

# How Inheritance Affects the Real Estate Market: Evidence from transaction and registry data

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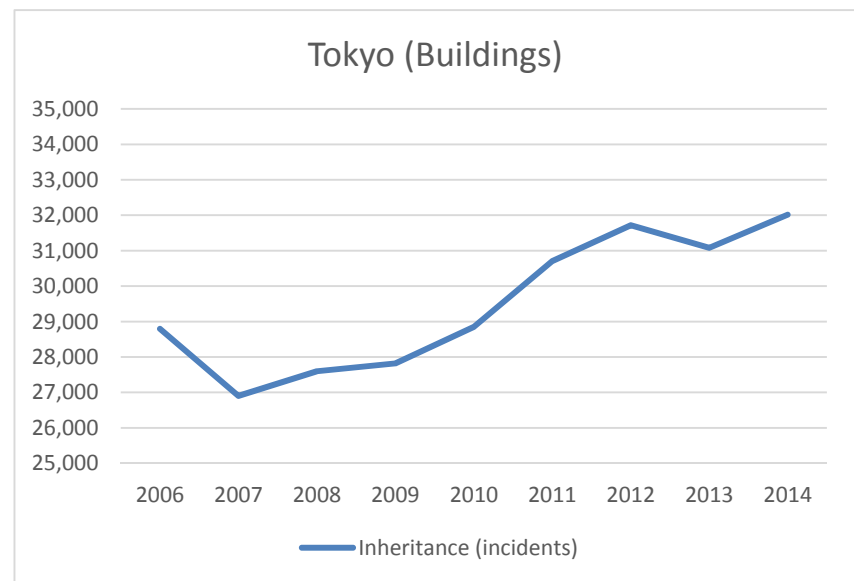
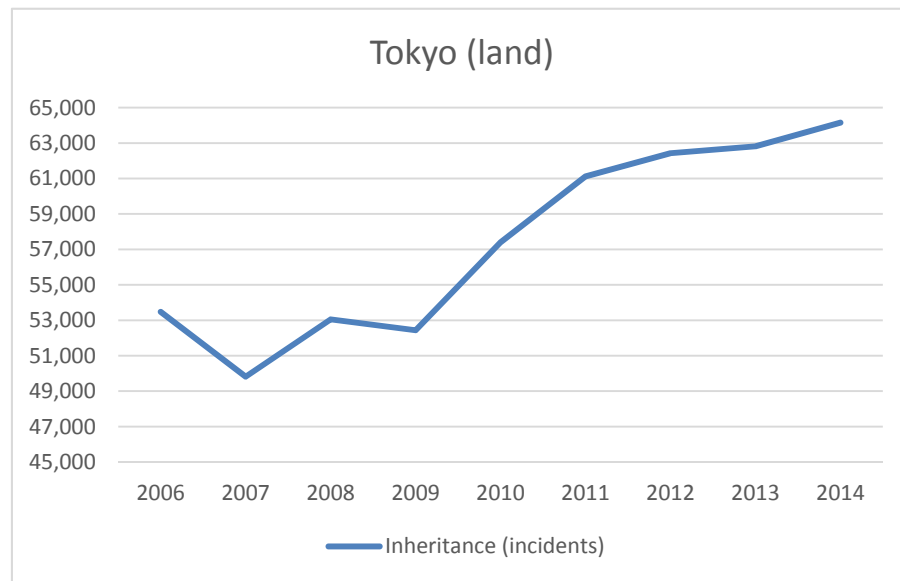
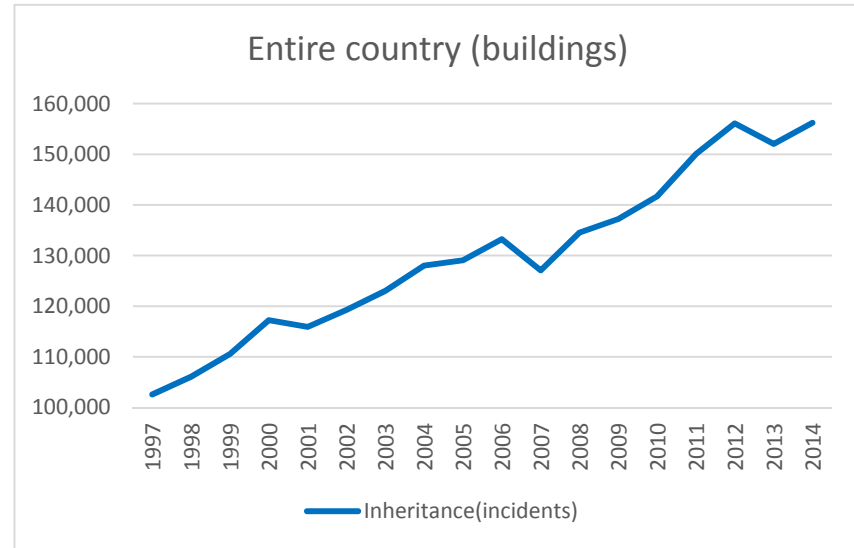
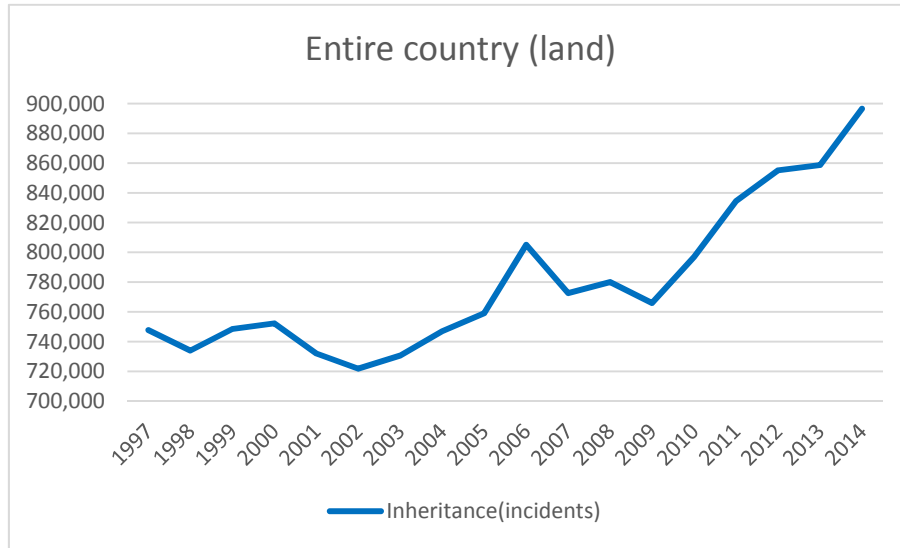
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# **INTRODUCTION**

# Research questions

- How do “exogenous” supply shocks affect the real estate market?
  - Supply of credit, geographical constraint, regulation and etc.
- What is the impact of the population aging?
  - Japan is a front-runner as a graying society and expected to face a substantial reduction of demand for real estate (Asset meltdown)
- How about inheritance?
  - Inheritance occurs to everyone but hard to predict when
  - Growing number of inheritance in Japan as a result of aging
  - It is frequently pointed out that many heirs sell real estate properties shortly after inheritance

# Number of inheritance of real estate in Japan



# What we do

- Focus on inheritance of real estate properties and related tax obligations and incentives
- Examine how they affect real estate prices through increased supply
  - First, examine the extent to which inheritance stimulates sales of real estate
  - Second, investigate how much exogenous supply shocks decrease real estate prices after controlling for a number of property characteristics including aging population ratio
- For the above purposes, combine two massive datasets on real estate transactions and registries in 2000-2014

# Related literature

- Impact of exogenous shocks on the real estate market
  - Exogenous variation in the credit supply
    - Favara and Imbs (2015)
  - Exogenous variation in the geographical constraint and regulation for land development
    - Saiz (2010); Hilber and Vermeulen (2014)
  - We study a different type of exogenous supply shocks: sales of real estate induced by inheritance
  - Inheritance is anticipated but cannot be avoided
- Effect of taxation
  - Transaction tax
    - Best and Kleven (2015): Bunching of real estate transactions around the threshold tax rate
  - Capital gain tax
    - Yamazaki (1996); Yamazaki and Idee (1997): Lock-in effect of real estate transactions
    - Cunningham and Engelhardt (2008); Shan (2011)
  - We study the impact of inheritance tax and capital gain tax
- Asset meltdown
  - Adverse effect of aging on the demand for real estate
    - Mankiw and Weil (1989); Nishimura and Takats (2012)
  - We focus on the effect of aging but on the supply side of real estate market
  - We control for the demand side by employing the population aging ratio

# **INHERITANCE, TAX PROGRAMS, AND REAL ESTATE MARKET**

# Inheritance, tax programs, and real estate transactions

- Examine the interaction among inheritance, inheritance-related tax programs, and transactions in real estate markets
- Focus on the following two:
  - Inheritance tax
  - Deduction of inheritance tax amount in capital gains by the sales of inherited assets
- Show how each of these two increases the number of real estate sales



# Inheritance tax in Japan

## **Inheritance tax**

- Heirs pay inheritance tax proportional to the tax base calculated from asset amount they receive from the ones who die
- Tax base = the value of inherited assets - basic allowance
- Tax rate: 10%-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 in Japan

## Capital gains tax

- Capital gains incurred by the sales of assets including land, buildings, stocks, bonds, jewelries are taxed
- Tax base for capital gain = sales price of assets – (costs expensed upon acquisition + transaction costs)
- Tax rate: 15% for income tax and 5% for residence tax (for long period of ownership) and 30% for income tax and 9% for residence tax (for short period of ownership)

# Deduction of inheritance tax amount in capital gains

## **Special treatment of capital gains tax after inheritance**

- In case heirs sell assets shortly after paying inheritance tax, they may add the tax amount to costs expensed upon acquisition
- Substantial tax reduction in case of large capital gains and/or large payment of inheritance tax
- Deduction applies to the sales of inherited assets within 3 years from the payment of inheritance tax

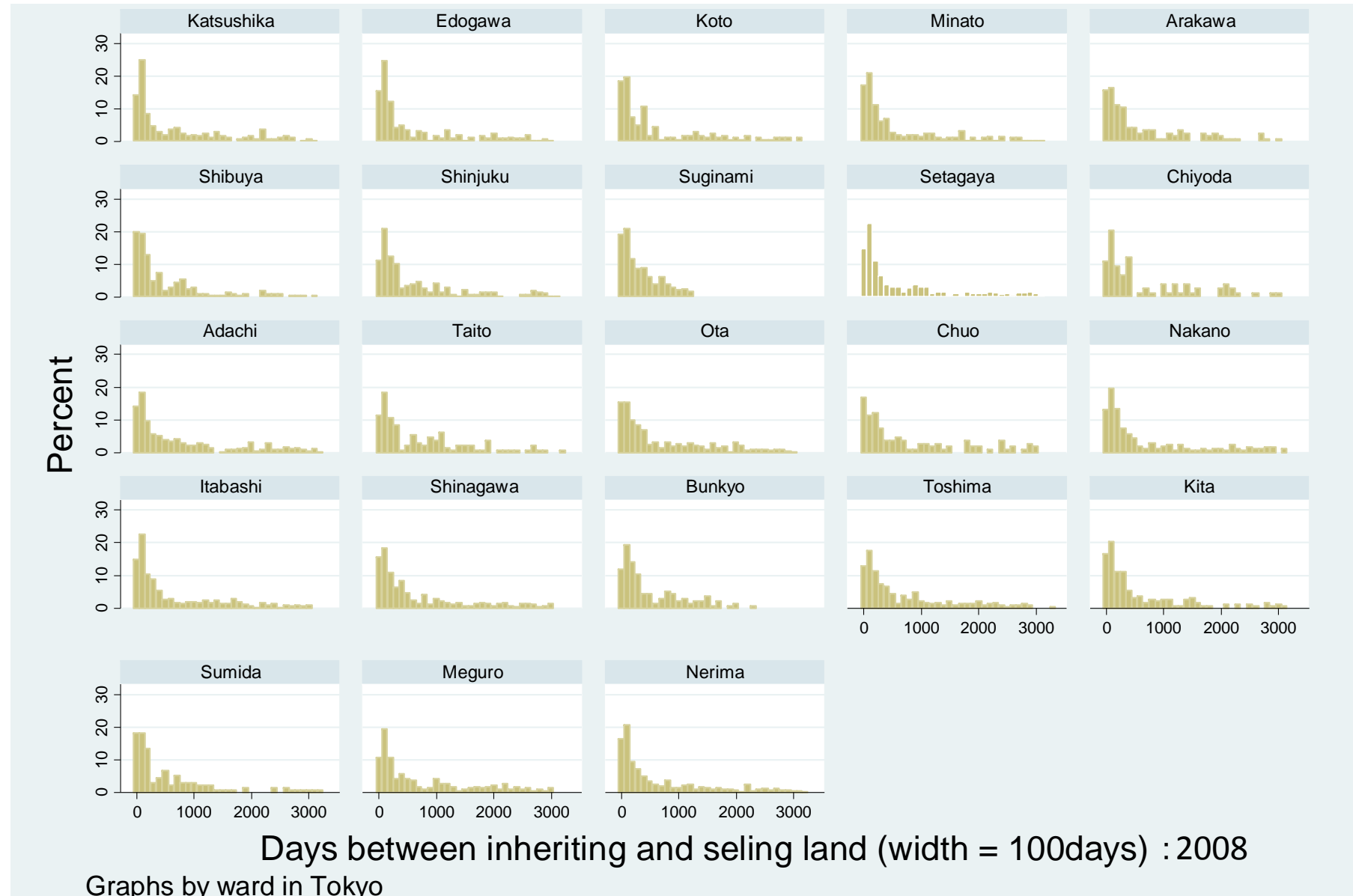
# Effect of these tax programs on the sales of real estate

## **Two types of heirs that are motivated to sell inherited assets shortly after inheritance**

- Those that are liquidity-constrained and unable to pay inheritance tax by their regular income
  - Tend to liquidate the assets by the tax due date (10 months after inheritance)
- Those that covered their inheritance tax obligation by their income but want to sell the inherited assets for some reasons
  - Tend to liquidate the assets by the expiration date of special treatment of capital gains tax (3 years and 10 months after inheritance)

**Actually, the duration between inheritance and sales of real estate is considerably short in our data**

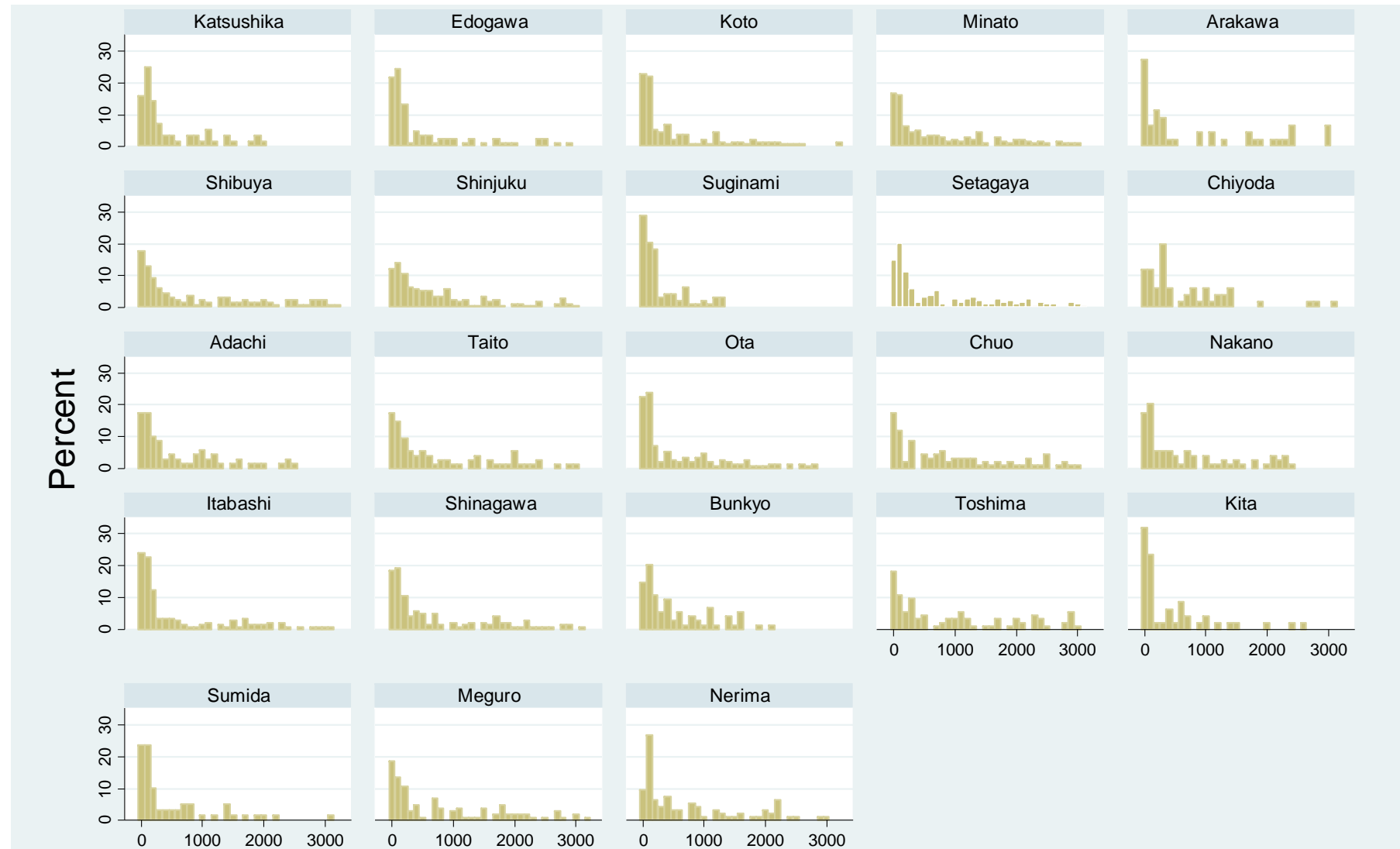
# Duration between inheritance and sales of real estate: Land



# Duration between inheritance and sales of real estate: Detached houses



# Duration between inheritance and sales of real estate: Condominium units



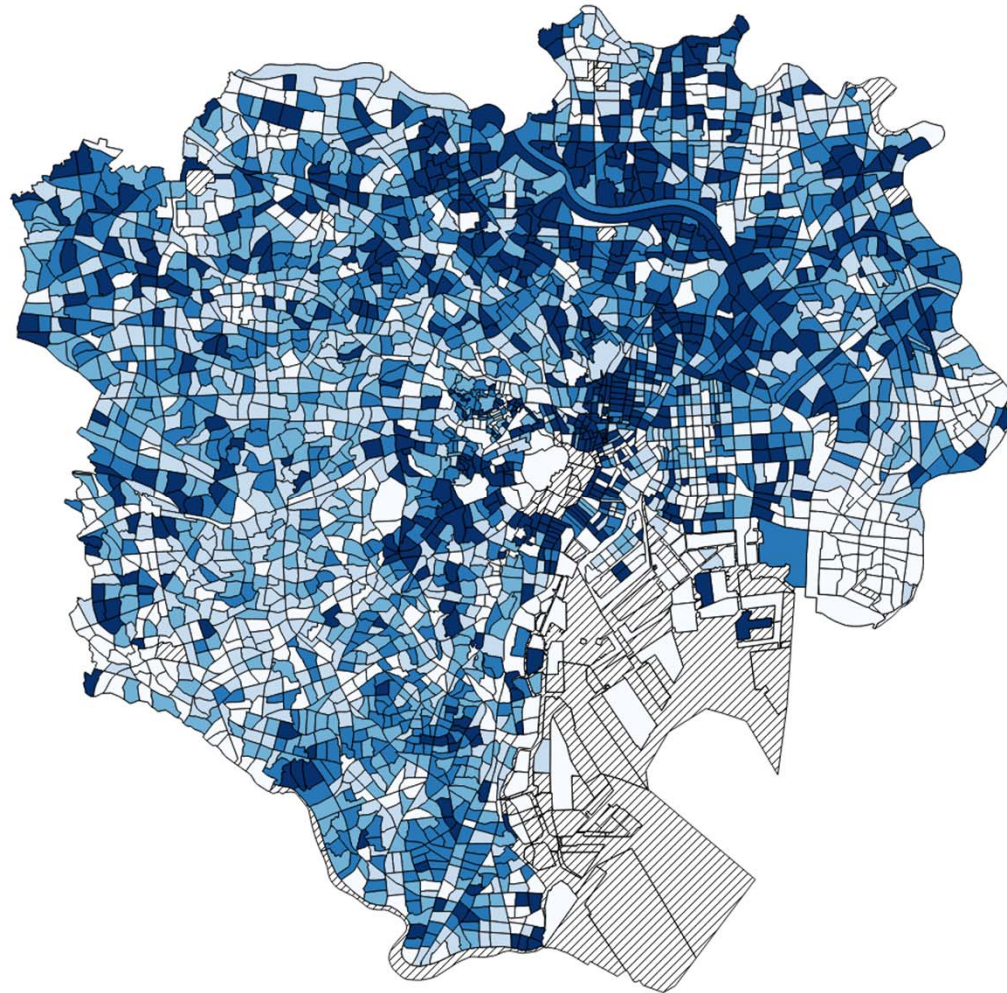
Days between inheriting and selling condominium unit (width = 100days): 2008  
Graphs by ward in Tokyo

# Inheritance and population aging: Are they highly correlated?

- One important concern is the relationship between the two
- Population aging ratio is usually a proxy for the demand for real estate, while the number of inheritance indicates the extent that heirs are eager to sell real estate properties
- If these two (aging of population and inheritance) are highly spatially correlated, it is difficult to identify which of the two (increased supply or decreased demand) causes the drop in real estate prices
- However, we find this is not the case in our data
  - Population aging ratio is high in old town (下町), while inheritance occurs frequently in uptown (山の手)
  - Population aging ratio represents the extent of aging among all the residents, while inheritance reflects the extent of aging among property owners
- In the estimation, we include both of these two variables

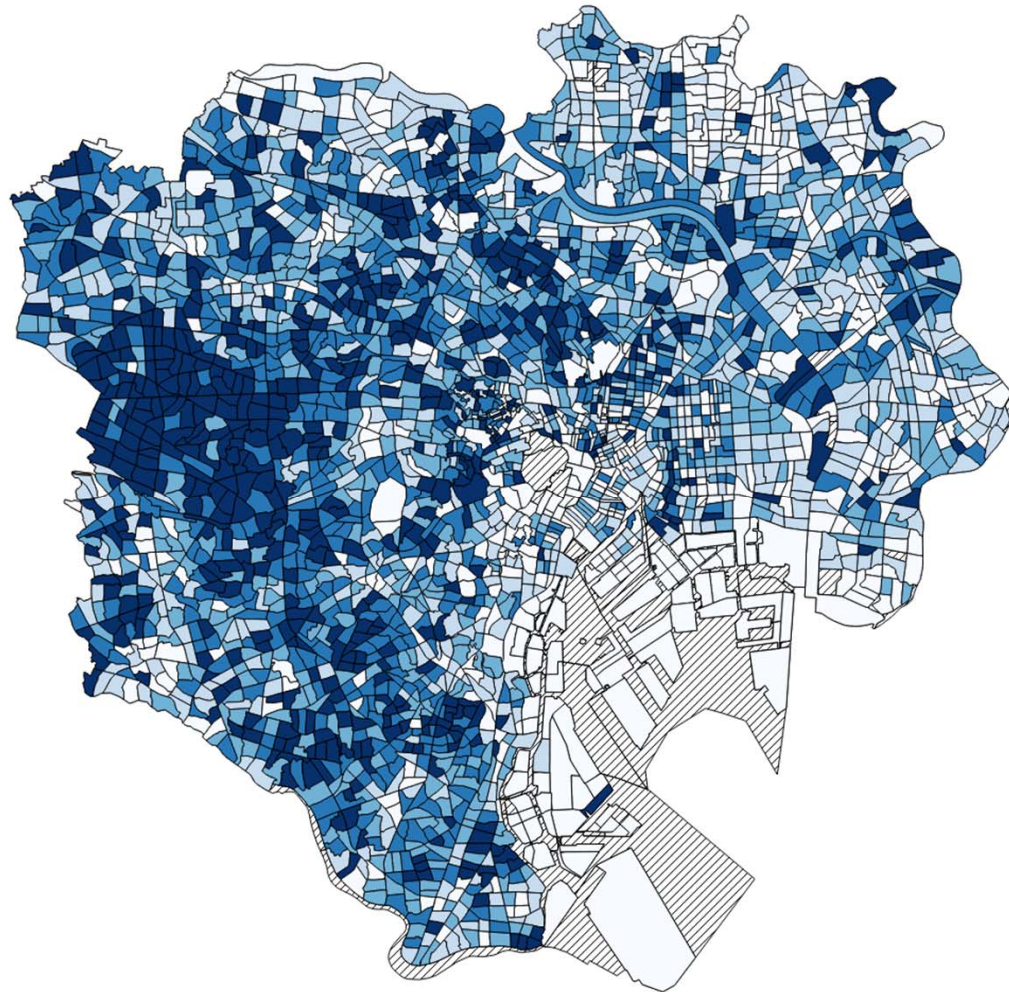


Ageing rate in 2005  
(Ratio of population of age 65+ to total population)



## Inheritance ratio in 2005-2008

(Number of unique lots where inheritance occurred between 2005-2008/Total number of unique lots that experienced registry changes during the period)



# **EMPIRICAL APPROACH**

# Data

- Registry data (登記変更情報)
  - The registry offices of the government record all the ownership changes on land and buildings for each address by types of reasons, including
    - Sales-purchase
    - Inheritance
    - Foreclosure
    - Donation
    - Establishment of buildings or land pieces
    - Division/merger of land pieces
  - Enable us to identify the date of inheritance and sales-purchase of land/building for each piece of land
  - Cover Tokyo metropolitan area (central 23 cities) for years 2000-2014
  - Provided by JON, a private company specialized in collecting such registry data 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 not only information on properties that were actually transacted but also on those that were offered by these agencies for sales
  - Three types of properties: Land (土地), detached houses (一戸建て), and condominium units (区分所有)
    - Offer sales prices
    - Contract prices
    - Address
    - Contract date
    - Other characteristics of real estate
  - Cover Tokyo metropolitan area (central 23 cities) for years 2000-2015
  - Provided by Recruit Co. Ltd.

# Data

- We combine these two datasets and construct several important variables by the district-year (丁目-年) level for analysis
- There are 3,132 districts (丁目) within Tokyo central 23 cities (as of 2010 Population Census)
  - Inheritance ratio1: number of unique lots (地番) that experienced inheritance for the past three years in a district/ number of unique lots that experienced registry changes for the past three years
  - Inheritance ratio2: number of unique lots (地番) that experienced inheritance for the past three years in a district/ acreage of the district in square kilometers
  - Sales ratio1: number of newly registered properties for sale in a year/number of unique lots that experienced registry changes for the past three years
  - Sales ratio2: number of newly registered properties for sale in a year/acreage of the district in square kilometers
  - Average land prices based on Public Notice on Land Prices (公示地価) issued annually by Ministry of Land, Infrastructure, Transportation, and Tourism (MLIT)

# Data

- Other variables are constructed by the transaction level
- For each type of properties, variables that represent property characteristics differ
  - For land
    - Acreage of land
    - Number of minutes it takes on foot from the nearest subway station
    - Number of minutes from the nearest station to Tokyo station
    - Building to land ratio
    - Floor to area ratio
    - Width of road in front
  - For detached houses
    - Acreage of land
    - Number of years after construction
    - Floor size
    - Number of minutes it takes on foot from the nearest subway station
    - Number of stories of the building
    - Number of rooms
    - Number of minutes from the nearest station to Tokyo station
    - Dummy for reinforced concrete building
    - Building to land ratio
    - Floor to area ratio
    - Width of road in front
  - For condominium units
    - Number of years after construction
    - Floor size
    - Number of minutes it takes on foot from the nearest subway station
    - Number of stories of the building
    - Number of rooms
    - Number of minutes from the nearest station to Tokyo station
    - Dummy for reinforced concrete building
    - Dummy for south-facing rooms

# Estimation model

- Two-step estimation with IV for sales inventory variable

$$\begin{aligned} \text{Sales/Inventory}(i,t) &= \alpha + \beta_1 \text{Inheritance}(i,t-3,t) + \beta_2 \text{Inheritance} \times \text{AppValue}(i,t) \\ &+ \psi \mathbf{X}(i,t) \\ &+ \delta_1(\text{city}) + \delta_2(\text{year}) + \varepsilon(i,t) \end{aligned}$$

$$\begin{aligned} \text{PRICE}(i,t) &= \gamma + \eta_1 \text{Sales/Inventory}(i,t) + \xi \mathbf{X}(i,t) \\ &+ \phi_1(\text{city}) + \phi_2(\text{year}) + e(i,t) \end{aligned}$$

where

i: property identification

t: Year-Month-Week



# RESULTS

# Summary statistics (Land:土地)

Table 1								
Summary Statistics: Regression Sample								
Variables	Obs.	Mean	Std.Dev	Min	Q1/4	Median	Q3/4	Max
Land								
Unit Price: Sales price/acreage (ten thousand JPY/m <sup>2</sup> )	25979	65.15	78.46	0.610	45.62	59.72	75.62	11360
Sales ratio: (number of unique newly registered properties for sale in a year)/(number of unique lots that experienced registry changes) (%)	25979	4.250	3.290	0	2.110	3.470	5.460	33.06
Sales index: (number of unique newly registered properties for sale in a year)/(acreage of the district in km <sup>2</sup> )	25979	28917	21714	0	14074	23684	37273	190000
Inheritance ratio: (number of unique lots that experienced inheritance for the past three years)/(number of unique lots that experience registry changes for the past three years)	25979	5.230	1.710	0	4.190	5.190	6.100	13.65
Inheritance index: (number of unique lots that experienced inheritance for the past three years)/(acreage of the district in km <sup>2</sup> )	25979	37025	15539	0	26087	36111	46667	110000
Population aging rate: (population of age 65+)/(total population) (%)	25979	18.59	3.180	5.380	16.60	18.38	20.23	40.18
Average housing appraisal value in the district: (million JPY/m <sup>2</sup> )	25979	0.570	0.400	0.150	0.430	0.520	0.610	10.79
Acreage of land (m <sup>2</sup> )	25979	117.5	86.19	0.500	73.03	99.27	134.5	6164
Minutes to the nearest subway station on foot	25979	8.630	4.410	0	5	8	11	36
Minutes from the nearest subway station to Tokyo by train during the day	25979	30.21	7.290	4	26	30	35	126
Building to land ratio (%)	25979	54.78	13.51	0	50	60	60	100
Floor to area ratio (%)	25979	162.3	85.50	0	100	150	200	900
Width of road in front (m)	25979	4.920	3.670	0	3.900	4	5.800	72

# Summary statistics (Detached houses:戸建)

Detached houses								
Variables	Obs.	Mean	Std.Dev	Min	Q1/4	Median	Q3/4	Max
Unit Price: Sales price/acreage (ten thousand JPY/m2)	78855	59.56	24.88	0.0500	48.10	58.13	68.27	4768
Sales ratio: (number of unique newly registered properties for sale in a year)/(number of unique lots that experienced registry changes) (%)	78855	4.560	3.700	0	2.190	3.680	5.930	55.88
Sales index: (number of unique newly registered properties for sale in a year)/(acreage of the district in km2)	78855	30610	23659	0	14444	25000	40435	210000
Inheritance ratio: (number of unique lots that experienced inheritance for the past three years)/(number of unique lots that experience registry changes for the past three years)	78855	4.960	1.630	0	3.910	4.900	5.870	13.65
Inheritance index: (number of unique lots that experienced inheritance for the past three years)/(acreage of the district in km2)	78855	35022	15674	0	23636	33704	45263	140000
Population aging rate: (population of age 65+)/(total population) (%)	78855	18.71	3.400	5.380	16.67	18.59	20.52	40.18
Average housing appraisal value in the district: (million JPY/m2)	78855	0.480	0.240	0.140	0.350	0.450	0.540	10.79
Age of the structure in years	78855	3.600	7.940	0	0.0800	0.250	0.830	87.92
Structure area (floor space area) (m2)	78855	103.0	48.05	0.950	84.77	94.96	107.6	7535
Acreage of land (m2)	78855	88.72	52.86	2	62.39	80.64	100.6	8060
Minutes to the nearest subway station on foot	78855	9.500	4.900	0	6	9	13	63
Total number of stories in the building; i.e. the total height of the building	78855	2.350	0.700	0	2	2	3	25
Number of rooms in the unit (excluding SLDK)	78855	3.450	0.890	0	3	3	4	45
Minutes from the nearest subway station to Tokyo by train during the day	78855	31.09	7.700	4	26	31	37	48
Dummy for reinforced concrete construction	78855	0.0300	0.160	0	0	0	0	1
Building to land ratio (%)	78855	54.61	14.42	0	50	60	60	264
Floor to area ratio (%)	78855	162.8	78.22	0	100	150	200	840
Width of road in front (m)	78855	4.540	2.430	0	4	4	5.400	99.90

# Summary statistics

## (Condominium units: 区分建物)

Condo. Units								
Variables	Obs.	Mean	Std.Dev	Min	Q1/4	Median	Q3/4	Max
Unit Price: Sales price/acreage (ten thousand JPY/m <sup>2</sup> )	53301	53.81	19.81	0.350	41.03	50.53	63.01	831.6
Sales ratio: (number of unique newly registered properties for sale in a year)/(number of unique lots that experienced registry changes) (%)	53301	3.350	2.430	0	1.570	2.780	4.500	27.42
Sales index: (number of unique newly registered properties for sale in a year)/(acreage of the district in km <sup>2</sup> )	53301	28092	23339	0	11818	22273	36875	170000
Inheritance ratio: (number of unique lots that experienced inheritance for the past three years)/(number of unique lots that experience registry changes for the past three years)	53301	4.540	1.530	0	3.480	4.440	5.470	13.65
Inheritance index: (number of unique lots that experienced inheritance for the past three years)/(acreage of the district in km <sup>2</sup> )	53301	38128	17764	0	25172	36667	49167	140000
Population aging rate: (population of age 65+)/(total population) (%)	53301	17.63	3.570	5.380	15.51	17.63	19.56	40.18
Average housing appraisal value in the district: (million JPY/m <sup>2</sup> )	53301	0.660	0.480	0.170	0.390	0.520	0.740	10.14
Age of the structure in years	53301	20.87	12.19	0	9.580	21.17	31.25	68.33
Structure area (floor space area) (m <sup>2</sup> )	53301	61.27	22.93	1.900	48.16	59.26	70.62	877.8
Minutes to the nearest subway station on foot	53301	7.040	4.250	0	4	6	10	96
Total number of stories in the building; i.e. the total height of the building	53301	9.170	5.290	0	6	8	11	143
Number of rooms in the unit (excluding SLDK)	53301	2.210	0.890	0	2	2	3	51
Minutes from the nearest subway station to Tokyo by train during the day	53301	26.60	8.130	1	20	26	33	48
Dummy for reinforced concrete construction	53301	0.600	0.490	0	0	1	1	1
Dummy variable for the unit facing south	53301	0.340	0.470	0	0	0	1	1
Story of the unit; i.e. the height of the unit that was sold	53301	6.900	3.770	0	4	6	8	80

# Result for the first-stage estimation (Inheritance ratio1 & sales ratio1)

TSL: First stage													
VARIABLES	Land				Detached houses				Condominium units				
	OLS	IV	IV	IV	OLS	IV	IV	IV	OLS	IV	IV	IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	Sales ratio	
<b>Inheritance ratio1</b>		<b>-0.0235*</b>	<b>-0.0235*</b>	<b>0.0519*</b>		<b>0.0471***</b>	<b>0.0477***</b>	<b>0.0291</b>		<b>0.0341***</b>	<b>0.0305***</b>	<b>-0.0106</b>	
<b>Average housing appraisal value in the district</b>			<b>-0.365***</b>	<b>0.372</b>			<b>-0.354***</b>	<b>-0.547**</b>			<b>-0.308***</b>	<b>-0.578***</b>	
<b>Inheritance × AppValue</b>				<b>-0.146***</b>				<b>0.0398</b>				<b>0.0659***</b>	
Population aging rate		0.0158**	0.0177***	0.0176***		0.0119***	0.0119***	0.0120***		-0.0146***	-0.0149***	-0.0143***	
Age of the structure in years						-0.0433***	-0.0430***	-0.0430***		0.0177***	0.0179***	0.0178***	
Structure area (floor space area) in square meters						-0.000310	-0.000241	-0.000243		0.00281***	0.00292***	0.00283***	
Acreage of land		-0.000629*	-0.000598*	-0.000605***		0.00137***	0.00135***	0.00135***					
Minutes to the nearest subway station on foot		0.0783***	0.0768***	0.0768***		0.0721***	0.0710***	0.0710***		0.0788***	0.0763***	0.0764***	
Total number of stories in the building; i.e. the total height of the building						-0.268***	-0.269***	-0.269***		-0.00302	-0.000967	-0.000322	
Number of rooms in the unit (excluding SLDK)						-0.0546***	-0.0540***	-0.0541***		0.0357***	0.0281**	0.0281**	
Minutes from the nearest subway station to Tokyo by train during the day		0.0165***	0.0140***	0.0145***		0.0257***	0.0239***	0.0239***		0.0409***	0.0385***	0.0384***	
Dummy for reinforced concrete construction						0.0715	0.0789	0.0777		0.00541	-0.00198	0.000137	
Building to land ratio		0.0139***	0.0136***	0.0136***		0.0131***	0.0133***	0.0133***					
Floor to area ratio		-0.00420**	-0.00414**	-0.00418***		-0.00580**	-0.00582**	-0.00581***					
Width of road in front		0.0259***	0.0257***	0.0262***		0.0858***	0.0858***	0.0857***					
Dummy variable for the unit facing south										-0.0403**	-0.0409**	-0.0403**	
Story of the unit; i.e. the height of the unit that was sold										-0.000358	-0.000935	-0.000879	
Constant		2.268***	3.143***	2.399***		3.207***	3.826***	3.950***		-0.259**	0.356***	0.494***	
Fixed Effects													
Year dummy variable		YES	YES	YES		YES	YES	YES		YES	YES	YES	
Ward dummy variable		YES	YES	YES		YES	YES	YES		YES	YES	YES	
Observations		25,979	25,979	25,979		78,855	78,855	78,855		53,301	53,301	53,301	

# Result for the second-stage estimation (Inheritance ratio1 & sales ratio1)

Baseline Specification: OLS and TSL													
VARIABLES	Land				Detached houses				Condominium units				
	OLS	IV	IV	IV	OLS	IV	IV	IV	OLS	IV	IV	IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price	
<b>Sales ratio1</b>	<b>-0.00158</b>	<b>-31.62</b>	<b>-46.58***</b>	<b>-39.15***</b>	<b>0.0723***</b>	<b>9.734***</b>	<b>-19.87***</b>	<b>-18.69***</b>	<b>0.0649***</b>	<b>15.51***</b>	<b>-13.48***</b>	<b>-11.26***</b>	
Population aging rate	0.189	0.599	0.794**	0.697**	-0.0255	-0.188***	0.309***	0.289***	0.0712***	0.236***	-0.0736*	-0.0499	
Age of the structure in years					-0.290***	0.128	-1.153***	-1.102***	-0.810***	-1.089***	-0.566***	-0.606***	
Structure area (floor space area) in square meters					-0.0338***	-0.0312***	-0.0393***	-0.0389***	0.0709***	0.0269**	0.110***	0.103***	
Acreage of land	-0.00827	-0.0284*	-0.0379***	-0.0332***	0.0764***	0.0632***	0.104***	0.102***					
Minutes to the nearest subway station on foot	-0.401***	2.095	3.277***	2.690***	-0.119***	-0.805***	1.296***	1.213***	-0.366***	-1.563***	0.683***	0.511***	
Total number of stories in the building; i.e. the total height of the building					-3.209***	-0.570	-8.654***	-8.332***	0.355***	0.417***	0.301***	0.310***	
Number of rooms in the unit (excluding SLDK)					-0.854***	-0.319	-1.957***	-1.891***	-0.481***	-1.023***	-0.00666	-0.0843	
Minutes from the nearest subway station to Tokyo by train during the day	-0.552***	-0.0103	0.246	0.119	-0.257***	-0.497***	0.237***	0.207***	-0.347***	-0.975***	0.204***	0.114**	
Dummy for reinforced concrete construction					6.327***	5.630***	7.767***	7.681***	1.851***	1.753***	1.937***	1.923***	
Building to land ratio	-0.138**	0.299	0.506***	0.403***	0.143***	0.0126	0.412***	0.396***					
Floor to area ratio	0.0490***	-0.0830	-0.145***	-0.114***	-0.0395***	0.0170	-0.156***	-0.149***					
Width of road in front	1.167***	2.004***	2.400***	2.203***	0.313***	-0.517***	2.025***	1.924***					
Dummy variable for the unit facing south									-0.0410	0.575*	-0.581**	-0.493**	
Story of the unit; i.e. the height of the unit that was sold									0.518***	0.522***	0.514***	0.514***	
Constant	146.8***	217.7***	251.3***	234.6***	111.8***	79.76***	177.8***	173.9***	81.63***	84.67***	78.97***	79.41***	
Fixed Effects													
Year dummy variable	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Ward dummy variable	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Observations	25,979	25,979	25,979	25,979	78,855	78,855	78,855	78,855	53,301	53,301	53,301	53,301	

# Result for the first-stage estimation (Inheritance ratio2 & sales ratio2)

TSLs: First stage												
VARIABLES	Land				Detached houses				Condominium units			
	OLS	IV	IV	IV	OLS	IV	IV	IV	OLS	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index	Sales index
<b>Inheritance ratio2</b>		<b>0.260***</b>	<b>0.252***</b>	<b>0.196***</b>		<b>0.380***</b>	<b>0.381***</b>	<b>0.275***</b>		<b>0.457***</b>	<b>0.457***</b>	<b>0.235***</b>
<b>Average housing appraisal value in the district</b>			<b>-4,217***</b>	<b>-7,220***</b>			<b>-3,503***</b>	<b>-10,668***</b>			<b>-1,032***</b>	<b>-12,403***</b>
<b>Inheritance × AppValue</b>				<b>0.0995***</b>				<b>0.211***</b>				<b>0.271***</b>
Population aging rate		-322.7***	-297.0***	-287.1***		-200.5***	-199.7***	-179.2***		-776.0***	-778.3***	-686.1***
Age of the structure in years						-280.2***	-277.0***	-279.5***		112.7***	113.1***	121.0***
Structure area (floor space area) in square meters						-0.965	-0.279	0.127		13.85***	14.19***	16.46***
Acreage of land		-10.40***	-10.13***	-9.975***		-0.533	-0.732	-0.765				
Minutes to the nearest subway station on foot		417.9***	397.4***	398.6***		355.1***	344.1***	346.5***		582.0***	574.2***	555.5***
Total number of stories in the building; i.e. the total height of the building						-1,113***	-1,124***	-1,159***		147.4***	154.6***	159.2***
Number of rooms in the unit (excluding SLDK)						-347.2***	-341.0***	-342.1***		193.0*	167.8	35.40
Minutes from the nearest subway station to Tokyo by train during the day		-73.48***	-107.8***	-110.2***		-24.54	-42.71***	-44.14***		262.3***	254.5***	179.2***
Dummy for reinforced concrete construction						-84.29	-10.31	38.31		-9.074	-34.10	-61.97
Building to land ratio		100.8***	98.05***	100.1***		91.03***	92.62***	94.49***				
Floor to area ratio		-22.35***	-21.61***	-21.89***		-29.07***	-29.29***	-29.29***				
Width of road in front		11.83	6.938	2.454		228.9***	229.1***	226.1***				
Dummy variable for the unit facing south										-493.2***	-495.4***	-492.5***
Story of the unit; i.e. the height of the unit that was sold										6.947	4.986	9.823
Constant		21,866***	32,105***	34,171***		20,296***	26,429***	30,596***		-2,696**	-660.1	10,259***
Fixed Effects												
Year dummy variable		YES	YES	YES		YES	YES	YES		YES	YES	YES
Ward dummy variable		YES	YES	YES		YES	YES	YES		YES	YES	YES
Observations		25,979	25,979	25,979		78,855	78,855	78,855		53,301	53,301	53,301

# Result for the second-stage estimation (Inheritance ratio2 and sales ratio2)

Baseline Specification: OLS and TSLS												
VARIABLES	Land				Detached houses				Condominium units			
	OLS	IV	IV	IV	OLS	IV	IV	IV	OLS	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price
<b>Sales ratio2</b>	<b>-2.00e-05</b>	<b>-6.79e-05</b>	<b>-0.000664***</b>	<b>-0.000623***</b>	<b>2.69e-06</b>	<b>8.93e-06</b>	<b>-8.52e-05***</b>	<b>-9.90e-05***</b>	<b>-9.35e-07</b>	<b>2.45e-05***</b>	<b>1.01e-05</b>	<b>-1.21e-05*</b>
Population aging rate	0.185	0.175	0.0538	0.0622	-0.0243	-0.0243	-0.0242	-0.0242	0.0700***	0.0851***	0.0765***	0.0633***
Age of the structure in years					-0.292***	-0.291***	-0.317***	-0.321***	-0.809***	-0.812***	-0.810***	-0.808***
Structure area (floor space area) in square meters					-0.0338***	-0.0338***	-0.0337***	-0.0337***	0.0711***	0.0712***	0.0711***	0.0711***
Acreage of land	-0.00853	-0.00915	-0.0169***	-0.0164***	0.0765***	0.0766***	0.0759***	0.0758***				
Minutes to the nearest subway station on foot	-0.396***	-0.382***	-0.209*	-0.221*	-0.114***	-0.116***	-0.0962***	-0.0934***	-0.361***	-0.368***	-0.364***	-0.358***
Total number of stories in the building; i.e. the total height of the building					-3.225***	-3.218***	-3.324***	-3.340***	0.355***	0.352***	0.354***	0.356***
Number of rooms in the unit (excluding SLDK)					-0.857***	-0.854***	-0.892***	-0.898***	-0.479***	-0.482***	-0.480***	-0.478***
Minutes from the nearest subway station to Tokyo by train during the day	-0.557***	-0.568***	-0.714***	-0.704***	-0.255***	-0.253***	-0.277***	-0.280***	-0.344***	-0.345***	-0.345***	-0.344***
Dummy for reinforced concrete construction					6.334***	6.339***	6.271***	6.261***	1.851***	1.861***	1.856***	1.847***
Building to land ratio	-0.136**	-0.130**	-0.0642	-0.0687	0.144***	0.143***	0.153***	0.155***				
Floor to area ratio	0.0487***	0.0478***	0.0372***	0.0380***	-0.0399***	-0.0397***	-0.0419***	-0.0423***				
Width of road in front	1.165***	1.161***	1.104***	1.108***	0.319***	0.318***	0.323***	0.324***				
Dummy variable for the unit facing south									-0.0440	-0.0321	-0.0389	-0.0493
Story of the unit; i.e. the height of the unit that was sold									0.518***	0.517***	0.517***	0.518***
Constant	147.4***	148.6***	164.5***	163.4***	111.9***	111.7***	114.5***	114.9***	81.63***	81.30***	81.49***	81.78***
Fixed Effects												
Year dummy variable	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Ward dummy variable	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	25,979	25,979	25,979	25,979	78,855	78,855	78,855	78,855	53,301	53,301	53,301	53,301



# Findings

- When inheritance ratio and average appraisal value are employed for IVs  
inheritance  $\uparrow \Rightarrow$  sales  $\uparrow \Rightarrow$  real estate prices  $\downarrow$
- When appraisal value of land prices is higher  
inheritance  $\uparrow \Rightarrow$  sales  $\uparrow \uparrow$
- Substantial economic significance
- There are several qualifications
  - When only inheritance ratio is employed, sales  $\uparrow \Rightarrow$  real estate prices  $\uparrow$
  - Inheritance ratio may not be enough as an instrument
  - Land in the baseline case, inheritance  $\uparrow \Rightarrow$  sales inventory  $\downarrow$
  - Condominium units in the robustness check case, sales  $\uparrow \Rightarrow$  marginally significant impact on prices

# Issues to be addressed

- Construction of the transaction-level variable on the incidence of inheritance and sales
  - Currently, we only have the district-level variable on the number of inheritance and the density of sales
  - It is difficult to construct the variable. Since 地番 (used in JON data) and 住居表示 (used in Recruit data) do not automatically match → Any ways to do this?
  - But when done, we are able to examine the “spillover” from inheritance-related real estate transactions to other transactions within a district
- Persistence of the price decline caused by the supply shock
  - Currently, we only show instantaneous negative impact on real estate prices in the district level
  - However, such idiosyncratic shocks may disappear shortly when buyers in the neighborhood flow into the market and drive up the prices
  - Hence, it is worth examining the persistence of the price decline