

How Inheritance Affects the Real Estate Market in an Aging Economy: Evidence from Transaction and Registry data

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Workshop

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INTRODUCTION

Research question

- What is the impact of population aging on the real estate market?
 - Mankiw and Weil (1989) on “asset meltdown”
 - Exit of baby boomers in the US will reduce demand for real estate and thus decline prices by 47% in the next two decades
 - A number of studies that followed have produced mixed results
 - Positive: Takats (2012); Saita, Shimizu, and Watanabe (2016)
 - Slightly positive: Engelhardt and Poterba (1991); Hendershott (1991)
 - Negative: Hort (1998)
- However, the mechanism is not necessarily clear:
How aging affects the market
 - Which really matters, declining demand or increasing supply of properties offered for sale?

Literature on the identification issue

- Burgeoning literature on the identification between supply and demand in the realty market
 - Credit market deregulation: Favara and Imbs (2015)
 - Foreclosures: Campbell, Giglio, and Pathak (2011); Brunnermeier and Julliard (2008); Mian and Sufi (2009)
 - Geographical constraints: Saiz (2010); Hilber and Vermeulen (2016)
 - International capital flows: Aizenman and Jinjark (2009); Badarinsa and Ramadorai (2015); Miyakawa, Shimizu, and Uesugi (2016)
 - Death of realty owners: Campbell, Giglio, and Pathak (2011)

This paper

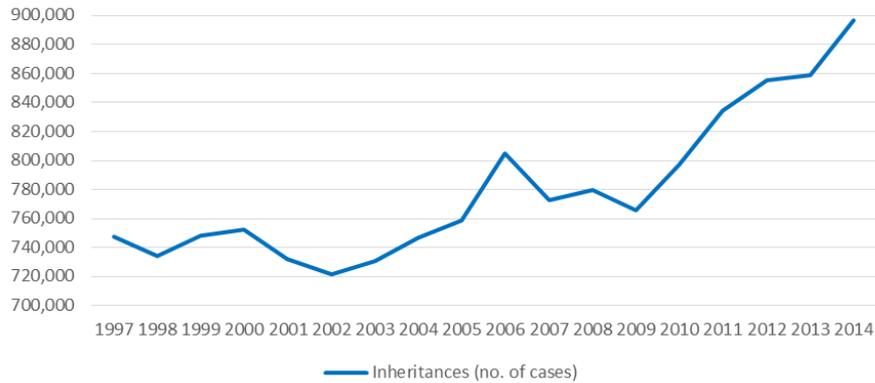
- Develops a novel and unique way of identifying the mechanism through which population aging affects the realty market
 - Focuses on the instantaneous impact of death and inheritance, the timing of which is difficult to predict
 - Exploits unique characteristics of the inheritance and capital gains taxes in Japan
 - Finds it beneficial for families with an aged realty owner and young prospective heirs to sell the property shortly after the aged owner dies and the young heirs inherit the property
- Thus identifies exogenous increases in the supply of real estate properties caused by owners' deaths and subsequent inheritances

The paper specifically examines

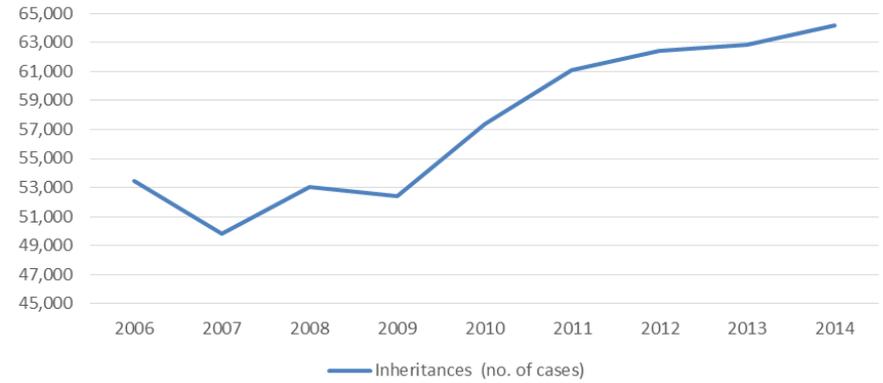
1. Whether properties whose owner has died and which are passed on by inheritance are more likely to be sold
2. The extent to which such exogenous supply-side pressure decreases realty prices
3. If the demand elasticity of real estate properties differs across subsamples

Number of inheritances in Japan

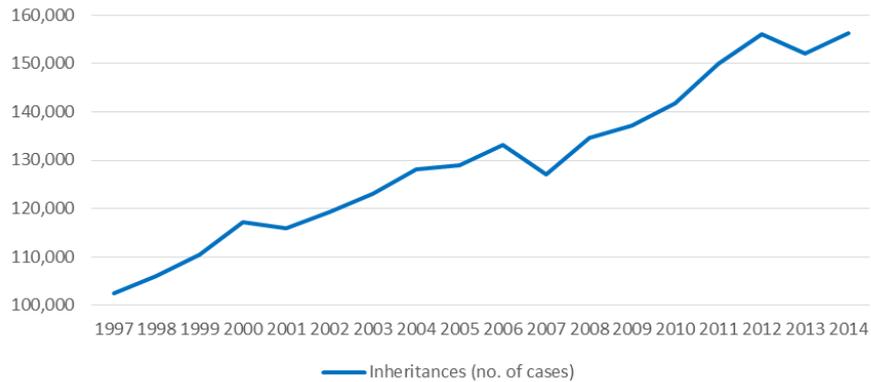
Nationwide (Land)



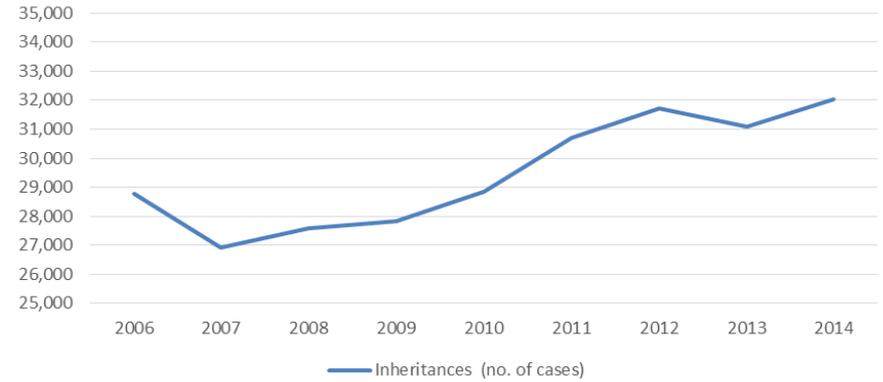
Tokyo (Land)



Nationwide (Buildings)

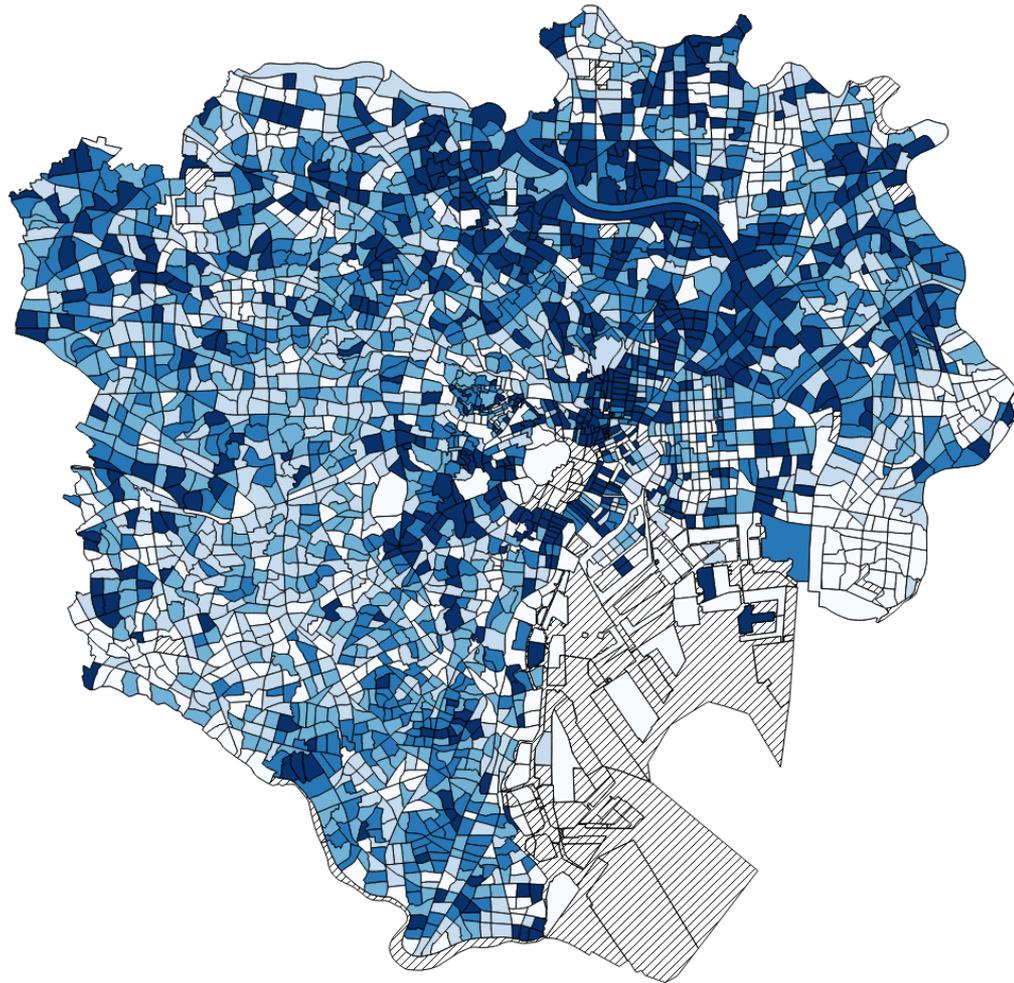


Tokyo (Buildings)



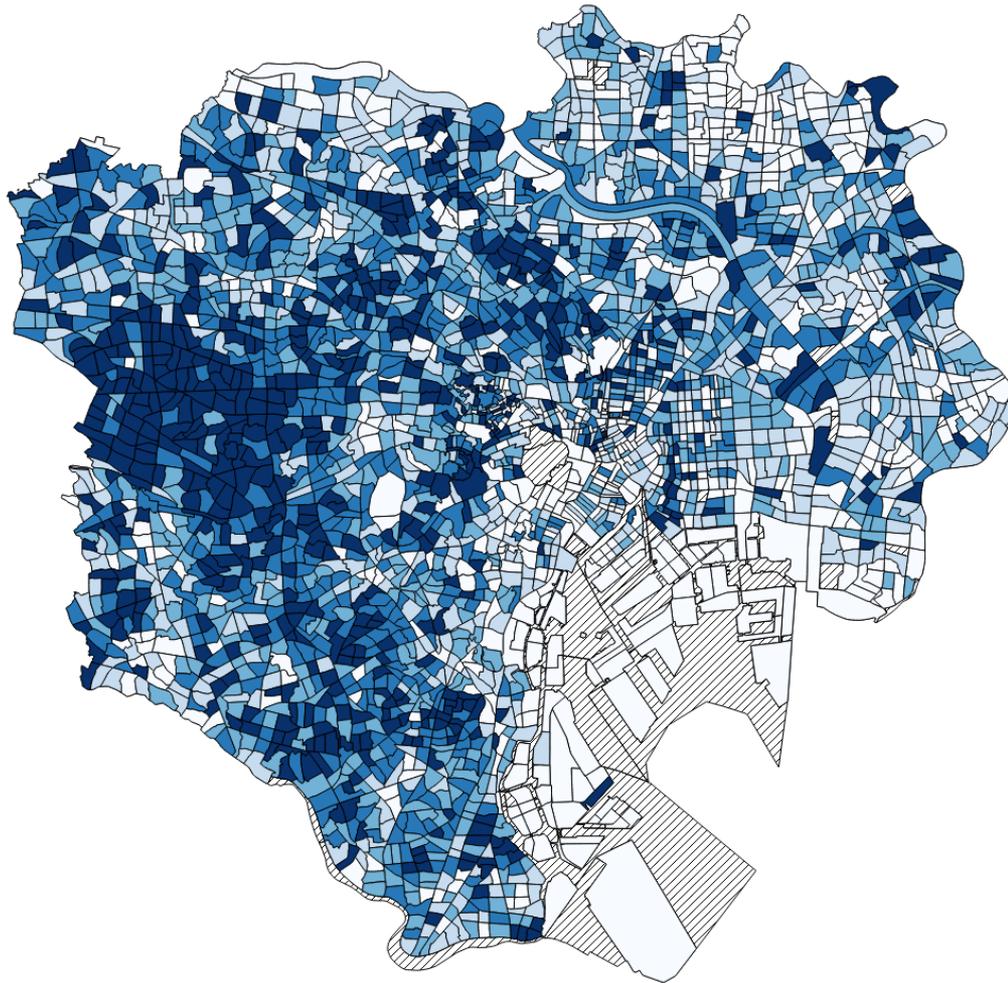
Aged population ratio (Tokyo in 2005)

(Ratio of the population aged 65 or above in a district to the total population in the district)

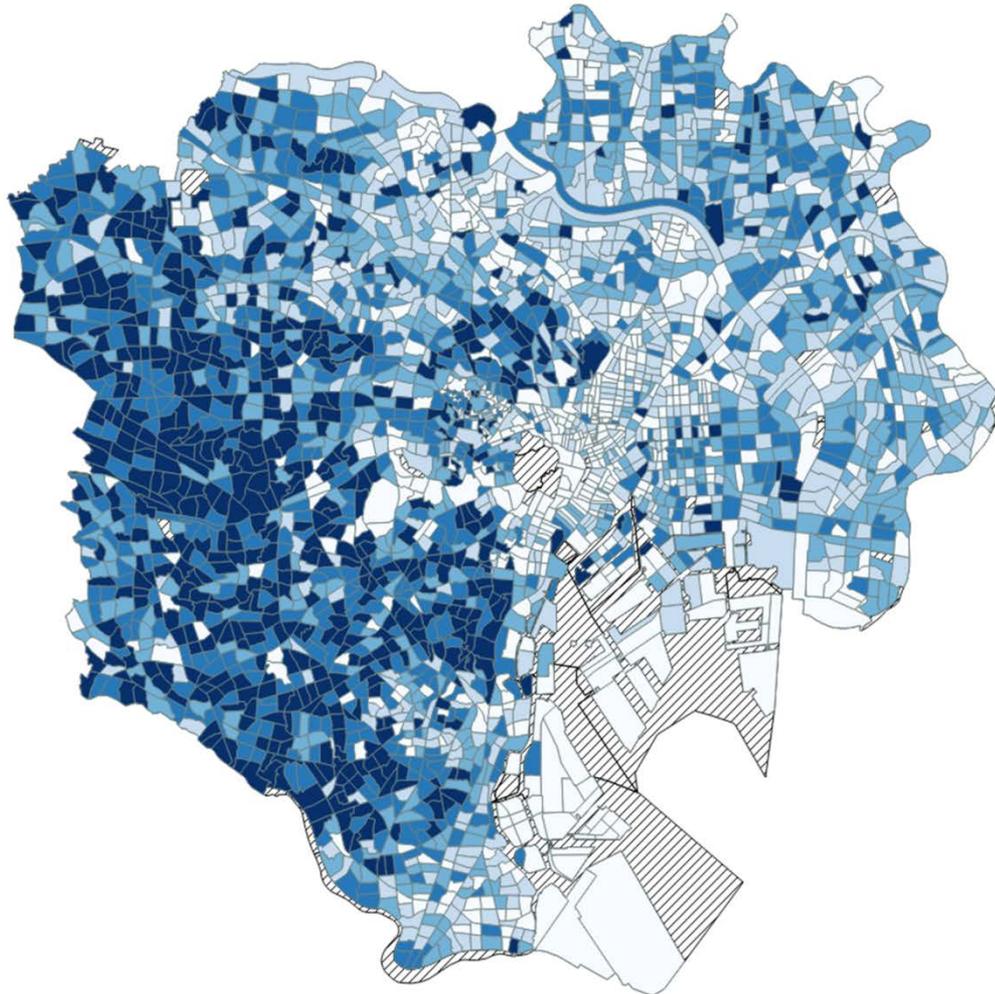


Incidence of inheritance (Tokyo in 2006-2008)

(Ratio of the number of unique real estate pieces that were passed on by inheritance during 2006-2008 to the number of unique real estate pieces for which registry information changed during the same period)



Density of real estate properties for sale (Tokyo in 2005)
(Ratio of the size of properties newly offered for sale in a district in a year to
the size of the district)



IMPACT OF INHERITANCE TAX SYSTEM ON THE TIMING OF REAL ESTATE SALES

Timing of real estate sales

- We consider the decision of a hypothetical family with two persons from different generations: an old and a young person
 - The old: owns a realty property
 - The young: expected to inherit the assets of the old
- The family chooses between the two options in order to maximize the amount of assets after the old dies:
 - (1) The old owner sell the property now and transfer the proceeds in the form of financial assets to the young heir when he dies
 - (2) The old owner holds the property until he dies and the young heir receives it as part of his inheritance and sells it

Inheritance tax system in Japan

- Unique characteristics of the inheritance and capital gains tax scheme
 - Differential treatment of real estate assets and financial assets in terms of how their tax base values are calculated
 - Deduction of the inheritance tax amount from realized capital gains (in case property is sold within three years after inheritance)

Inheritance tax system and timing of real estate sales

- An example:
 - Value of realty property that the old owns: JPY100million (assumed to be constant)
 - Inheritance tax rate: 30%
 - Capital gains tax rate: 20%
 - Tax base values to market values for inheritance tax: 60% (real estate property), 100% (financial assets)
 - The amount of assets the family keeps
JPY56million in case of (1) < JPY66million in case of (2)
- Thus, the family prefers (2) to (1): it holds the property and sells it shortly after the heir has inherited it rather than sell it when the old property owner is alive

EMPIRICAL APPROACH

Estimation framework

- Examine the relationship between realty prices and the number of properties for sale
- First, estimate the equation using OLS
- However, possibly biased estimates caused by omitted unobservable variables and/or reverse causality
 - Owners put their real estate properties up for sale in response to prices going up
- Hence, we employ two instruments for the variable representing properties for sale
 - The number of properties that were passed on through inheritance within a certain spatial area
 - Its interaction term with the average appraisal land value within the area

Model

- IV estimation for FOR_SALE variable

$$\begin{aligned}\text{Ln}(\text{FOR_SALE}(i,t)) &= \alpha + \beta_1 \text{INHERIT}(i,t-3,t) + \beta_2 \text{INHERIT} \times \text{APPRAISAL_AVG}(i,t) \\ &+ \psi X(i,t) \\ &+ \delta_j + \delta_t + \varepsilon(i,t)\end{aligned}$$

$$\begin{aligned}\text{Ln}(\text{PRICE}(i,t)) &= \gamma + \eta \text{Ln}(\text{FOR_SALE}(i,t)) + \xi X(i,t) \\ &+ \phi_j + \phi_t + e(i,t)\end{aligned}$$

where

i: property identification

t: Year-Month-Week

Expected signs of coefficients: $\beta_1 > 0$ and $\eta < 0$; β_2 may be positive/negative

Data

- Registry data (登記変更情報)
 - Information on changes in the status of each piece of real estate that is recorded in public registries
 - Information includes transfer of ownership due to
 - Sales/purchases
 - Inheritances
 - Foreclosures
 - Gifts
 - Establishment of new real estate properties
 - Division/merger of land pieces
 - Accompanied by the date when the change occurs and the location of each real estate property
 - The data cover the 23 wards of Tokyo for years 2000-2014
 - Hand-collected by JON, a private company that specializes in collecting registry information from local governments

Data

- Real estate transaction data (取引価格情報)
 - Real estate transaction information collected from a number of real estate agencies
 - Include information not only about the properties that are eventually sold but also about those that are only offered for sale by property owners
 - Three types of property: Land (土地), detached houses (一戸建), and condominiums (区分建物)
 - Offer sales price and date
 - Contract price and date
 - Address
 - Contract date
 - Other characteristics of real estate
 - Cover the 23 wards of Tokyo for years 2000-2014
 - Collected by Recruit Co. Ltd.

Data

- We merge these two data sources to construct dataset
- Two types of variables: district (called “chome” and there are 3,132 within 23 wards in Tokyo)-related and property-related variables
- District-related variables
 - INHERIT: Number of unique real estate pieces that were passed on by inheritance during the preceding three years / the number of unique real estate pieces for which registry information changed during the same period.
 - FOR_SALE1: Size of properties newly offered for sale in a district in a year / size of the district.
 - AGED: Population aged 65 or above in a district / total population in the district
 - APPRAISAL_AVG: Average appraised land prices in a district constructed from the *Public Notice of Land Prices*

Data

- Property-related variables
- For land
 - Land area
 - Number of minutes to the nearest subway station
 - Number of minutes to the Tokyo terminal station
 - Building-to-land ratio
 - Floor-to-land ratio
 - Width of the road the property faces
- For detached houses
 - Land area
 - Number of years since construction of the building
 - Floor area
 - Number of minutes to the nearest subway station
 - Number of stories of the real estate property
 - Number of rooms in the real estate property
 - Number of minutes to the Tokyo terminal station
 - Dummy for properties that are reinforced concrete structures
 - Building-to-land ratio
 - Floor-to-land ratio
 - Width of the road the property faces
- For condominiums
 - Number of years since construction of the building
 - Floor area
 - Number of minutes to the nearest subway station
 - Number of stories of the real estate property
 - Number of rooms in the real estate property
 - Number of minutes to the Tokyo terminal station
 - Dummy for properties that are reinforced concrete structures
 - Dummy for properties facing south
 - Floor on which the property is located

RESULTS

Summary statistics (Land:土地)

(a) Land

	n	Mean	S.D.	Min.	25%	Median	75%	Max.
Year	25677	2007	3.389	2002	2005	2007	2011	2013
PRICE	25677	628.5	247.3	6.132	455.6	593.8	751.5	1741
lnPRICE	25677	6.370	0.388	1.814	6.122	6.386	6.622	7.462
FOR_SALE1	25677	0.017	0.014	0	0.007	0.013	0.022	0.128
ln(FOR_SALE1)	25677	-4.443	0.918	-9.022	-4.942	-4.321	-3.811	-2.052
INHERIT	25677	0.052	0.017	0	0.042	0.052	0.061	0.136
AGED	25677	0.186	0.032	0.054	0.166	0.184	0.202	0.402
APPRAISAL_AVG	25677	560.7	358.2	147	426	515	607	10000
G_APPRAISAL_AVG	25677	-0.004	0.038	-0.166	-0.024	-0.01	0.01	0.517
LAND_AREA	25677	116.9	84.37	1	73	99.22	133.9	6164
DISTANCE_STATION	25677	8.642	4.407	0	5	8	11	36
DISTANCE_TOKYO	25677	30.31	7.259	5	26	31	35	126
BUILDING_RATIO	25677	0.547	0.135	0	0.5	0.6	0.6	1
FLOOR_RATIO	25677	1.61	0.834	0	1	1.5	2	9
ROAD_WIDTH	25677	4.887	3.541	0	3.8	4	5.7	72

Summary statistics

(Detached houses:一戸建)

(b) Detached houses

	n	Mean	S.D.	Min.	25%	Median	75%	Max.
Year	77747	2007	3.57	2002	2004	2007	2011	2013
PRICE	77747	585	150	0.538	479.5	579.3	677.8	1081
lnPRICE	77747	6.337	0.27	-0.62	6.173	6.362	6.519	6.985
FOR_SALE1	77747	0.012	0.01	0	0.005	0.009	0.015	0.087
ln(FOR_SALE1)	77747	-4.832	0.945	-10.24	-5.402	-4.722	-4.18	-2.441
INHERIT	77747	0.050	0.016	0	0.039	0.049	0.059	0.136
AGED	77747	0.187	0.034	0.054	0.167	0.186	0.205	0.402
APPRAISAL_AVG	77747	468.5	193.9	138	353	446	538	4100
G_APPRAISAL_AVG	77747	-0.008	0.031	-0.167	-0.025	-0.014	0.003	0.448
BUILDING_AGE	77747	3.508	7.864	0	0.083	0.25	0.75	87.92
FLOOR_AREA	77747	102.1	46.76	21.06	84.64	94.77	106.9	7535
LAND_AREA	77747	87.47	50.27	2	62.25	80.36	100.2	8060
DISTANCE_STATION	77747	9.51	4.913	0	6	9	13	63
HEIGHT	77747	2.351	0.704	0	2	2	3	25
ROOMS	77747	3.447	0.88	0	3	3	4	45
DISTANCE_TOKYO	77747	31.15	7.695	4	26	31	37	48
CONCRETE	77747	0.023	0.151	0	0	0	0	1
BUILDING_RATIO	77747	0.546	0.145	0	0.5	0.6	0.6	2.64
FLOOR_RATIO	77747	1.628	0.782	0	1	1.5	2	8.4
ROAD_WIDTH	77747	4.533	2.427	0	4	4	5.4	99.9

Summary statistics

(Condominiums: 区分建物)

(c) Condominiums								
	n	Mean	S.D.	Min.	25%	Median	75%	Max.
Year	52789	2009	3.599	2002	2006	2010	2012	2013
PRICE	52789	529.6	173	3.516	409.5	503.2	625.5	1198
lnPRICE	52789	6.220	0.327	1.257	6.015	6.221	6.439	7.088
FOR_SALE1	52789	0.007	0.007	0	0.002	0.005	0.009	0.071
ln(FOR_SALE1)	52789	-5.44	0.993	-10.12	-6.065	-5.361	-4.756	-2.645
INHERIT	52789	0.045	0.015	0	0.035	0.045	0.055	0.136
AGED	52789	0.176	0.036	0.054	0.155	0.176	0.196	0.402
APPRAISAL_AVG	52789	647.2	463.6	166	385	520	728.2	10000
G_APPRAISAL_AVG	52789	-0.008	0.043	-0.213	-0.033	-0.017	0.013	0.517
BUILDING_AGE	52789	21.00	12.15	0	9.75	21.42	31.33	68.33
FLOOR_AREA	52789	60.96	22.48	12.01	48.07	59.08	70.37	877.8
DISTANCE_STATION	52789	7.055	4.25	0	4	6	10	96
HEIGHT	52789	9.058	4.931	0	6	8	11	143
ROOMS	52789	2.211	0.887	0	2	2	3	51
DISTANCE_TOKYO	52789	26.65	8.136	1	20	26	33	48
CONCRETE	52789	0.595	0.491	0	0	1	1	1
SOUTH	52789	0.343	0.475	0	0	0	1	1
FLOOR_UNIT	52789	6.832	3.544	0	4	6	8	80

OLS estimation results

Variable	Dependent variable: ln(PRICE)		
	(1)	(2)	(3)
	Land OLS	Detached OLS	Condos OLS
ln(FOR_SALE1)	0.0157*** (0.00184)	0.00474*** (0.000754)	0.00694*** (0.000883)
AGED	0.0584 (0.0502)	-0.0741*** (0.0189)	0.0177 (0.0216)
BUILDING_AGE		-0.00733*** (8.03e-05)	-0.0147*** (6.86e-05)
FLOOR_AREA		-0.000827*** (1.60e-05)	0.000457*** (4.04e-05)
LAND_AREA	-0.000470*** (1.82e-05)	0.000887*** (1.47e-05)	
DISTANCE_STATION	-0.00946*** (0.000354)	-0.00262*** (0.000128)	-0.00755*** (0.000185)
HEIGHT		-0.0490*** (0.00125)	0.00337*** (0.000206)
ROOMS		-0.0105*** (0.000761)	0.00411*** (0.00106)
DISTANCE_TOKYO	-0.0109*** (0.000315)	-0.00395*** (0.000120)	-0.00753*** (0.000157)
CONCRETE		0.0819*** (0.00430)	0.0130*** (0.00172)
BUILDING_RATIO	0.00537 (0.0173)	0.176*** (0.00780)	
FLOOR_RATIO	0.0153*** (0.00315)	-0.0532*** (0.00141)	
ROAD_WIDTH	0.00773*** (0.000443)	0.00514*** (0.000271)	
SOUTH			0.00127 (0.00152)
FLOOR_UNIT			0.00735*** (0.000260)
Constant	7.434*** (0.0337)	7.222*** (0.0383)	6.811*** (0.0126)
Number of observations	25,677	77,747	52,789
R-squared	0.633	0.619	0.751
Year dummies	YES	YES	YES
Ward dummies	YES	YES	YES

IV estimation results

Variable	(1) Land First stage	(2) Land IV	(3) Detached First stage	(4) Detached IV	(5) Condos First stage	(6) Condos IV
ln(FOR_SALE1)		-0.246*** (0.0316)		-0.301*** (0.00862)		-0.159*** (0.00615)
INHERIT	4.541*** (0.377)		9.843*** (0.290)		6.189*** (0.310)	
INHERIT*APPRAISAL_AVG	-0.00295*** (0.000341)		-0.0194*** (0.000447)		-0.0104*** (0.000241)	
AGED	2.773*** (0.173)	0.867*** (0.118)	0.831*** (0.0914)	0.234*** (0.0345)	-0.331*** (0.109)	-0.0133 (0.0279)
BUILDING_AGE			-0.0109*** (0.000376)	-0.0109*** (0.000173)	0.00592*** (0.000333)	-0.0138*** (9.48e-05)
FLOOR_AREA			0.00108*** (7.52e-05)	-0.000546*** (2.93e-05)	0.00477*** (0.000195)	0.00121*** (5.90e-05)
LAND_AREA	0.000749*** (6.11e-05)	-0.000274*** (3.38e-05)	0.000550*** (6.92e-05)	0.00107*** (2.65e-05)		
DISTANCE_STATION	0.0283*** (0.00119)	-0.00213** (0.000999)	0.0208*** (0.000602)	0.00464*** (0.000303)	0.0337*** (0.000892)	-0.00138*** (0.000328)
HEIGHT			-0.0771*** (0.00588)	-0.0726*** (0.00230)	0.00330*** (0.00100)	0.00355*** (0.000266)
ROOMS			0.0199*** (0.00358)	-0.00457*** (0.00135)	0.000126 (0.00515)	0.00577*** (0.00137)
DISTANCE_TOKYO	0.00740*** (0.00107)	-0.00888*** (0.000483)	0.00332*** (0.000575)	-0.00159*** (0.000222)	0.0213*** (0.000755)	-0.00349*** (0.000250)
CONCRETE			0.0412** (0.0202)	0.0924*** (0.00759)	0.0685*** (0.00834)	0.0264*** (0.00228)
BUILDING_RATIO	0.437*** (0.0582)	0.124*** (0.0271)	0.772*** (0.0366)	0.406*** (0.0152)		
FLOOR_RATIO	-0.245*** (0.0105)	-0.0498*** (0.00888)	-0.269*** (0.00657)	-0.135*** (0.00337)		
ROAD_WIDTH	-0.00802*** (0.00150)	0.00542*** (0.000654)	0.0154*** (0.00127)	0.00985*** (0.000497)		
SOUTH					0.00230 (0.00738)	0.00191 (0.00197)
FLOOR_UNIT					-0.00276** (0.00126)	0.00702*** (0.000337)
Constant	-5.204*** (0.111)	6.023*** (0.175)	-5.006*** (0.180)	5.389*** (0.0847)	-7.086*** (0.0537)	5.527*** (0.0494)
Number of observations	25,677	25,677	77,747	77,747	52,789	52,789
R-squared	0.251	0.344	0.313	-0.188	0.365	0.585
Year dummies	YES	YES	YES	YES	YES	YES
Ward dummies	YES	YES	YES	YES	YES	YES

Summary of findings

First stage estimation

- Incidence of inheritance in a district has a positive effect on the density of properties for sale in the district ($\beta_1 > 0$)
- In areas of high realty prices, the extent that inheritance increases the density of properties for sale becomes small ($\beta_2 < 0$)

Second stage estimation

- Coefficients on $\ln(\text{FOR_SALE1})$ are negative ($\eta_1 < 0$) in IV estimation
inheritance $\uparrow \Rightarrow$ # of properties for sale $\uparrow \Rightarrow$ real estate prices \downarrow
- One percent increase in sales offer results in 0.16 to 0.30 percent decrease in realty prices
- Demand elasticity is rather high between 3.32 ($=1/0.301$) and 6.3 ($=1/0.159$)
- Coefficients on the variable for population aging (AGED) are positive/negative
aging in general $\uparrow \Rightarrow$ real estate prices?

Further examination

- Demand elasticity (inverse of η_1) may be different across markets
- (Absolute value of) demand elasticity may be high in markets with abundant substitutable real estate properties
- We divide the sample into two:
 - wards that increased permitted floor-to-land ratio (容積率) in 2005-2013
 - wards that decreased it
- We find mixed results
 - In the wards that relaxed land-use regulations, demand elasticity is higher for land than in the wards that tightened regulations
 - but lower for detached houses and condominiums

IV estimation results taking land use regulation into account

Variables	Wards that increased permitted floor-to-land ratio			Wards that decreased permitted floor-to-land ratio		
	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
	Land	Detached	Condos	Land	Detached	Condos
ln(FOR_SALE1)	-0.143*** (0.0319)	-0.389*** (0.0115)	-0.194*** (0.00794)	-0.572*** (0.0975)	-0.160*** (0.0111)	-0.129*** (0.00772)
AGED	0.576*** (0.118)	0.332*** (0.0434)	-0.0642** (0.0357)	1.947*** (0.454)	0.109 (0.0868)	0.215*** (0.0501)
BUILDING_AGE		-0.0123*** (0.000224)	-0.0139*** (0.000122)		-0.00749*** (0.000341)	-0.0138*** (0.000162)
FLOOR_AREA		-0.000501*** (3.64e-05)	0.000828*** (7.89e-05)		-0.00161*** (9.68e-05)	0.00203*** (8.96e-05)
LAND_AREA	-0.000423*** (2.93e-05)	0.00103*** (3.22e-05)		0.000953*** (0.000206)	0.00308*** (0.000119)	
DISTANCE_STATION	-0.00526*** (0.00100)	0.00638*** (0.000382)	0.000110 (0.000431)	0.0121*** (0.00409)	0.00255*** (0.000781)	-0.00157*** (0.000547)
HEIGHT		-0.0804*** (0.00295)	0.00460*** (0.000378)		-0.0221*** (0.00483)	0.00238*** (0.000393)
ROOMS		-0.000936 (0.00174)	0.0127*** (0.00186)		-0.0200*** (0.00271)	-0.00874*** (0.00215)
DISTANCE_TOKYO	-0.00939*** (0.000393)	-0.00171*** (0.000271)	-0.00348*** (0.000304)	0.00634 (0.00448)	0.000309 (0.000731)	-0.000701 (0.000477)
CONCRETE		0.104*** (0.0104)	0.0257*** (0.00302)		0.0636*** (0.0116)	0.0324*** (0.00370)
BUILDING_RATIO	0.0180 (0.0263)	0.551*** (0.0207)		0.0936 (0.105)	0.119*** (0.0278)	
FLOOR_RATIO	-0.000806 (0.00910)	-0.187*** (0.00495)		-0.165*** (0.0257)	-0.0384*** (0.00377)	
ROAD_WIDTH	0.00473*** (0.000592)	0.0120*** (0.000626)		0.0256*** (0.00389)	0.00393*** (0.00128)	
SOUTH			0.00832*** (0.00253)			-0.00838** (0.00353)
FLOOR_UNIT			0.00749*** (0.000455)			0.00572*** (0.000530)
Constant	5.464*** (0.183)	4.324*** (0.0668)	5.000*** (0.0606)	3.940*** (0.585)	5.862*** (0.0942)	5.614*** (0.0620)
Number of observations	22,136	69,954	38,021	3,541	7,793	14,768
R-squared	0.466	-0.698	0.466	-1.077	0.280	0.630
Year dummies	YES	YES	YES	YES	YES	YES
Ward dummies	YES	YES	YES	YES	YES	YES

Conclusions

- When considering the impact of population aging on realty prices, it is important to focus on inheritances
- Significant increase of real estate properties for sale after inheritance, followed by a decline of realty prices
- We focused on inheritances due to specific institutional features in Japan, but inter-generational transfers of real estate properties occur in any country
- The impact of such inter-generational transfers on the realty market is worth examining in other countries as well

Future issues

- Construction of the transaction-level variable on the incidence of inheritance and sales
 - Although there is transaction-level information on inheritance and property sales, we aggregate the information to the district level
 - It is difficult to construct the variable at the transaction level, since 地番 (used in JON data) and 住居表示 (used in Recruit data) do not automatically match
 - But when done, we are able to examine the “spillover” from inheritance-related real estate transactions to other transactions within a district
- Examination of the impact of institutional changes
 - Recent rise of effective inheritance tax rate in Japan

APPENDIX

Inheritance tax

- Imposed upon persons who obtain assets by inheritance or bequest and is calculated based on the value of the assets concerned
 - ← different from estate tax in the US
- Taxable value = total sum of the assessed values for all the heirs of the decedent – the amount of basic exemption
- Tax rate ranges between 10% and 55%
- Tax payment due: 10 months after inheritance
- Real estate has the largest share (more than 40% in year 2013) among the properties inherited in Japan

Capital gains tax

- Capital gains refer to the increase in value of an asset such as a stock, bond, or real estate
- Capital gains from the sales of different types of assets are subject to different types of taxes
- In the case of capital gains from the sale of real estate property, they are subject to income and inhabitant taxes
- Tax rate: 15% (income tax) and 5% (inhabitant tax) if the property has been owned for more than five years and 30% (income tax) and 9% (inhabitant tax) if the property has been owned for five years or less

Special treatments regarding the income and inhabitant taxes on capital gains from the sale of inherited real estate property

- Tax rates of 15% (income tax) and 5% (inhabitant tax) are applied to capital gains from the sale of inherited assets if the combined period of ownership by the decedent and heirs is no less than five years
- Amount of inheritance tax is deducted from the capital gains from the sale of inherited assets, if assets are sold within three years after the payment of inheritance tax, thus reducing the amount of income and inhabitant tax payment

Effects of inheritance tax system on the timing of real estate sales

- Suppose that the old person in the family owns one real estate property and that the family chooses between the following two options:
 - The old property owner sells the property now and transfer the proceeds in the form of financial assets to the young heir when he dies
 - The old owner holds the property until he dies and the young heir receives it as part of his inheritance and sells it
- After the asset owner dies, inheritance tax is levied proportional to the taxable value of the property with the tax rate a
- Taxable value of assets is calculated differently between real estate and financial assets
 - Taxable value of financial assets is their full market value
 - Real estate assets are valued at a fraction c (<1) of their market value
- Capital gains tax is also levied when the owner sells real estate property with the tax rate b (<1)
- Assume that the original purchase price that the current owner paid in the past is zero and that the value of real estate is unity and unchanged over time
- Depending on the interval between the payment of inheritance tax and the sale of the inherited property, the amount of inheritance tax paid by the young heir is subtracted from the amount of taxable capital gains

Effects of inheritance tax system on the timing of real estate sales

- The amount of after-tax assets the young heir receives if the old realty owner chooses the first option of selling their property before his death and bequeathing the amount in the form of financial assets

$$R_1 = (1-b)(1-a) = (1-b) - a(1-b) \quad (1)$$

- The amount the heir receives when the owner chooses the second option in the case in which the amount of taxable capital gains is the same

$$R_{2_Late_Sale} = 1 - ac - b = (1-b) - ac \quad (2)$$

- The amount of the heir receives when the owner chooses the second option in the case in which the amount of inheritance tax paid for the property is subtracted from the capital gains from the sale of the property

$$R_{2_Early_Sale} = (1-ac)(1-b) = (1-b) - ac(1-b) \quad (3)$$

- where a is the inheritance tax rate for financial assets, ac is the inheritance tax rate for real estate assets and $(1-b)$ is the after-tax capital gains

Effects of inheritance tax system on the timing of real estate sales

- Subtracting (3) from (1), measure the extent of the family's incentive of the old owner holding the real estate and bequeathing it to the young heirs

$$D_{Early_sale} = a(1-b)(1-c) \quad (4)$$

- (4) is always positive as long as $a > 0$
- Hence, our hypothetical family strongly prefers holding the property and selling it shortly after the heir has inherited it to selling it when the old owner is alive
- Further, differentiating (4) with respect to a , b , and c , we have

$$\frac{\partial D}{\partial a} > 0, \frac{\partial D}{\partial b} < 0, \frac{\partial D}{\partial c} < 0 \quad (5)$$