Karato, K, O. Movshuk and C. Shimizu (2015)
- \rightarrow Karato, Movshuk and Shimizu (2015)
- Shimizu, C., W. E. Diewert, K. G. Nishimura and T. Watanabe (2015)
- \rightarrow Shimizu, *et al* (2015),

According to Kotchen (2006)[15], green markets can principally be understood as a form of a private provision of a public good and as such can have either beneficial or detrimental effects depending on technology, individual wealth levels and the initial level of the public good. This proposition has been evaluated empirically, for example by Jacobsen, Kotchen and Vandenbergh (2012)[20] in the context of residential electricity demand.

Despite these apparent obstacles, the existing evidence of the residential market points to a significant green premium. An early study by Dian and Miranowski (1989)[4] showed that increasing energy efficiency increases housing prices. Banfi et al. (2005)[1] have published research findings indicating that rental housing tenants are prepared to pay up to 13% higher rent for buildings that have adopted energy-saving measures. Similarly, Fuerst et al (2013)[11] found a price effect of higher energy performance in the British housing market for a large sample of sales transactions in the 1995-2011 time period, indicating a 14% premium of the highest band of the Energy Performance Certificate (EPC) over the lowest band. They also find that this effect tends to be larger for terraced dwellings and flats compared to detached and semi-detached houses. Earlier, Brounen and Kok (2011) 2] had examined the relationship between EPC ratings and sale price for 31,993 residential sale prices in 2008-9 in the Netherlands and report significant premiums for more energy-efficient buildings. Although their dataset contains a large number of control variables, the adoption rate of EPCs in the Dutch housing market was relatively low at the time (7-25% depending on the year) which may limit their findings. Similarly, Zheng and Kahn (2008)[28] and Zheng, Kahn and Deng (2012)[29] find significant price premia for 'green' properties in the Chinese housing market and a study by Deng, Li and Quigley (2012)[3] finds substantial economic returns to green buildings in Singapore. Kok and Kahn (2012)[16] as well as Hyland et al (2013)[13] arrive at

References:

- P.Eriksson and Anne Kovalainen (2016), "Qualitative Methods in real estate studies" 2nd edition. Chap 4
- R.Cauvery et al (2000), "Research Methodology" Chap 3&4.

Today's Case:

• Aging and Real Estate Prices -Evidence from Japanese and US Regional Data-

1 Motivations

- Aging in Japan are advancing faster than in other major developed nations, and this is expected to have substantial effects on the country's economic systems, including its social security system.
- The shrinking of Japan's birth rate, aging of its society, and declining of its population
- \rightarrow Real Estate Market

Aging and Real Estate Market

- What kind of effect will the falling birthrate, aging society, and declining population have on the real estate market?
- Will the often mentioned real estate price asset meltdown really occur?
- →How much demographic factors affected real estate prices in Japan and the U.S. ?

2 Empirical Method and Data 2.1 Empirical method

Nishimura (2011), Nishimura and Takáts (2012), Takáts (2012)

$$\Delta \ln P_{it} = \alpha + \beta \Delta \ln G D P P C_{it} + \gamma \Delta \ln O L D D E P_{it} + \delta \Delta \ln T P O P_{it} + \varepsilon_{it}$$
(1)

GDPPC is per capita GDP,

- OLDDEP is the old age dependency ratio, which is defined by the ratio of population aged 65+ to the working population (i.e. population aged 20-64),
- TPOP is total population.

The disturbance term is represented by ϵ_{it} .

2.2 Data

- Regional real estate price data.
- US: the Office of Federal Housing Finance Agency (FHFA).

• Japan:
$$\ln p_{jt} = \sum_{k=0}^{K} \beta_k X_{jkt} + \sum_{s=0}^{\tau} \delta_s D_s + v_{jt},$$
 (2)

 p_{jt} the nominal land price for a property i in year t

- X_{jkt} the attributes associated with property *i*
- D_s time dummy,
- ϵ_{it} disturbance term.

Table1: Hedonic Regressions of Real Land Prices

Prefecture	Constant term	Acreage	Building to land ratio	Floor area ratio	Distance to nearest station	Distance to major urban center	Time dummy	Adj. R- squared	N.Obs
Hokkaido	9.882	-0.890	1.370	-0.070	-0.025	0.000	YES	0.246	27,225
Aomori	10.021	-0.902	6.759	0.351	-0.024	-0.003	YES	0.335	5,456
Iwate	10.069	-1.012	1.783	0.958	0.006	-0.010	YES	0.505	3,528
Miyagi Kataga Vanata Saitama	10.588 111 103 11.362	-0.913 -0.582 -0.582	0.028 4523 11533 0.057	-0.359 343 0.589	-0.050 §½ -0.075	0.000 -0.029	YES 業員業 YES	0.357	11,559 ·홍 갑기 31,476
Chiba	11.334	-0.870	1.676	0.049	-0.148	-0.015	YES	0.573	30,689
Tokyo	11.192	0.742	3.870	1.920	-0.217	0.000	YES	0.663	55,352
Kanagawa ¹ Vilionana ¹ Vilionana ¹ Viliona ¹ V				-0.710 -0.7455346555555555555555555555555555555555			YES		45,665 5,524,525,525,525,525,525,525,525,525,52
Fukuoka Naga Nagasaki Kumamoto Miyazaki Miyazaki Kagoshima Okinawa	9.830 9.936 9.268 9.268 9.268 9.268 10.114 11.020 10.728	0.005 -0.574 -0.011 -0.011 -0.011 -0.011 -0.011 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.005 -0.005 -0.574 -0.025 -0.025 -0.574 -0.025 -0.574 -0.025 -0.574 -0.025 -0.574 -0.025 -0.574 -0.025 -00	1.683 -1 3/3 -1 177 -1 177 -1 0×4 -2.026	0.301 0.40/ 0.463 -0.848 1.020	-0.076 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.056	0.000 -11112 -11112 -11114 -11114 -11114 -11114 -11114 -11114 -11114 -11114	YES YES YES YES YES	0.367 0.479 0.677 0.783 0.368 0.594	19,827 2,429 2,634 2,534 3,703

Note: The explained variable is the natural logarithmic value of land price. The indicated acreage, building-to-land ratio, floor area ratio, distance to nearest station, and distance to major urban center coefficient estimate values are multiplied by 1,000.

Real House prices by states (U.S.)



Source: Office of Federal Housing Enterprise Oversight, "House Price Index", U.S. Census of Bureau, "Census of Housing: Median home value."

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Real land prices by prefectures (JPN)



Source: Ministry of Land, Infrastructure, Transport and Tourism "Published Land Prices"

Table2: Sources of Employed Data

	Japan	U.S.
Data format	Prefectural panel data	State panel data
Data period	1976 to 2010	1975 to 2011
Housing price	Estimated hedonic function based on Ministry of Land, Infrastructure, Transport and Tourism "Land Price Data (Residential Land)," we set data for representative locations by prefecture and estimated quality-adjusted public land prices (amount base) using estimated hedonic function	We estimated state-by-state quality-adjusted housing prices (amount base) using Federal Housing Finance Agency "All-Transactions Indexes" rates of change and "Summary Statistics for House Prices" price median values
Income	Prefectural income based on the Cabinet Office's "Prefectural Economic Accounts" (linked using price comparisons at base points in time)	U.S. Department of Commerce, "Bureau of Economic Analysis" GDP by state (Chained by price ratio between base periods)
Interest rate	National value from Bank of Japan's "Average Contractual Interest Rate on Bank Loans" (synthesized rate for all Japanese banks)	Federal Reserve Board, "Contract Rate on 30-Year, Fixed-Rate Conventional Home Mortgage Commitments" (National)
Consumer price index	Consumer price index by prefectural capital (synthesized) from Statistics Japan's "Consumer Price Index"	United States Department of Labor, "Bureau of Labor Statistics" CPI (All Items) by state
New housing supply	New housing starts (total number for owned homes, rental homes, issued housing, and condominiums) from the Ministry of Land, Infrastructure, Transport and Tourism's "Statistical Survey of Construction Starts"	U.S. Census, "Building Permits Survey," New Privately-Owned Housing Units Authorized by Building Permits by state
Population by age group	Based on 'national census(population ratios by five- year age groups), Ministry of Internal Affairs and Communications calculated population figures by multiplying these ratios by the population, demographics, and household data based on the Basic Resident Register	U.S. Census, "State Population Estimates" Population by age and state

2.3.Demographic Changes: Dependency Ratio and Old age dependency ratio

- Nishimura (2011)
- **Dependency Ratio** = $\frac{aged \ 0-19 \ and \ 65+,}{population \ aged \ 20-64}$
- (3a)

- Takáts (2012)
- Old age dependency Ratio = $\frac{aged 65+}{population aged 20-64}$

Figure 3a: Real Estate Prices and Demographic Changes in Key Regions: Japan



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Figure 3b: Real Estate Prices and Demographic Changes in Key Regions: US



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3 Empirical Results 3.1 Tests on unit root

$$y_{it} = \rho_i y_{it-1} + \theta_{mi} d_{mt} + \epsilon_{it}$$

$$d_{it} = \{0\}, \quad d_{2t} = \{1\}, \quad d_{3t} = \{1, t\}$$

$$i = 1, 2, \dots, N \quad t = 1, 2, \dots, T \quad m = 1, 2, 3$$

$$\Delta y_{it} = \delta_i y_{it-1} + \sum_{k=1}^{L_i} \gamma_{ik} \Delta y_{it-k} + \theta_{mi} d_{mt} + \epsilon_{it}$$

The common unit root test proposed by Levin, Lin and Chu's (2002) is a unit root test that assumes regions have *a common unit root*, and the null and the alternative are given by

$$H_0 : \delta_i = \delta; \quad H_1 : \delta_i = \delta < 0$$

• The individual unit root test proposed by Im, Pesaran and Shin (2003) and Maddala and Wu (1999) is a unit root test that assumes *the unit roots differ between regions*. The null and the alternative hypotheses are given by

$$H_0:\delta_i=0 \qquad i$$

and

$$H_{1} : \delta_{i} \begin{cases} <0, & \text{for } i = 1, 2, \dots, N_{1} \\ =0, & \text{for } i = N_{1} + 1, N_{1} + 2, \dots, N \end{cases}$$
Table3: Unit Root Test

			Star	ndard		One-period lag				
Region	Variables	Common Un	it Root	Indivuc	lial Unit Root	Commo	on Unit Root	Indivudial Unit Root		
		Levin, Lin ar	d Chu	AD	F - Fisher	Levin,	Lin and Chu	ADF - Fisher		
Japan	Housing price (real value)	-5.7 (0.00)) ***	123	(0.03) **	-12.9	(0.00) ***	333	(0.00) ***	
	Income (real value)	-10.5 (0.0)) ***	144	(0.00) ***	-23.9	(0.00) ***	591	(0.00) ***	
	Old dependency ratio	0.6 (0.72	2)	24	(1.00)	-3.1	(0.00) ***	94	(0.47)	
	Total population	0.1 (0.5.	3)	99	(0.34)	-4.3	(0.00) ***	89	(0.62)	
	Interest rate (real value)	-12.2 (0.0)) ***	285	(0.00) ***	-47.0	(0.00) ***	1347	(0.00) ***	
	New housing supply	5.3 (1.0))	50	(1.00)	-33.6	(0.00) ***	1011	(0.00) ***	
U.S.	Housing price (real value)	-6.9 (0.0)) ***	209.4	(0.00) ***	-9.1	(0.00) ***	379	(0.00) ***	
	Income (real value)	-3.4 (0.0)) ***	50.8	(1.00)	-19.5	(0.00) ***	701	(0.00) ***	
	Old dependency ratio	-4.3 (0.0)) ***	-6.3	(0.02) **	-4.2	(0.00) ***	-7	(0.00) ***	
	Total population	-2.7 (0.0)) ***	84.9	(0.89)	-18.6	(0.00) ***	547	(0.00) ***	
	Interest rate (real value)	-2.8 (0.0)) ***	230.7	(0.00) ***	0.0	(0.00) ***	786	(0.00) ***	
	New housing supply	-3.6 (0.0)) ***	225.1	(0.00) ***	-18.2	(0.00) ***	536	(0.00) ***	

Note: The figure in each field represents the test statistic (P value). "***" indicates that the null hypothesis is dismissed at a 1% level of significance, "**" at a 5% level of significance, and "*" at a 10% level of significance. The ADF test lag order was selected based on the SIC criterion. The formulation used in the test was a model including a constant term.

3.2 Tests on Cointegration1

- The Kao test proposed by Kao (1999),
- \rightarrow Cointegration relationship in each region is *identical*.
- The Pedroni test proposed by Pedroni (1999)
- → Cointegration relationship is *heterogeneous* across regions

$$\Delta \hat{e}_{it} = \mu_i \hat{e}_{it-1} + \sum_{k=1}^{L_i} \varphi_{ik} \Delta \hat{e}_{it-k} + \epsilon_{it}$$
Kao test:
H₀ : $\mu_i = \mu = 0$ H₁ : $\mu_i = \mu < 0$
Pedroni test:

Table 4: Cointegration Tests

Region	Kao test	Pedroni test								
	ADF	Panel rho	Panel ADF	Group rho	Group ADF					
Japan	-5.8 (0.00) ***	0.3 (0.63)	-4.1 (0.00) ***	2.7 (1.00)	-7.2 (0.00) ***					
U.S.	0.0 (0.00) ***	-0.8 (0.22)	-4.2 (0.00) ***	1.8 (0.97)	-4.3 (0.00) ***					

Note: The figure in each field represents the test statistic (P value). "***" indicates that the null hypothesis is dismissed at a 1% level of significance, "**" at a 5% level of significance, and "*" at a 10% level of significance. The ADF test lag order was selected based on the SIC criterion.

The presence of conintegration relationship among the four variables.

→Error Correction Model

(Granger's representation theorem; Engle and Granger (1987)).

Regression Model

- Four variables are cointegrated
- →Error Correction Model

$$\Delta \ln P_{it} = a_{mi} + b_{1m} \Delta \ln \text{GDPPC}_{it} + b_{2m} \Delta \ln \text{OLDDEP}_{it}$$
$$+ b_3 \Delta \ln \text{TPOP}_{it} + b_4 \text{ECT}_{it-1} + v_{it}$$

$$ECT_{it} \equiv \ln P_{it} - (\alpha_{mi} + \beta_{1m} \ln GDPPC_{it} + \beta_{2m} \ln OLDDEP_{it} + \beta_{3m} \ln TPOP_{it})$$

Table5: Baseline Regressions

	No. of observa tions	Adj. R2	GD	P per ca	pita	Old dep	endency	ratio	Tota	popula	tion		EC term	
Japan	1,645	0.629	0.2188	0.0000		-1.3167	0.0000		0.9177	0.00		-0.1033	0.00	
Standard error/t value			0.058	/	3.7	6 0.186	/	-7.06	0.290	/	3.17	0.009	/	-11.33
U.S.	1,836	0.439	0.4515	0.0000		-0.9067	0.0000		0.7514	0.00		-0.1272	0.00	
Standard error/t value			0.042	/	10.6	6 0.116	1	7.79	0.116	/	6.46	0.010	/	-12.29

The coefficient on per capita GDP : Japan 0.2188, US 0.4515, Takáts:0.8842. Old age dependency ratio: Japan -1.3167, US -0.9067, Takáts:-0.6818. Total population:

Japan 0.9177, U.S. 0.7514, Takáts: 1.0547.

Figure 4a: Decomposition of Land Price Changes over 1976-2010



Figure 4b: Decomposition of Land Price Changes over 1976-1990



Real land price growth: +7.3 percent Economic growth: Demographic changes: -2.9 percent

+0.6 percent

Figure 4c: Decomposition of Land Price Changes over 1991-2010



- Real land price growth: -3.4 percent Economic growth: Demographic changes: -4.2 percent
- -0.1 percent

Table6a: Robustness Check Japan

Model	No. of observations	Adj. R2	GDP per	capita	Old aş depende ratio	ge ncy	Tota populat	ll tion	Time fixed effect	Local fixed effect
Japan										
Base model: BM	1,645	0.629	0.2188	* * *	-1.3167	***	0.9177	***	Yes	None
without time fixed effect	1,645	0.159	0.4401	* * *	-1.9702	* * *	2.5376	* * *	None	None
with local fixed effect	1,645	0.621	0.2302	* * *	-1.7280	* * *	2.0220	* * *	Yes	Yes
with local fixed effect and	1 645	0 182	0 3801	* * *	2 2071	* * *	1 0806	* * *	None	Vac
without time fixed effect	1,045	0.162	0.0071		-2.2071		4.0000		None	105
without EC term	1,645	0.602	0.1468	* *	-1.0790	* * *	0.8333	* * *	Yes	None
BM+ Interest rate	1,598	0.629	0.1433	* *	-1.4071	***	1.0508	***	Yes	None
BM + New housing supply	1,645	0.627	0.2297	* * *	-1.2701	* * *	1.1372	* * *	Yes	None
BM + interest rate + new	1 509	0.620	0.1664	* * *	1.2688	***	1 2517	***	Var	Nono
housing supply	1,398	0.029	U.1004		-1.30/5		1.2517		res	Inone
BM + interest rate + new	1 509	0 629	0.0000		1 2560	***	1 10/1	***	Vac	Nono
housing supply (1 period lag)	1,398	0.028	0.0890		-1.3309		1,1941		ies	Inone

Table6b: Robustness Check U.S.

Model	No. of observations	Adj. R2	GDP per	capita	Old age dependency ratio		Total population		Time fixed effect	Local fixed effect
U.S.										
Base model: BM	1,836	0.439	0.4515	* * *	-0.9067	* * *	0.7514	***	Yes	None
without time fixed effect	1,836	0.247	0.5874	* * *	-1.1576	* * *	0.6163	***	None	None
with local fixed effect	1,836	0.454	0.4525	* * *	-0.5363	* * *	1.8079	***	Yes	Yes
with local fixed effect and	1,836	0.263	0.5847	* * *	-1.2666	* * *	0.8503	***	None	Yes
without time fixed effect	_,									
without EC term	1,836	0.394	0.4714	***	-0.7821	***	0.8222	***	Yes	None
BM+ Interest rate	1,783	0.449	0.4415	* * *	-0.9375	***	0.7385	* * *	Yes	None
BM + New housing supply	1,834	0.459	0.3819	* * *	-0.7824	* * *	0.6308	***	Yes	None
BM + interest rate + new	1 783	0 468	0 3725	* * *	-0.8128	* * *	0 6139	***	Ves	None
housing supply	1,705	0.100	0.0140		-0.0120	-0.0120			105	None
BM + interest rate + new	1 783	0 469	0 4555	* * *	-0 6489	* * *	0 4272	* * *	Ves	None
housing supply (1 period lag)	1,705	0.107	U.TJJJ		-0.0407		0.72/2		105	1 (one

4 Demographic Impact over the Next 30 Years

- Forecast the real land prices in Japan using the regression,
- The projection on demographic changes released by the **IPSS(National Institute of Population and Social Security Research).**
- Based on natural increases/decreases calculated from the survival probability and the number of births by cohort and social increases/decreases due to movement between regions.
- Population projections : **the medium variant projection**, which is based on the assumption of medium fertility, unless otherwise mentioned.

Figure 5: Historic and Forecasted Demographic Impacts on Land Prices



Table 8: Contribution of Demographic Changes EstimatedBased on IPSS and UN Population Projections

IPSS

	Low variant			Me	dium varia	nt	High variant		
	ТРОР	OLDDEP	Impact	ТРОР	OLDDEP	Impact	ТРОР	OLDDEP	Impact
2020	122,384,895	50.205%	-0.934%	124,099,925	53.256%	-1.097%	125,786,270	54.005%	-1.112%
2030	113,182,509	57.337%	-1.551%	116,617,657	58.692%	-1.559%	120,213,772	60.034%	-1.564%
2040	102,350,474	71.223%	-2.496%	107,275,850	71.716%	-2.411%	112,505,673	72.207%	-2.324%

United nations

	Low variant			Me	edium varia	nt	High variant			
	ТРОР	OLDDEP	Impact	ТРОР	OLDDEP	Impact	ТРОР	OLDDEP	Impact	
2020	123,068,714	52.728%	-1.083%	125,381,724	52.728%	-1.040%	127,694,735	52.728%	-0.998%	
2030	115,234,250	58.217%	-1.560%	120,624,738	58.217%	-1.455%	126,019,596	58.217%	-1.355%	
2040	106,182,068	73.393%	-2.510%	114,517,258	70.377%	-2.199%	122,988,034	67.598%	-1.902%	

5 Conclusion

- The demographic factor had a greater impact on real estate prices in Japan than in the U.S.
- We find that it will be -2.4 percent per year in 2010-2040 while it was -3.8 percent per year in 1975-2010
- Suggesting that aging will continue to have downward pressure on land prices over the next 30 years, although the demographic impact will be slightly smaller than it was in 1975-2010 as the old age dependency ratio will not increase as much as it did before.

Change rate of Population Growth: 2010-2035



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Change rate of Labor: 2010-2035 / Labor: 15-65



Change rate of Children / 0-14



Change rate of Up75 Population Growth: 2010-2035



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Table7: Contributions of Demographic Changes in 2011-2040

	With migra	tion		Without migrati	on	
	2020	2030	2040	2020	2030	2040
Hokkaido	-43.3%	-56.4%	-69.4%	-40.5%	-52.6%	-65.3%
A OMOTI IWALE NI IVALI A KILA Y AMAgala						
Fukushima	-40.9%	-55.9%	-67.1%	-33.1%	-45.3%	-54.5%
Saitama	-39.0%	-48.7%	-65.3%	-40.9%	-51.7%	-68.4%
Chiba	-41.0%	-50.7%	-66.3%	-40.8%	-51.1%	-67.3%
Tokyo	-25.1%	-38.1%	-60.5%	-34.3%	-50.7%	-72.2%
Kanagawa	-34.3%	-45.9%	-64.5%	-36.7%	-50.2%	-69.6%
Niloala Isnikawa Fuku Yamanasni Navano Snizuoka Aichi	-32.3%	-40.9%	-58.3%	-34.1%	-44.2%	-62.2%
Osaka	-35.5%	-44.5%	-63.2%	-35.4%	-44.3%	-63.1%
Hyogo	-35.7%	-46.0%	-62.2%	-35.3%	-45.2%	-61.2%
Nara	-40.2%	-51.3%	-65.3%	-37.1%	-47.0%	-60.6%
Wkayama	-36.0%	-48.9%	-63.2%	-32.4%	-42.8%	-55.5%
Fukuoka	-38.7%	-48.7%	-61.4%	-37.3%	-46.7%	-59.1%
Okinawa	-34.2%	-48.5%	-60.7%	-33.5%	-46.6%	-57.5%

Figure A1: Land Prices Forecasted



Figure A2: Land Prices Forecasted with the Assumption of No Inter-Prefectural Migration



Figure 6a: Contributions of Demographic Changes in 2011-2040



Figure 6b: Effects of Inter-Prefectural Migration on Demographic Impacts in 2011-2040



Announcements:

- Tutorial 1 begins on Jan 29th & Feb 5th.
- –Questions will be posted on IVLE
- Data Collection and Literature Survey.

References in RE3201:

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