# Disentangling the effect of housing on household stock holdings: Evidence from Japanese micro data

Tokuo Iwaisako (Hitotsubashi University)
**Arito Ono (Chuo University)**
Amane Saito (GPIF)
Hidenobu Tokuda (Mizuho Research Institute)

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* The views and opinions expressed are those of the authors and do not necessarily reflect those of any of the institutions with which they are affiliated.

# Research question

- ***Does investment in housing reduce households' holdings of risky financial assets (i.e., stocks)?***
- Mixed empirical evidence
  - **Yes**: Negative relationship (Fratantoni 1998, Faig and Shum 2002)
  - **No**: Positive relationship (Heaton and Lucas 2000)
  - **Ambiguous**: No relationship (Shum and Faig 2006), non-monotonic relationship (Yamashita 2003), relationship depends on the empirical proxy used for stock holdings (Yao and Zhang 2005) or housing (Cocco 2005)
    - Iwaisako et al. (2015): Negative for the extensive margin, positive for the intensive margin

# Chetty et al. (2017 JF)

①home equity = ②property value − ③mortgage debt

- **Theory**: Important to distinguish the effects of ①HE, ②PV, and ③M
  - Exogenous increases in ②**PV** (holding ①HE fixed) reduce stock holdings through:
    - (1) increased illiquidity and exposure to house price risk (Grossman and Laroque 1990, Chetty and Szeidl 2007, Flavin and Yamashita 2002), and (2) higher ③M
  - Exogenous increases in total wealth including ①**HE** (holding ②PV fixed) increase stock holdings through:
    - the diversification effect (Yao and Zhang 2005) and smaller ③M

# Chetty et al. (2017 JF)

- **Empirics**: Address endogeneity of housing and financial portfolio choice to overcome potential biases in the estimates of previous studies
  - 3 research designs to reconcile the theory with data
  - Use variations across states in the **current house price** and the **time-of-purchase house price** to generate exogenous variations in property value and home equity
    - Current house prices positively affect both property value and home equity
    - Time-of-purchase house prices negatively affect home equity

# What we do

- Application of Chetty et al. (2017) using a micro survey data of Japanese households during 2000–2015
- Previous studies that replicate Chetty et al. (2017) to European countries obtained mixed findings
  - Fougère and Poulhès (2012) using French households data: Property value and home equity have significant and opposite-signed effects on household portfolio
  - Michielsen et al. (2016) using Dutch households data: Both home equity and mortgage debt do not have a significant impact on household portfolio

# What we do

- (1) Replication of Chetty et al. (2017)
  - Simple OLS regressions
  - Two-stage least squares (2SLS) regressions using house price indices as instrumental variables (IV)

We do not have data for the value of constructions

    - Main regressors: **land value** and **home equity**
    - Prediction: **land value reduces** stock holdings; **home equity increases** stock holdings

# What we do

- (2) 2SLS using another specification form
  - Main regressors: **land value** and **initial mortgage debt**
  - Motivations
    - In theory, the negative effect of land value (holding home equity fixed) on stock holdings work through (1) illiquidity and price risk of housing assets and (2) higher mortgage debt. **Which channel is more important?** If (1)<(2), the effect of **land value** on stock holdings is **positive**
    - It is possible that households who purchased houses when land prices were higher repaid mortgage debts more aggressively. Then **the effect of land prices at the time of purchase on home equity might be ambiguous**

# What we find

- (1) 2SLS similar to Chetty et al. (2017)
  - Mixed results; the effect of land value on stock holdings is not significant
- (2) 2SLS using another specification form
  - An increase in **land value increases** stock holdings while an increase in **initial mortgage debt reduces** stock holdings
    - No evidence for the negative effect of increased housing assets on households' stock holdings
    - The statistical significance for the effect of initial mortgage debt is weaker, which suggests that the effect might be heterogeneous among Japanese households

# EMPIRICAL STRATEGY

# Simple OLS

Stock holdings / Total liquid financial assets

$$\text{Stock share}_{it} = \alpha + \beta_1 \text{Land value}_{it} + \beta_2 \text{Home equity}_{it} + \gamma \mathbf{X_{it}} + \varepsilon_{it}$$

- Prediction: $\beta_1 < 0, \beta_2 > 0$
- Possible upward bias in $\beta_1$
  - Suppose future labor income is unobservable and captured by the error term $\varepsilon_{it}$
  - Unobservable income may be positively correlated with $\text{Land value}$, and hence the OLS estimates of $\beta_1$ is biased upward

# 2SLS: Identification strategy

- Use the regional-level **current land price** ($\mathrm{Lprice\_present}_j$) and the **time-of-purchase land price** ($\mathrm{Lprice\_purchase}_j$) indices as instruments
  - "Current year": the year in which household portfolio is measured
  - Region $j$: the region in which a household resides

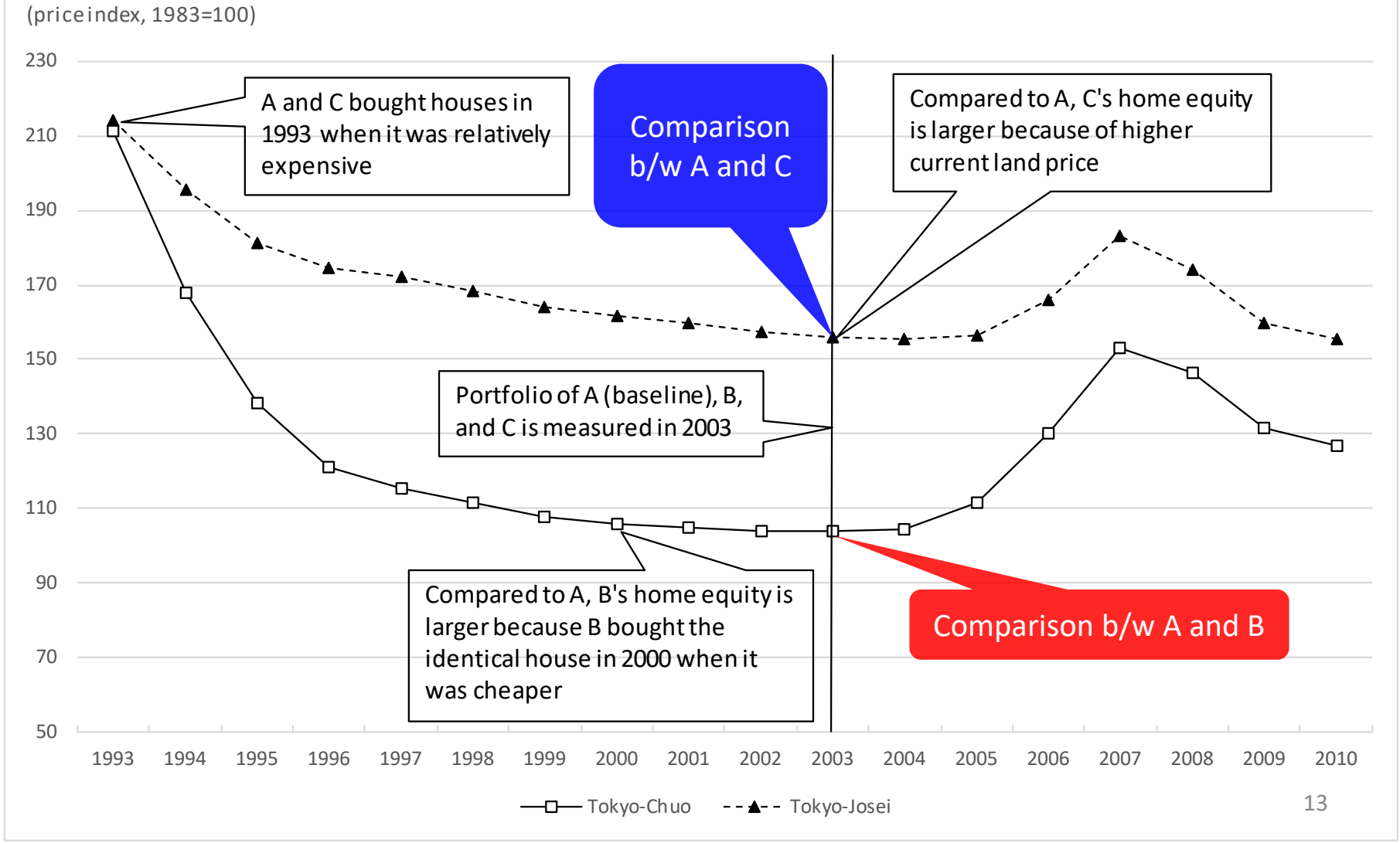
# 2SLS: Identification strategy

- Illustration (Current year: 2003, Baseline household A)
  - Household A and B bought identical houses in the same region (Tokyo-Chuo), but A bought it in 1993 while B bought it in 2000 (when house price was lower)

  ➔ B: same Land value but larger Home equity due to smaller Initial mortgage
    - This effect is captured by **Lprice_purchase**
  - Household C bought the house for the same price in the same year (i.e., 1993) as A did, but the house is located in a different region (where the house price is higher)

  ➔ C: same Initial mortgage, larger Land value and Home equity
    - This effect is captured by **Lprice_present**

# 2SLS: Identification strategy



# Alternative specification

$$\text{Stock share}_{it} = \alpha + \beta_1 \text{Land value}_{it} + \beta_2 \text{Initial mortgage}_{it} + \gamma \mathbf{X_{it}} + \varepsilon_{it}$$

- Prediction: $\beta_1 > 0$ if positive wealth effect is larger than negative illiquidity and price risk effects, $\beta_2 < 0$

# DATASET

# Dataset

- Nikkei RADAR, 2000–2015
  - Yearly household survey (repeated cross-section data) to those residing in the metropolitan area (within 40km-raduis from Tokyo Station)
- Public notice of land prices (PNLP)
  - To construct residential land price indices (Lprice_present, Lprice_purchase) for 22 regions identified from Nikkei RADAR during 1983–2015

# List of 22 regions

| Area | Distance from Tokyo station 0–10km | 10–20km | 20–30km | 30–40km |
|---|---|---|---|---|
| Tokyo-Chuo | 56 (0.012) | | | |
| Tokyo-Jonan | 207 (0.046) | 58 (0.013) | | |
| Tokyo-Johoku | 173 (0.038) | 99 (0.022) | | |
| Tokyo-Josei | 65 (0.014) | 45 (0.010) | | |
| Tokyo-Joto | 255 (0.057) | 66 (0.015) | | |
| Tokyo-outer | | 98 (0.022) | 339 (0.075) | 255 (0.057) |
| Saitama | | 308 (0.069) | 340 (0.076) | 268 (0.060) |
| Chiba | | 278 (0.062) | 345 (0.077) | 236 (0.053) |
| Kanagawa | | 196 (0.044) | 284 (0.063) | 464 (0.103) |
| Ibaragi | | | | 60 (0.013) |

**Note**: The figures show the number of observations for each region and the shares in parentheses

# Sample selection

- Nikkei RADAR contains roughly 2,700 households in each year (42,709 in years 2000–2015)
- We **exclude** the following households from our sample
  - Renters, homeowners that lack info on Land value (e.g., those living in an apartment)
  - Households with no mortgage debts
  - Households for which we cannot obtain data for one of the variables used in estimations
  - Difference between the current mortgage interest rate (national average) and the interest rate in the year of borrowing is more than 1 percentage point
- Number of observations: 4,495

# Sample selection

- Nikkei RADAR contains roughly 2,700 households in each
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**Reason for the exclusion**

- We need info about the year of purchasing houses, but Nikkei RADAR does not provide it

➔ Our **assumption**: year of borrowing = year of purchase

➔ Excluding households that likely refinanced mortgage debts

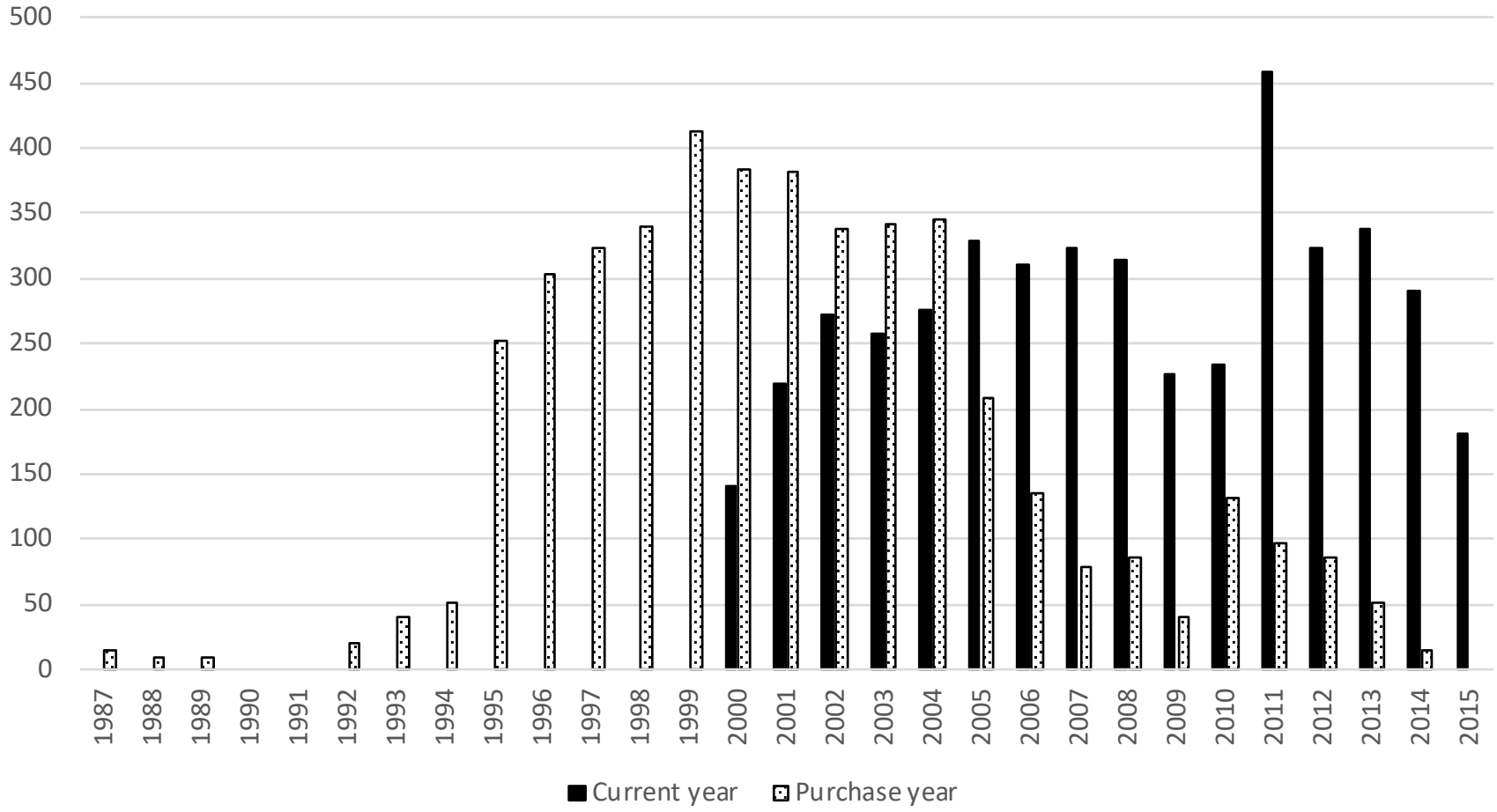
  - Difference between the current mortgage interest rate (national average) and the interest rate in the year of borrowing is more than 1 percentage point

- Number of observations: 4,495

# Summary statistics

| | Units | Mean | Median | S.D. | Min | Max |
|---|---|---|---|---|---|---|
| **Dependent variable** | | | | | | |
| Stock share | % | 9.003 | 8.299 | 18.795 | 0.000 | 100.000 |
| **Independent variables** | | | | | | |
| Land value | 10 million yen | 3.090 | 2.500 | 2.373 | 0.100 | 30.000 |
| Home equity | 10 million yen | 0.822 | 0.400 | 2.367 | -9.000 | 28.800 |
| Initial mortgage | 10 million yen | 3.328 | 3.000 | 1.762 | 0.300 | 40.000 |
| Income | 10 million yen | 0.849 | 0.850 | 0.420 | 0.050 | 4.000 |
| Financial asset | 10 million yen | 0.779 | 0.400 | 1.219 | 0.010 | 17.980 |
| Outside-Tokyo 23wards | dummy variable | 0.772 | 0.000 | 0.419 | 0 | 1 |
| Age 30 and under | dummy variable | 0.023 | 0.000 | 0.149 | 0 | 1 |
| Age 31-40 | dummy variable | 0.274 | 0.000 | 0.446 | 0 | 1 |
| Age 41-50 | dummy variable | 0.404 | 0.000 | 0.491 | 0 | 1 |
| Age 51-60 | dummy variable | 0.219 | 0.000 | 0.414 | 0 | 1 |
| Age 61-70 | dummy variable | 0.068 | 0.000 | 0.252 | 0 | 1 |
| Age 71over | dummy variable | 0.012 | 0.000 | 0.111 | 0 | 1 |
| **Instrumental variables** | | | | | | |
| Lprice_present | 1983=100 | 87.480 | 74.550 | 40.870 | 24.270 | 264.170 |
| Lprice_purchase | 1983=100 | 98.870 | 90.590 | 42.140 | 24.600 | 495.690 |

# Summary statistics



# RESULTS

# Simple OLS

| | (i) | (ii) |
|---|---|---|
| Estimation method: | OLS | OLS |
| Dependent variable: | Stock_share | Stock_share |
| Land value | 0.832 *** | 0.379 * |
| | [ 0.202 ] | [ 0.222 ] |
| Home equity | 0.302 | 0.087 |
| | [ 0.202 ] | [ 0.219 ] |
| Other controls | No | YES |
| Current year dummies | YES | YES |
| Purchase year dummies | YES | YES |
| Number of observations | 4,495 | 4,495 |

Opposite sign, confirming the upward bias as predicted

# 2SLS à la Chetty et al. (2017)

| | (i) | (ii) | (iii) |
|---|---|---|---|
| Estimation method: | | 2SLS | |
| Dependent variable: | Land value (1st stage) | Home equity (1st stage) | Stock share (2nd stage IV) |
| Land value | | | -1.997 |
| | | | [ 2.636 ] |
| Home equity | | | 7.235 * |
| | | | [ 3.919 ] |
| Lprice_present | 1327.073 *** | 1580.400 *** | |
| ( x 1/100K) | [ 314.924 ] | [ 321.391 ] | |
| Lprice_purchase | 87.058 | -734.176 ** | |
| ( x 1/100K) | [ 300.002 ] | [ 306.162 ] | |
| Other controls | YES | YES | YES |
| Current year dummies | YES | YES | YES |
| Purchase year dummies | YES | YES | YES |
| Number of observations | 4,495 | 4,495 | 4,495 |

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| Number of observations | 4,495 | 4,495 | 4,495 |

Consistent with the prediction, coefficients of the current land price on Land value and Home equity are both significantly positive, while that of the year-of-purchase land price on Home equity is significantly negative

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The coefficient of Home equity is weakly positive, but the negative coefficient of Land value is insignificant

# 2SLS using alternative specification

| | (i) | (ii) | (iii) |
|---|---|---|---|
| Estimation method: | | 2SLS | |
| Dependent variable: | Land value (1st stage) | Initial mortgage (1st stage) | Stock share (2nd stage) |
| Land value | | | 5.490 *** |
| | | | [ 1.913 ] |
| Initial mortgage | | | -6.201 * |
| | | | [ 3.375 ] |
| Lprice_present ( x 1/100K) | 1327.073 *** | -241.704 | |
| | [ 314.924 ] | [ 243.240 ] | |
| Lprice_purchase ( x 1/100K) | 87.058 | 961.656 *** | |
| | [ 300.002 ] | [ 231.714 ] | |
| Other controls | YES | YES | YES |
| Current year dummies | YES | YES | YES |
| Purchase year dummies | YES | YES | YES |
| Number of observations | 4,495 | 4,495 | 4,495 |

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| | (1st stage) | (1st stage) | (2nd stage) |
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| Other controls | YES | YES | YES |
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| Purchase year dummies | YES | YES | YES |
| Number of observations | 4,495 | 4,495 | 4,495 |

Consistent with the prediction, both the coefficient of the current land price on Land value and that of the year-of-purchase land price on Initial mortgage are significantly positive

# 2SLS using alternative specification

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| Other controls | YES | YES | YES |
| Current year dummies | YES | YES | YES |
| Purchase year dummies | YES | YES | YES |
| Number of observations | 4,495 | 4,495 | 4,495 |

The coefficient of Land value is significantly positive, while that of Initial mortgage is significantly negative

# Main results

- Positive coefficient of Land value (while holding Initial mortgage fixed) indicates that the negative effect of an increase in residential land is absent, or is smaller than the positive effect of an increase in households' net wealth
  - ¥1M increase in Land value raises Stock share by 0.5% pt.; ¥1M increase in Initial mortgage reduces Stock share by 0.6% pt.
- The effect of Initial mortgage on Stock share is statistically weaker
  - Heterogeneity among households?

# Extensions for future research

- About 70 percent of households in our sample do not possess any stocks
  - Stock share is left-censored at zero
- Extensions: IV-Tobit (Dep. var. = Stock share) and IV-Probit (Dep. var. = Stock holder, extensive margin)
  - The effect of Initial mortgage is insignificant

# Extensions for future research

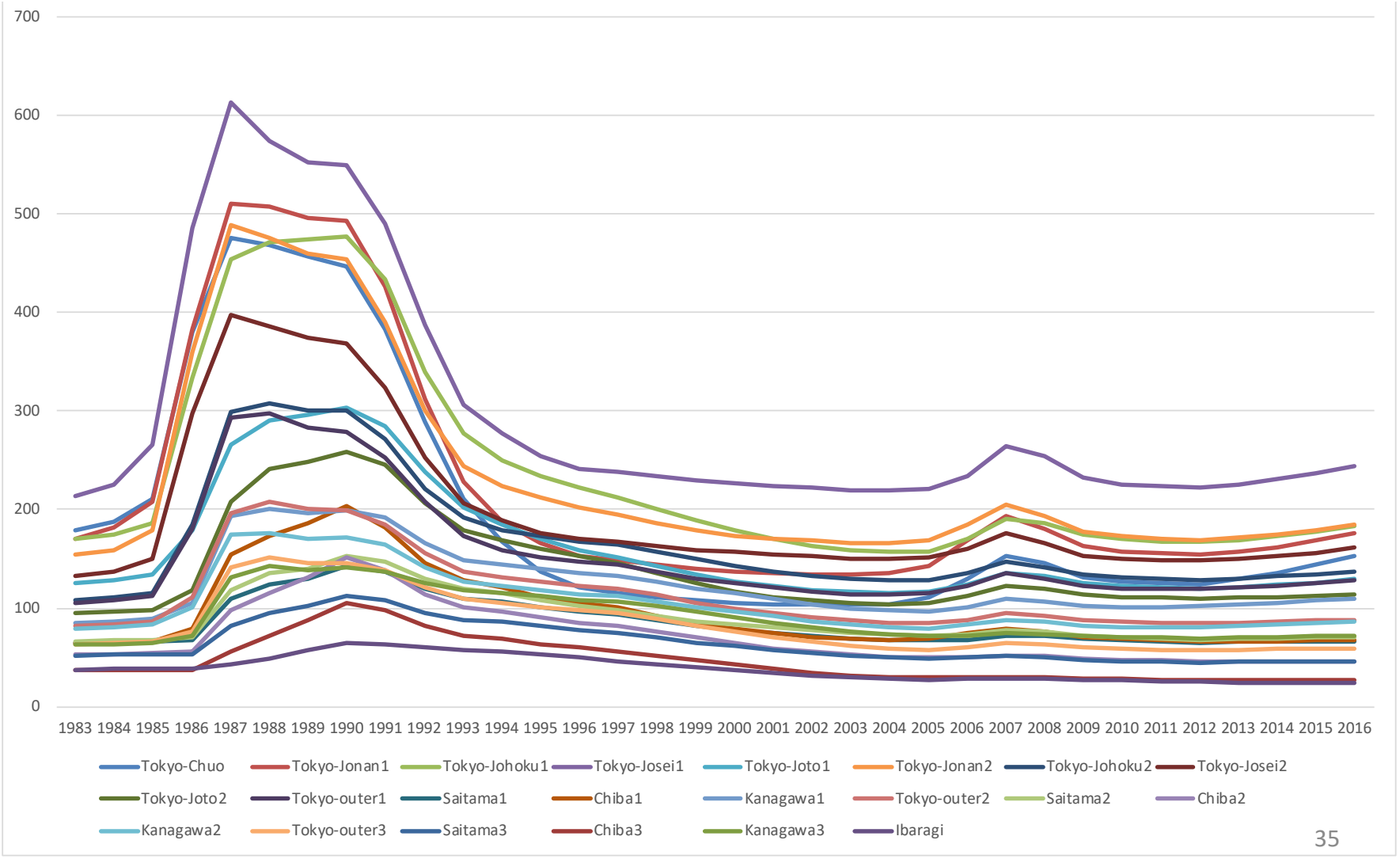
| Estimation method: | IV-Tobit | IV-Probit |
|---|---|---|
| Dependent variable: | Stock share (2nd stage) | Stock holder (2nd stage) |
| Land value | 13.562 ** | 0.241 * |
| | [ 5.369 ] | [ 0.130 ] |
| Initial mortgage | -11.214 | -0.181 |
| | [ 9.546 ] | [ 0.232 ] |
| Other controls | YES | YES |
| Current year dummies | YES | YES |
| Purchase year dummies | YES | YES |
| Number of observations | 4,495 | 4,495 |

Insignificant

# END OF PRESENTATION
# THANK YOU

# SUPPLEMENTARY SLIDES

# PNLP residential land price indices



# Possible remaining problems

- Regional-level omitted variable biases
  - Regional land prices may be correlated with (omitted) local economic conditions that affect households' portfolio choice
  - **Chetty et al. (2017)** use "variation in *national* house price indices (demand shock) × *state-level* housing supply elasticity (Saiz 2010)" as alternative IV & state FE
- Selection effects
  - Individuals who buy houses when land prices are relatively high may have different risk preferences
  - **Chetty et al. (2017)** use subsample of households to construct panel data

# Literature

- Why are housing assets important for household portfolio choice among financial assets?
  - The observed hump-shaped age profile of the share of stocks in a household portfolio is difficult to reconcile with standard models of portfolio allocation
    - US: Ameriks and Zeldes (2004), Canner et al. (1997), Europe: Guisso et al. (2002), Japan: Iwaisako (2009)
    - Standard models predict that age is irrelevant for or negatively correlated with the share of risky assets (e.g., Bodie et al. 1992)

# Literature

- Why are housing assets important for household portfolio choice among financial assets? (cont'd)
  - Many theoretical and empirical studies incorporate housing in a model of portfolio allocation to examine:
    - whether observed pattern of age profile of stock holding share can be accounted for
    - how the presence of housing affect stock market participation and the share of stocks in financial assets
    - Cocco (2004), Faig and Shum (2002), Flavin and Yamashita (2002), Iwaisako (2012), Yamashita (2003), Yao and Zhang (2005)

# Literature

- Many existing studies construct theoretical models and conduct numerical simulations and/or empirical analyses
- Cocco (2005): Investment in housing reduces equity market participation, especially for younger and poorer households
  - Equity market participation is measured by stock relative to liquid assets, stock relative to financial assets, stock relative to total assets, and absolute value
- Yamashita (2003): Households with higher house-to-net-worth ratio hold a lower proportion in stocks relative to financial assets
  - In the simulation model, however, the share of stockholdings is hump-shaped
  - Sample is limited to stock-owners

# Literature

- Yao and Zhang (2005): Households owning a house / with higher house-to-net-worth ratio
  - are less likely to hold stocks; hold less liquid asset to participate in stock market
  - hold a lower equity proportion in their total net worth (bonds, stocks, and home equity); substitution effect
  - hold a higher equity proportion in their liquid financial portfolio (bonds and stocks); diversification effect
    - Diversification effect is **not** found in the empirical analysis
- Iwaisako et al. (2015): Homeownership
  - reduces the probability of owning stocks (extensive margin)
  - increases the share of stocks relative to financial assets, conditional on owning stocks (intensive margin)

# Iwaisako et al. (2015)

- (1) Ratio of households owning stocks increased in the mid-2000s and remained the same thereafter
  - Throughout the 2000s, the ratio of household owning residential property were generally stable, while that with positive residential mortgages outstanding decreased substantially
- (2) Households with higher residential property relative to gross total asset are less likely to **own** stocks
  - Consistent with the **"crowding out" effect** hypothesis
- (3) Conditional on owning stocks, households with higher residential property relative to gross total asset hold a larger **share in stocks relative to financial assets**
  - Consistent with the **"diversification" effect** hypothesis