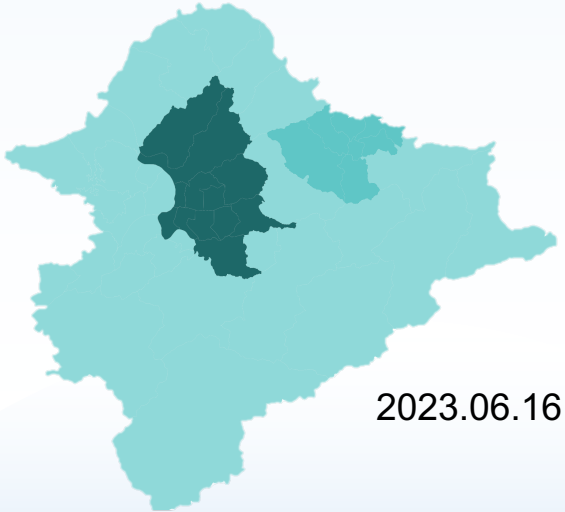
NATIONAL CHENGCHI UNIVERSITY
INTERNATIONAL MASTERS IN APPLIED
ECONOMICS AND SOCIAL DEVELOPMENT

Multi-House Tax Policy and Housing Price Effect :

Evidence from the Greater Taipei Metropolitan Area in Taiwan

Student:
Hsieh, Ming-Ying

Co-Advisors:
Wu, Wen-Chieh and Fu, Chien-Hao

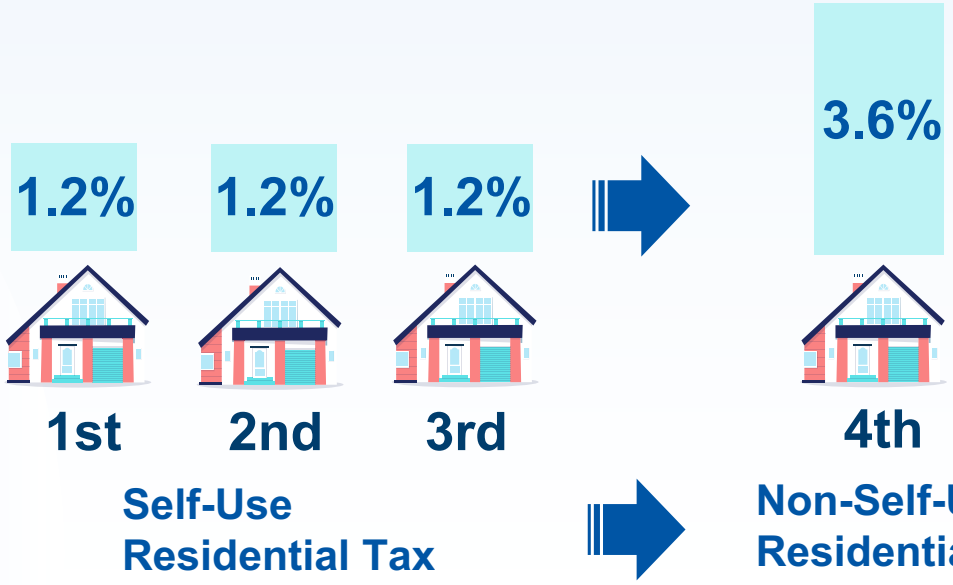


2023.06.16

TABLE OF CONTENTS

Introduction of Multi-House Tax Policy

Taipei City
was the leading city to carry out
the multi-house tax policy in **2014.07.**



Central Authority

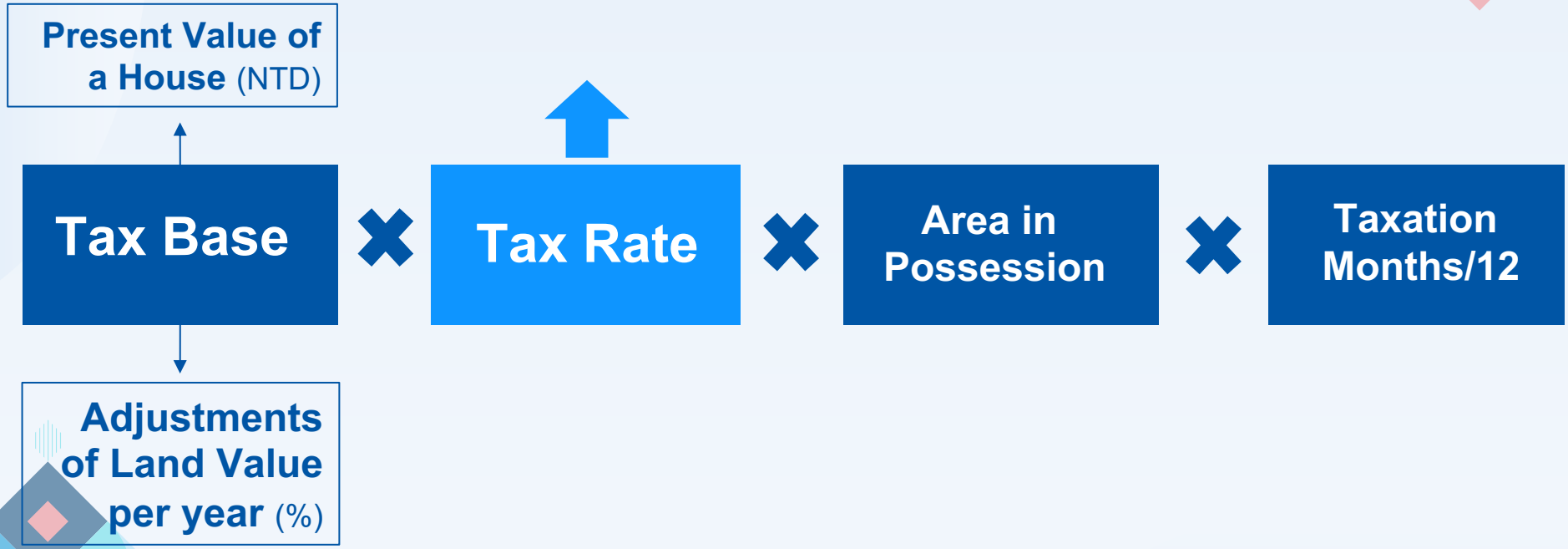
Local Tax

Local Executives

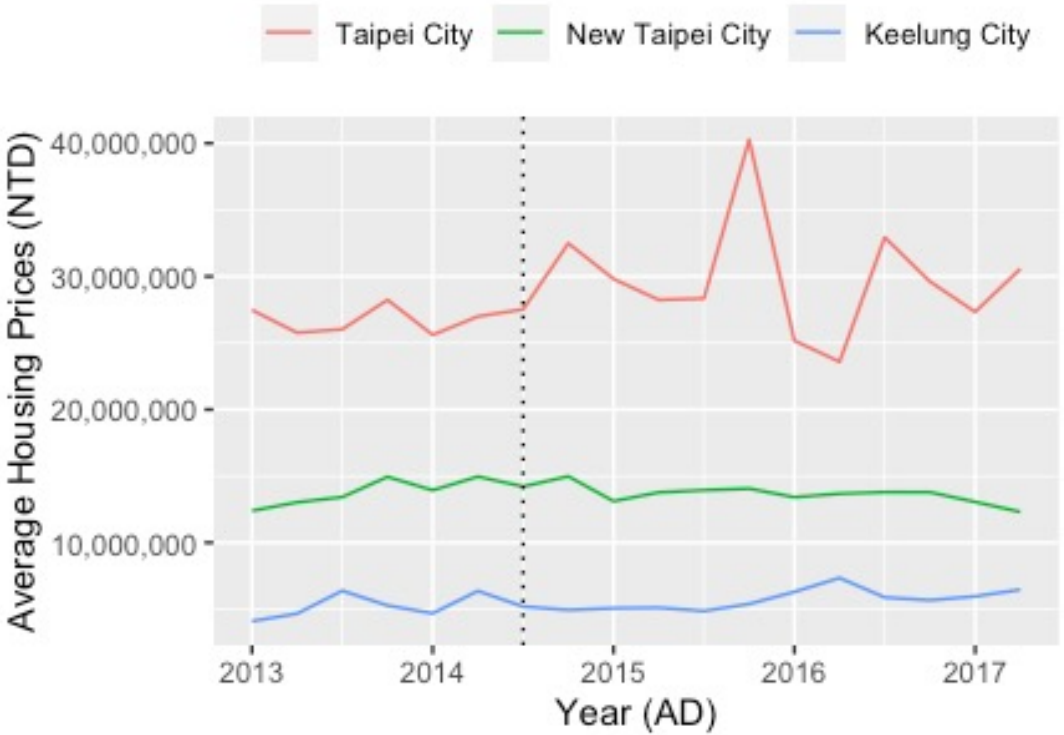
Introduction

The Composition of Annual Payment for the Multi-House Tax

(Simiiar with Housing Tax)



Introduction



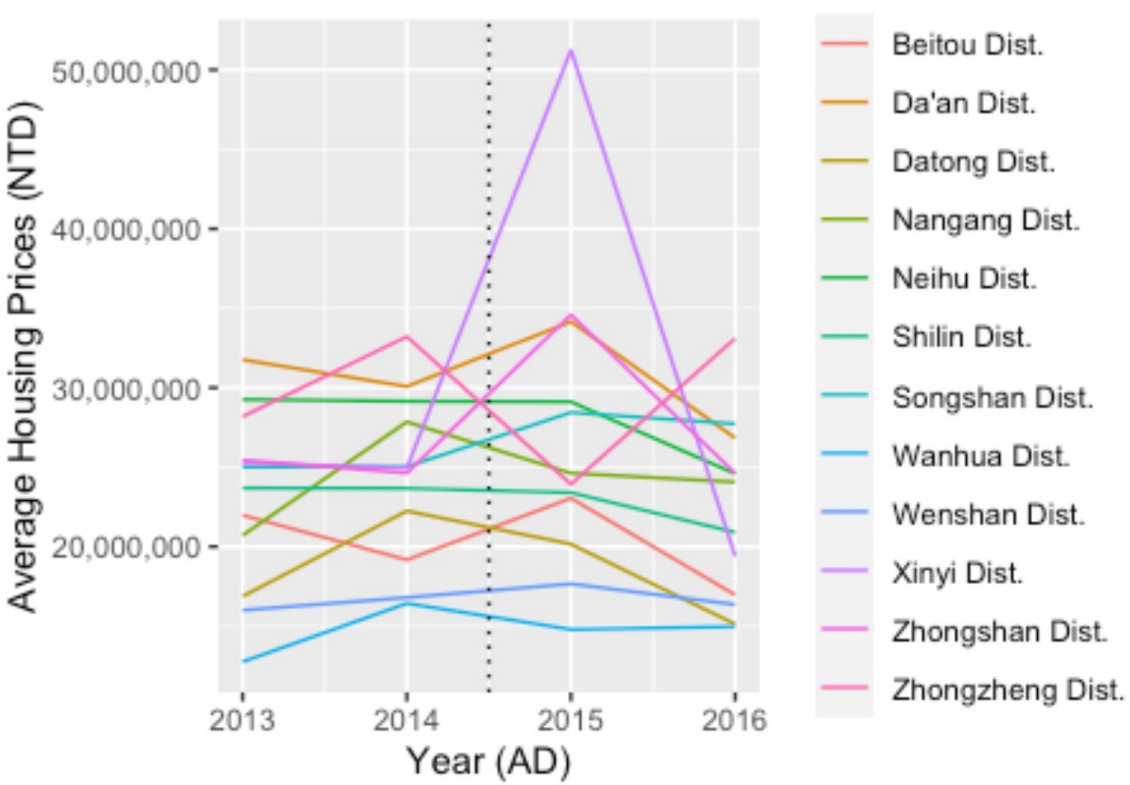
The Housing Price Trend in Three Cities of the Greater Taipei Metropolitan Area

Source: This Study

Introduction

1

Decrase in Housing Prices



The Changes in Housing Prices within Taipei City

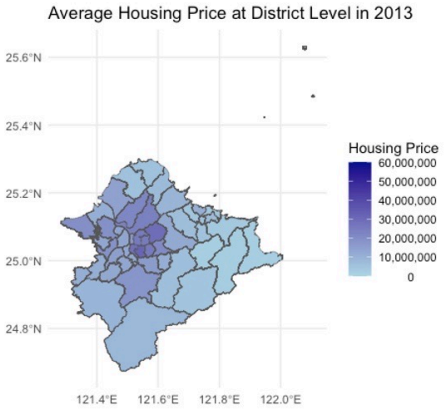
Source: This Study

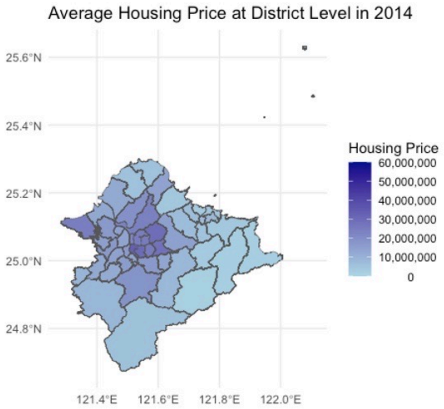
Introduction

2

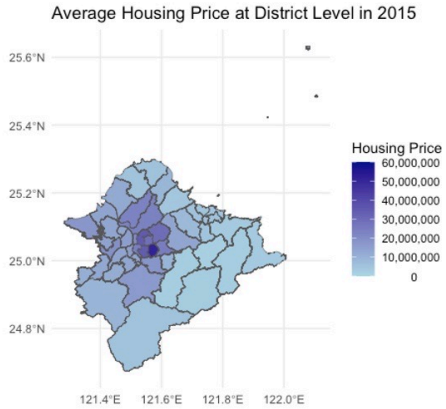
Fiscal Capitalization?

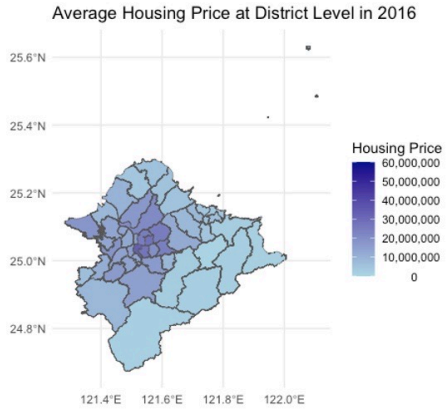
Implementation of the multi-house tax policy





Before



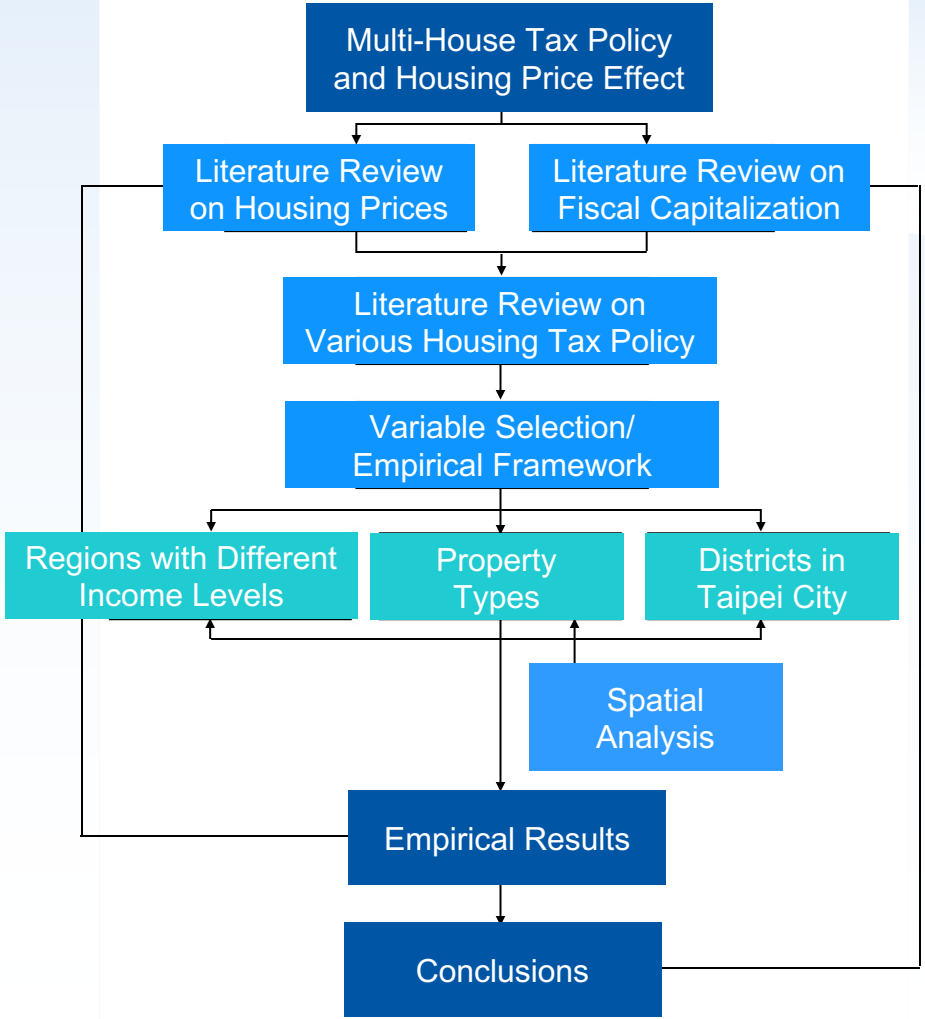


After

Fiscal Capitalization

The Choropleth Maps Showing Changes in Housing Prices at District Level
Source: This Study

Research Structure



1 Introduction

2 **Datasets and Variables**

3 Equations

4 Empirical Study

5 Conclusion

6 Suggestions for Further Studies

Datasets and Variables

Actual Price Registration Dataset
Micro-level

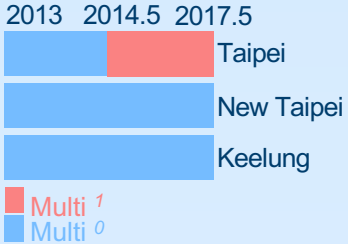
Datails of Transactions

Property Characteristics	-Transferred Area of Building and Land -Structure Age -Property Type
Outcome Variable	-Log of Housing Prices
Time	-Transaction Date (Year-Quarter)
Location	-Transaction Address (City-District)

Macro Trend
Binary Dummy

Impact of Multi-House Tax Policy

-Multi *0*
-Multi *1*



Control Variables
Macro-level

Regional Condition

Demographic Factors	-Households -Population Density -Gender Ratio -Birth Rate -Death Rate -Marriage Rate -Divorce Rate
Economic Status	-Individual Income Tax in Districts
Vacancy Rate	-Low-Use-Residentials /Total Buildings Classified for Residential Taxation Purposes

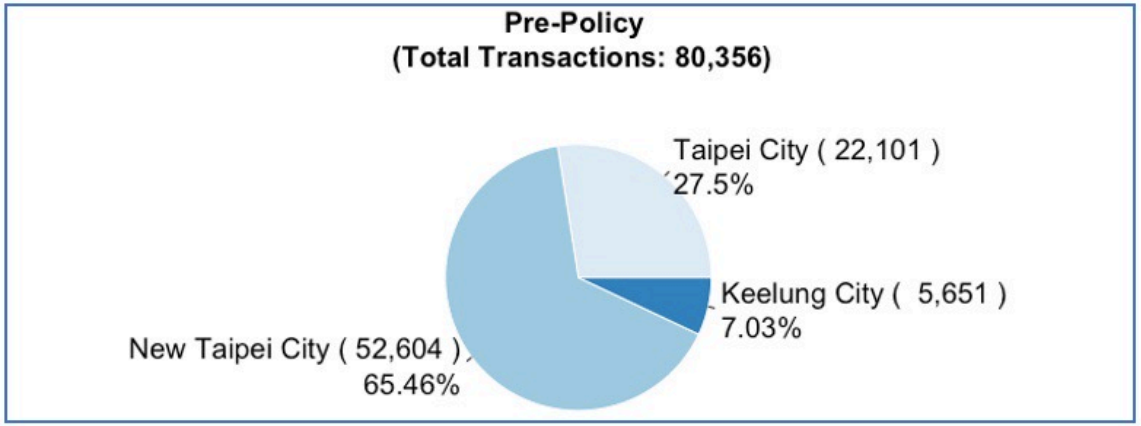
Descriptive Satistics

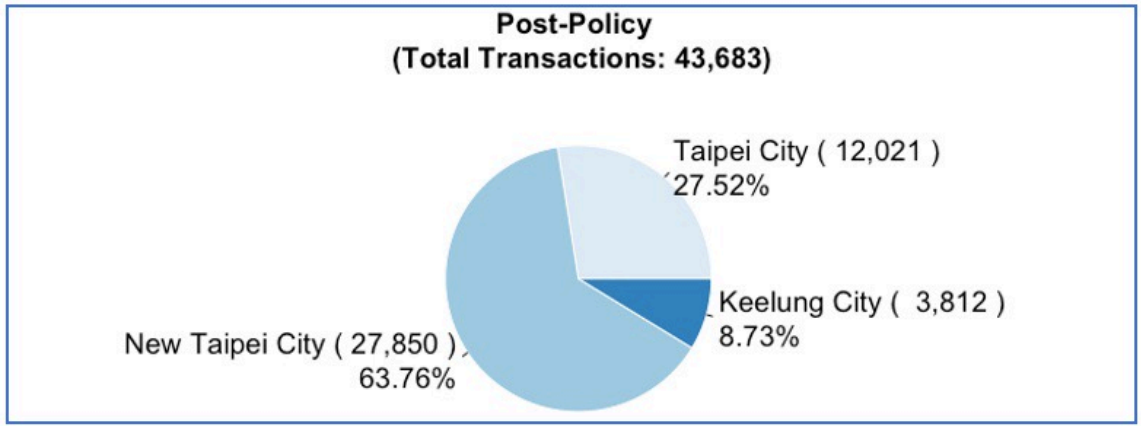
N=251,580	*Mean*	Median	*SD*	Min	Max
Log of House Prices	16.272	16.249	0.8228446	8.483	24.020
House Prices	17,190,000	11,400,00	69,847,089	4,831	27,030,000,000
Transferred Building Area	27.66	21.47	304.6755	0	10014.30
Transferred Land Area	143.91	115.68	70.95542	0.02	69125.53
Households	93488	89499	48693.57	2359	207151
Gender Ratio	95.60	95.90	3.764224	87.35	126.22
Population Density	12175	8095	10151.26	38	40089
Structure Age	23.562	22.889	13.61863	5.968	111.999
Vacancy Rate	0.08364	0.06987	0.035640	0.04490	0.32502
Birth Rate	0.009350	0.009349	0.001507	0.004018	0.012622
Death Rate	0.005743	0.005807	0.001075	0.003966	0.015760
Marriage Rate	0.006940	0.007068	0.000553	0.003167	0.008012
Divorce Rate	0.002411	0.002456	0.000300	0.001058	0.003441
Avg. Ind. Income Tax	1001.3	924.8	239.5556	618.7	1933.3

Note. "Avg. Ind. Income Tax" means "Average Individual Income Tax in Districts."

Exploratory Discussion

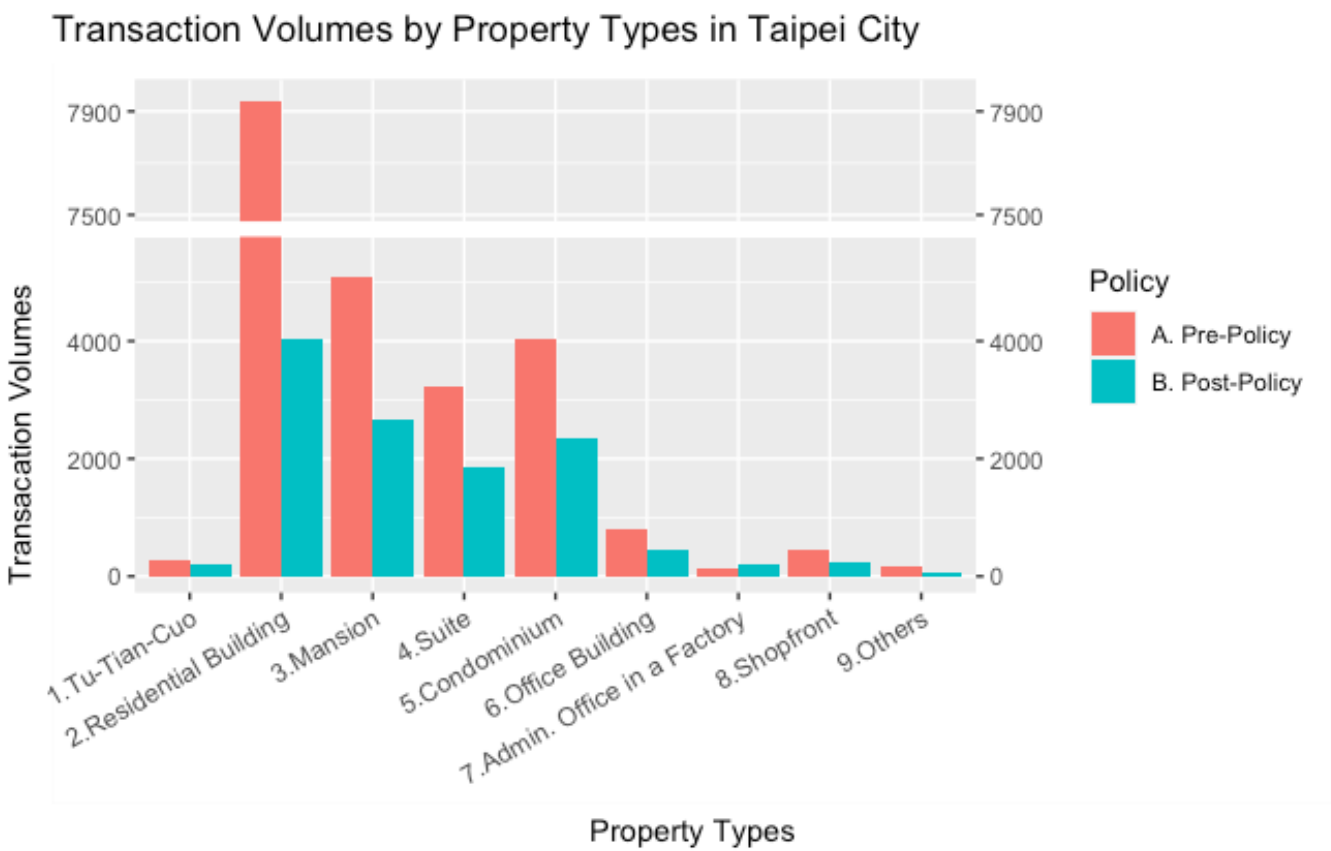
1. The Transaction Region Distribution: Pre-Policy vs. Post-Policy





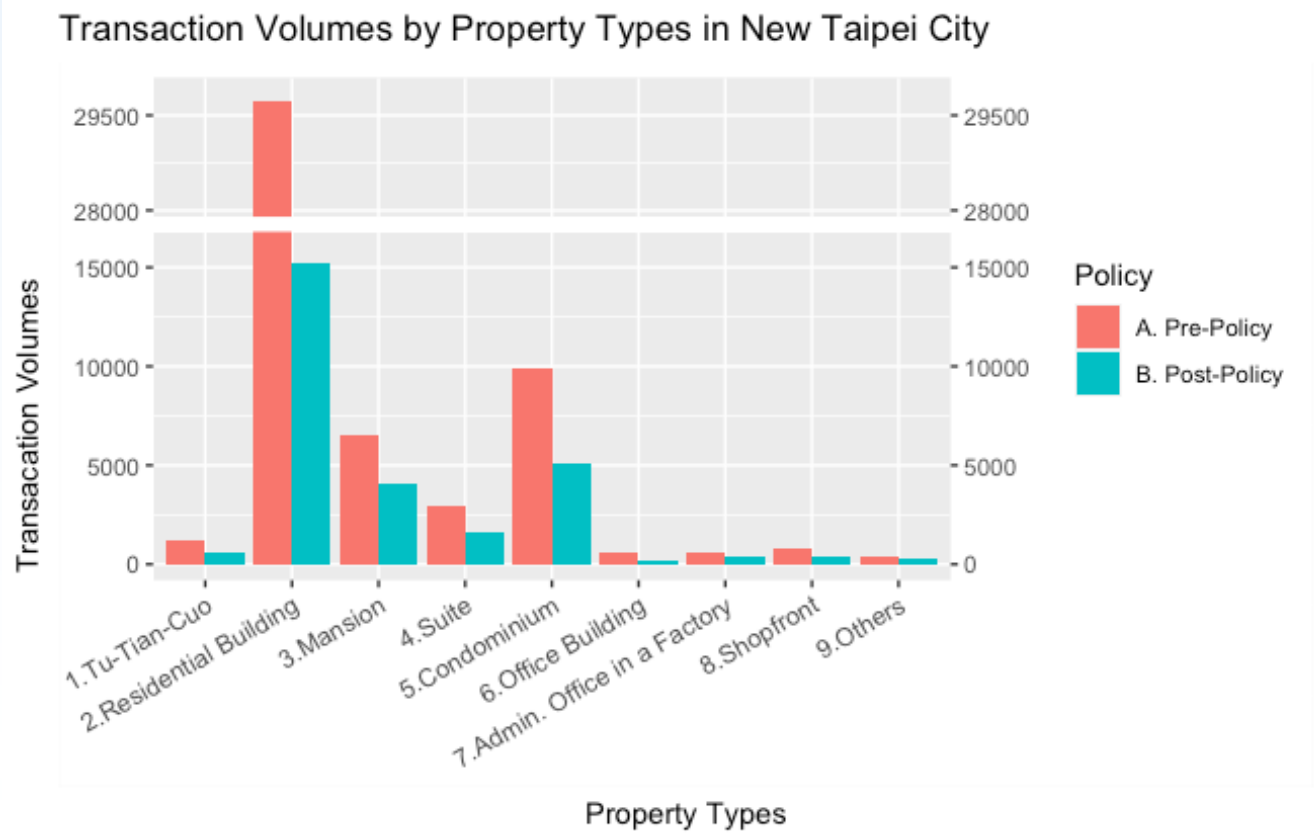
Exploratory Discussion

2. Average Transaction Volumes in Taipei City: Pre-Policy vs. Post-Policy



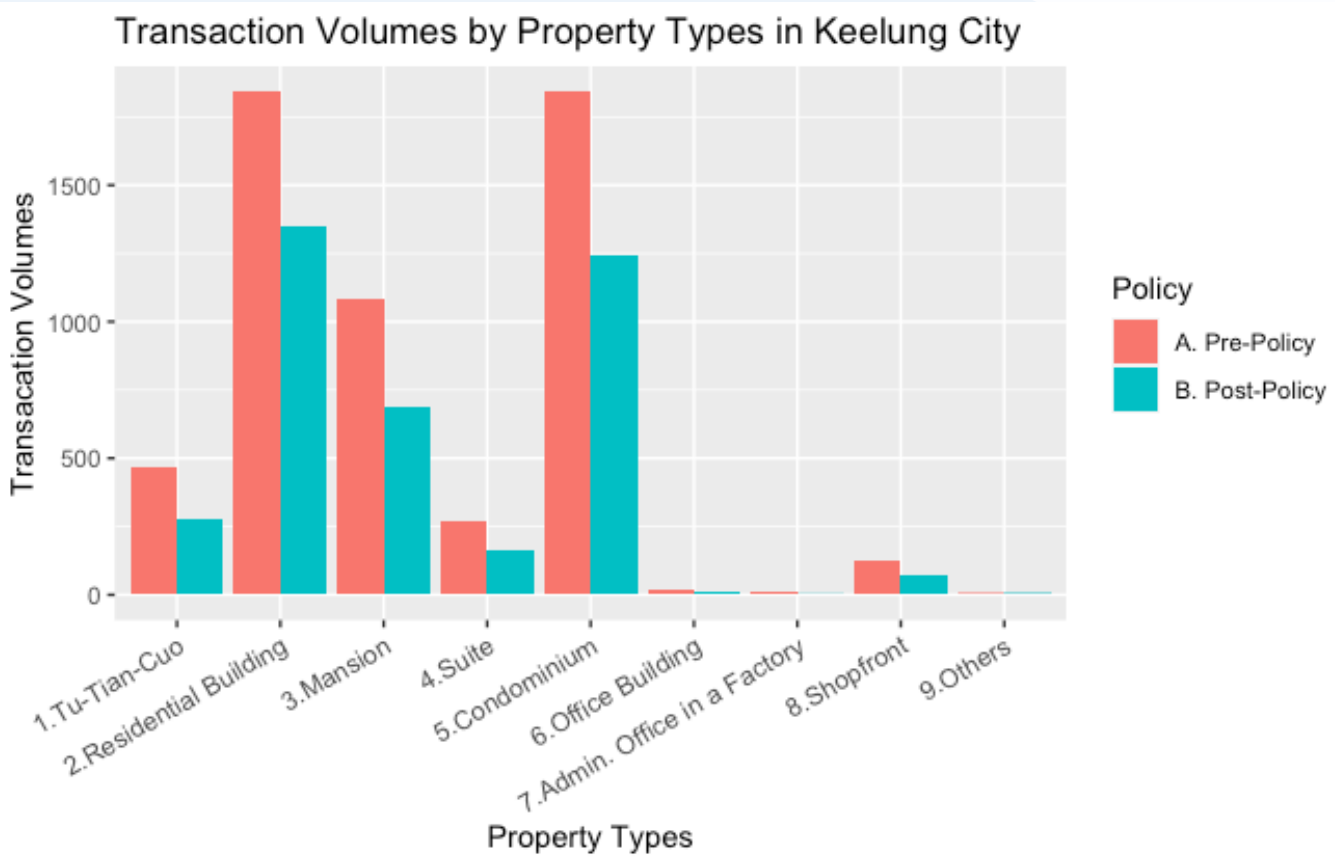
Exploratory Discussion

3. Average Transaction Volumes in New Taipei City: Pre-Policy vs. Post-Policy



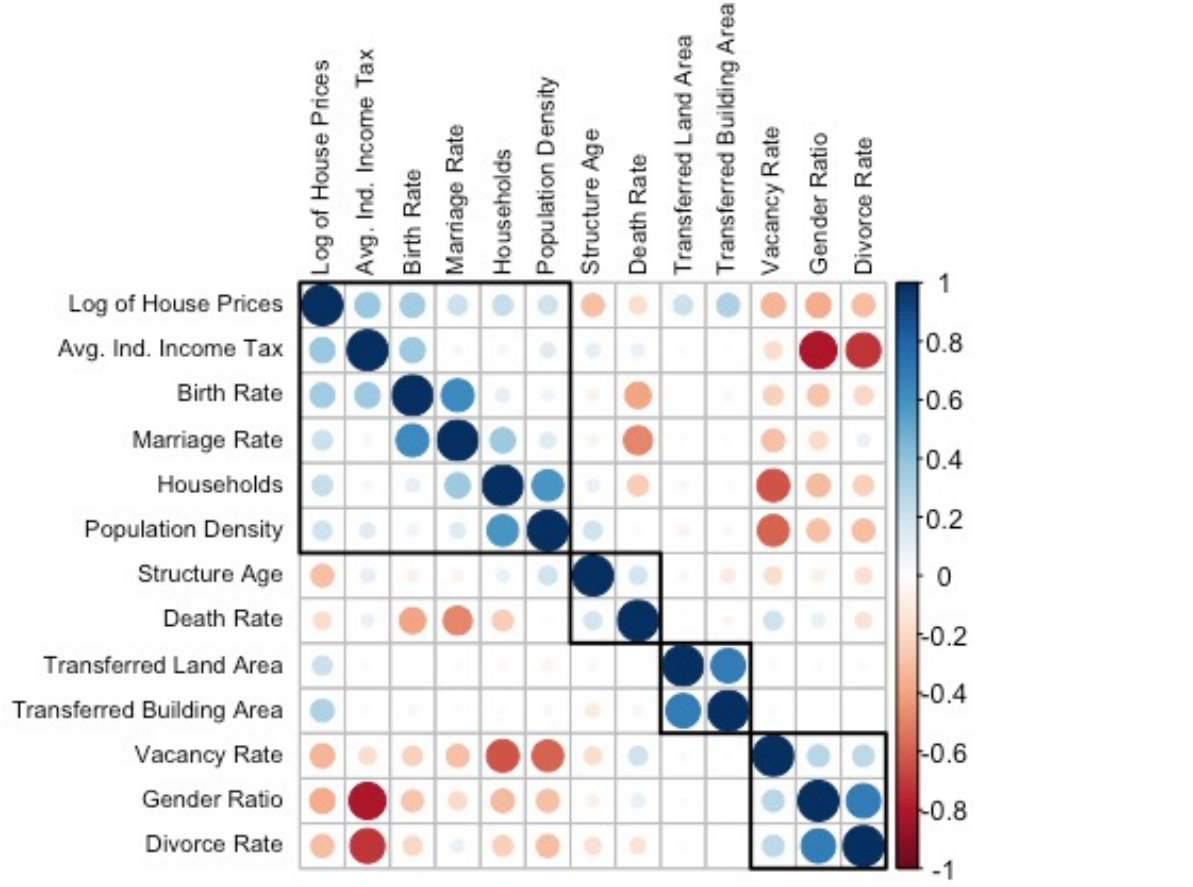
Exploratory Discussion

4. Average Transaction Volumes in Keelung City: Pre-Policy vs. Post-Policy



Exploratory Discussion

5. Matrixes of Pearson's Correlation Coefficients



1 Introduction

2 Datasets and Variables

3 **Equations**

4 Empirical Study

5 Conclusion

6 Suggestions for Further Studies

Equations

Hedonic Pricing Model with Fixed Effect

$$Y_{itz} = \alpha + \delta_1 MultihouseTax_{itz} + X_{it}^{*}\beta + \zeta_z + \tau_t + \epsilon_{itz} \quad (1)$$

Binary

Matrix of Control Variables

Time-Location Error Term

Hedonic Pricing Model with Fixed Effect + **Interaction with potential factors**

$$Y_{itz} = \alpha + \delta_1 MultihouseTax_{itz} + MultiHouseTax_{itz}^{k} Z_{iz}^{k} \Delta^{k} + Z_{iz}^{k}\gamma + X_{it}^{*}\beta + \zeta_z + \tau_t + \epsilon_{itz} \quad (2)$$

Interaction-Term, while k=1,2,3

Dummy of Interation

Equations

$k \in \{1, 2, 3\}$

Local Economic Status

$Z_{iz}^{1} = [Average\ Inc.\ Tax_{tz}]$

Differences in Effects based on **Variation in Tax Payments**

- $Continuous\ Variable$ — 3-1
- $Category\ Variable$
  - $H_{Inc.\_Region}$
  - $M_{Inc.\_Region}$ — 3-2

Differences of Effect by using **Predefined Dummy Groups**

Property Types

$Z_{iz}^{2} = [Property\ Type_{i}]$ — 4

Administrative Districts

$Z_{iz}^{3} = [Districts\ in\ Taipei\ City_{z}]$ — 5

Z=1 Setting Dummies for Interactions

Local Economic Status

Average Individual Income Tax in Each District = *Aggregated Values from* [*Opendata* **Average Individual Income Tax in Li** × *Weighted Value* **Propotion of** Population in Li to Population in District]

Rank them

- **1st -16th** → **High_Income_Region**
- **17th-32nd** → **Middle_Income_Region**
- **33rd-48th** → **Low_Income_Region** — **Baseline**

Setting Dummies for Interactions

Z=2 Property Type

Residential-Use	透天厝 Detached House
	Condominium
	Residential Building
	Mansion
	Suite
Non-Residential-Use	Office Building
	Administrative Office in a Factory
	Shopfront
	Others

Z=3 Administrative Districts in Taiepi City

Wanhua District	Nangang District
Da'an District	Neihu District
Zhongshan District	Beitou District
Zhongzhang District	Wenshan District
Datong District	Xinyi District
Shilin District	Songshan District

Baseline

Interpretation of Empirical Results

The Steps of Interpretating the Empirical Results in Each Round

A

Multi-House-Policy ^{1}

Coefficient

B

Potentially Fluctuates Housing Prices

- **Local Economic Status**
  - Continuous
  - Category
- **Property Types**
- **Administrative Districts**

Before

Coefficients with significance

After

Aggregated Effect with Intercation Factors After Multi ^{1}

By Summing the both **Coefficients** of Multi ^{1} and Default Dummies up

1 **Post-Multi-House Tax Policy Pricing Effects**

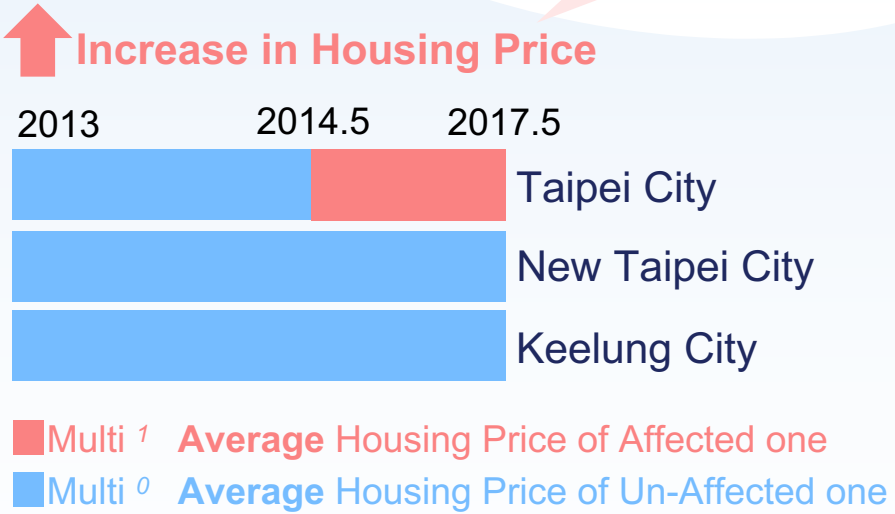
2 **Respective Effects on Pre-Defineded Groups of Dummies** (Multi ^{0})

3 **Effect of Multi-House Tax Policy on Housing Prices by Different Interactions**

1 Average Post-Multi-House Tax Policy Pricing Effects

Dependent Variable: Natural Log of Housing Prices	
Transferred Building Area	0.001***
	(0.00001)
Transferred Land Area	0.001***
	(0.00002)
Structure Age	-0.022***
	(0.0001)
Multi-House-Tax-Policy [1]	0.011**
	(0.005)
Households	-0.00000
	(0.00000)
Gender Ratio	-0.054***
	(0.006)
Population Density	-0.00000
	(0.00002)
Birth Rate	42.814***
	(3.228)
Death Rate	-48.996***
	(6.041)
Marriage Rate	-34.203***
	(5.406)
Divorce Rate	-35.909***
	(10.866)
Vacancy Rate	1.858***
	(0.276)
Average Individual Income Tax in Districts	0.00000
	(0.00003)

Reasonable but Insufficient



Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.276
N (Observations)	251,580
Note.	*$p<0.1$; **$p<0.05$; ***$p<0.01$

Z=1 3-1 Effect of Multi-House Tax Policy on Housing Prices by Local Economics Status (Continuous Variable)

1

Dependent Variable: Natural Log of Housing Prices	
Multi-House-Tax-Policy [1]	0.138***
	(0.027)
Multi [1] * Avg. Ind. Income Tax in Dist.	-0.0001***
	(0.00002)
Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.276
N (Observations)	251,580
Note.	*$p<0.1$; **$p<0.05$; ***$p<0.01$

Increase in Housing Price

Native Fiscal Capitalization

Effect on High-Income Region

0.138 + H*(-0.0001)

Effect on Low-Income Region

0.138 + L*(-0.0001)

Differences in Effects by knowing **Variation in Tax Payments** across the regions

Difference of Effect btn High and Low Income Region

(H-L)*(-0.0001)

Assuming the Difference of IncomeTax is 10,000 NTD

0.138 + 10,000*(-0.0001) = 0.138

Z=1

3-2 Effect of Multi-House Tax Policy on Housing Prices by Local Economics Status (Category Variable)

Dependent Variable: Natural Log of Housing Prices	
1 Multi-House-Tax-Policy [1]	0.207***
	(0.016)
High-Income-Region [d]	-0.009
	(0.007)
2 Middle-Income-Region [d]	-0.002
	(0.006)
3 Multi [1] * High-Income-Region [d]	-0.199***
	(0.018)
Multi [1] * Middle-Income-Region [d]	-0.213***
	(0.016)
Controlling Property Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economic Status	Yes
Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.277
N (Observations)	251,580

Note. *p<0.1; **p<0.05; ***p<0.01

Increase in Housing Price

Aggregated Effect

Increase

High-Income Region 0.008

Middle-Income Region -0.006

Decrease

Native Fiscal Capitalization only happened in High-Income Region (Taipei City)

Z=2 4 Heterogeneous Pricing Effects: Property Types

Controlling House Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economics Status	Yes
Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.276
N (Observations)	251,580

1

Dependent Variable: Natural Log of Housing Prices	
Multi-House-Tax-Policy[1]	0.072***
	(0.022)

Increase in Housing Price

Before (Multi ^{0})

Residential Building [d] *(11 floors above with elevator)*	0.010
	(0.008)
Condominium [d]	0.006
	(0.009)
Others [d]	-0.016
	(0.019)
Suite [d] *(1 room with 1 bathroom and 1 hall)*	0.009
	(0.009)
Shopfront [d]	0.031**
	(0.013)
Administrative office in a factory [d]	0.001
	(0.015)
Mansion [d] *(10 floors below with elevator)*	0.009
	(0.009)
Office Building [d]	0.019
	(0.013)

After (Multi ^{1})

Multi ^{1} * Residential Building [d]	-0.059***
	(0.023)
Multi ^{1} * Condominium [d]	-0.080***
	(0.023)
Multi ^{1} * Others [d]	-0.035
	(0.039)
Multi ^{1} * Suite [d]	-0.059**
	(0.026)
Multi ^{1} * Shopfront [d]	-0.063*
	(0.034)
Multi ^{1} * Administrative office in a factory [d]	-0.095**
	(0.039)
Multi ^{1} * Mansion [d]	-0.050**
	(0.024)
Multi ^{1} * Office Building [d]	-0.068**
	(0.034)

Z=2

Heterogeneous pricing effects: Property Types

Dependent Variable: Natural Log of Housing Prices

2

Before (Multi ^{0})

Residential Building ^{d} *(11 floors above with elevator)*	0.010
	(0.008)
Condominium ^{d}	0.006
	(0.009)
Others ^{d}	-0.016
	(0.019)
Suite ^{d} *(1 room with 1 bathroom and 1 hall)*	0.009
	(0.009)
Shopfront ^{d}	0.031**
	(0.013)
Administrative office in a factory ^{d}	0.001
	(0.015)
Mansion ^{d} *(10 floors below with elevator)*	0.009
	(0.009)
Office Building ^{d}	0.019
	(0.013)
Controlling House Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economics Status	Yes
Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.276
N (Observations)	251,580

lti ^{1})

Multi ^{1} * Resi	-0.059***
	(0.023)
Multi ^{1} * Cond	-0.080***
	(0.023)
Multi ^{1} * Othe	-0.035
	(0.039)
Multi ^{1} * Suite	-0.059**
	(0.026)
Multi ^{1} * Shop	-0.063*
	(0.034)
Multi ^{1} * Adm	-0.095**
	(0.039)
Multi ^{1} * Mans	-0.050**
	(0.024)
Multi ^{1} * Offic	-0.068**
	(0.034)

Shopfront

opened on the 1F of buildings with added value / located at booming area

0.031

Increase

Z=2

Heterogeneous pricing effects: Property Types

Dependent Variable: Natural Log of Housing Prices	
Multi-House-Tax-Policy[1]	0.072***
	(0.022)
Controlling House Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economics Status	Yes
Fixed Effect on Location (City-District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.276
N (Observations)	251,580

Increase in Housing Price

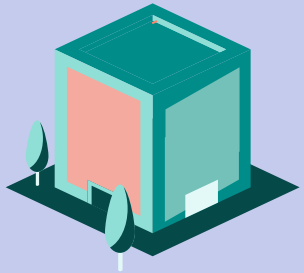
3

Before (Multi [0])	
Residential Building [d] *(11 floors above with elevator)*	0.010
	(0.008)
Condominium [d]	0.006
	(0.009)
Others [d]	-0.016
	(0.019)
Suite [d] *(1 room with 1 bathroom and 1 hall)*	0.009
	(0.009)
Shopfront [d]	0.031**
	(0.013)
Administrative office in a factory [d]	0.001
	(0.015)
Mansion [d] *(10 floors below with elevator)*	0.009
	(0.009)
Office Building [d]	0.019
	(0.013)

After (Multi [1])	
Multi [1] * Residential Building [d]	-0.059***
	(0.023)
Multi [1] * Condominium [d]	-0.080***
	(0.023)
Multi [1] * Others [d]	-0.035
	(0.039)
Multi [1] * Suite [d]	-0.059**
	(0.026)
Multi [1] * Shopfront [d]	-0.063*
	(0.034)
Multi [1] * Administrative office in a factory [d]	-0.095**
	(0.039)
Multi [1] * Mansion [d]	-0.050**
	(0.024)
Multi [1] * Office Building [d]	-0.068**
	(0.034)

Multi [1] = 0.72

Comparison among Residential-Purpose Buildings



Condominium

6F below
no security guard
no elevator
no public facilities
Cheaper Rents/ Older Structure

-0.080***+0.072=
-0.008***

Decrease

Residential Building

12F below
with security guard
with elevator
larger public facilities
Emerging Housing Trend

-0.059***+0.072=
0.013***

Increase

Mansion

7F-11F
with security guard
with elevator
with smaller public facilities
Traditional/Scarcity

-0.050**+0.072=
0.022**

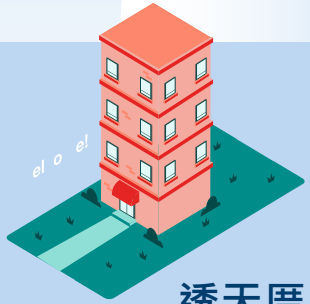
Increase

Suite

1 room
with 1 bathroom
with 1 hall
Popular with Middle-Class Tenants

-0.059**+0.072=
0.013**

Increase



透天厝 Detached House

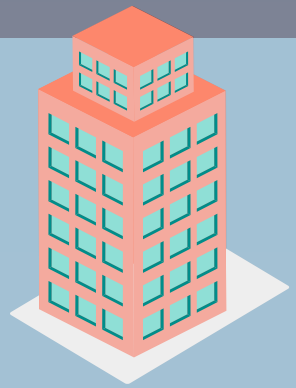
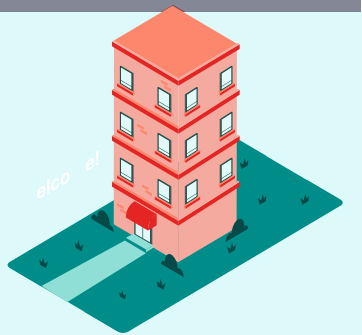
all stories owned by a single family
mostly in southern Taiwan
Luxury

Baseline

Fiscal Capitalization makes the wealty richer, but the poor burdens more tax spending

Multi [1] = 0.72

Comparison among Non-Residential-Purpose Buildings

	Office Building	Administrative Office in a Factory	Shopfront	透天厝 Detached House
				
	Commercial Zone	Commercial Zone	Commercial/ Residential Zone	Residential Zone
Multi [1] x Property Types [d]	-0.068**+0.072= 0.004**	-0.095**+0.072= -0.013**	-0.063**+0.072= 0.019**	Baseline
	Increase	Decrease	Increase	

Z=3 5 Heterogeneous Pricing Effects: Administrative Districts

Controlling House Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economics Status	Yes
Fixed Effect on Location (District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.214
N (Observations)	69,213

Dependent Variable: Natural Log of Housing Prices	
1 Multi-House-Tax-Policy [1]	0.066***
	(0.024)

Increase in Housing Price

2 Before (Multi [0])

Datong District [d]	-0.013
	(0.026)
Zhongshan District [d]	0.013
	(0.019)
Zhongzheng District [d]	0.011
	(0.023)
Xinyi District [d]	0.009
	(0.009)
Da'an District [d]	0.028
	(0.013)
Songshan District [d]	0.022
	(0.022)
Wenshan District [d]	0.006
	(0.021)
Neihu District [d]	0.016
	(0.019)
Nangang District [d]	-0.024
	(0.025)
Beitou District [d]	0.019
	(0.020)
Shilin District [d]	0.005
	(0.021)

After (Multi [1])

Multi [1] * Datong District [d]	0.002
	(0.023)
Multi [1] * Zhongshan District [d]	-0.033
	(0.026)
Multi [1] * Zhongzheng District [d]	-0.037
	(0.033)
Multi [1] * Xinyi District [d]	-0.016
	(0.032)
Multi [1] * Da'an District [d]	-0.020
	(0.030)
Multi [1] * Songshan District [d]	-0.036
	(0.031)
Multi [1] * Wenshan District [d]	-0.048*
	(0.028)
Multi [1] * Neihu District [d]	-0.031
	(0.026)
Multi [1] * Nangang District [d]	-0.0004
	(0.035)
Multi [1] * Beitou District [d]	-0.026
	(0.027)
Multi [1] * Shilin District [d]	0.018
	(0.029)

Z=3 5 Heterogeneous Pricing Effects: Administrative Districts

Controlling House Characteristics	Yes
Controlling Demographic Factors	Yes
Controlling Local Economics Status	Yes
Fixed Effect on Location (District)	Yes
Fixed Effect on Time (Year-Quarter)	Yes
Adjusted R^2	0.214
N (Observations)	69,213

Before (Multi ^{0})

Dependent Variable: Natural Log of Housing Prices	
Multi-House-Tax-Policy ^{1}	0.066***
	(0.024)
Datong District ^{d}	-0.013
	(0.026)
Zhongshan District ^{d}	0.013
	(0.019)
Zhongzheng District ^{d}	0.011
	(0.023)
Xinyi District ^{d}	0.009
	(0.009)
Da'an District ^{d}	0.028
	(0.013)
Songshan District ^{d}	0.022
	(0.022)
Wenshan District ^{d}	0.006
	(0.021)
Neihu District ^{d}	0.016
	(0.019)
Nangang District ^{d}	-0.024
	(0.025)
Beitou District ^{d}	0.019
	(0.020)
Shilin District ^{d}	0.005
	(0.021)

Increase in Housing Price

3 **After** (Multi ^{1})

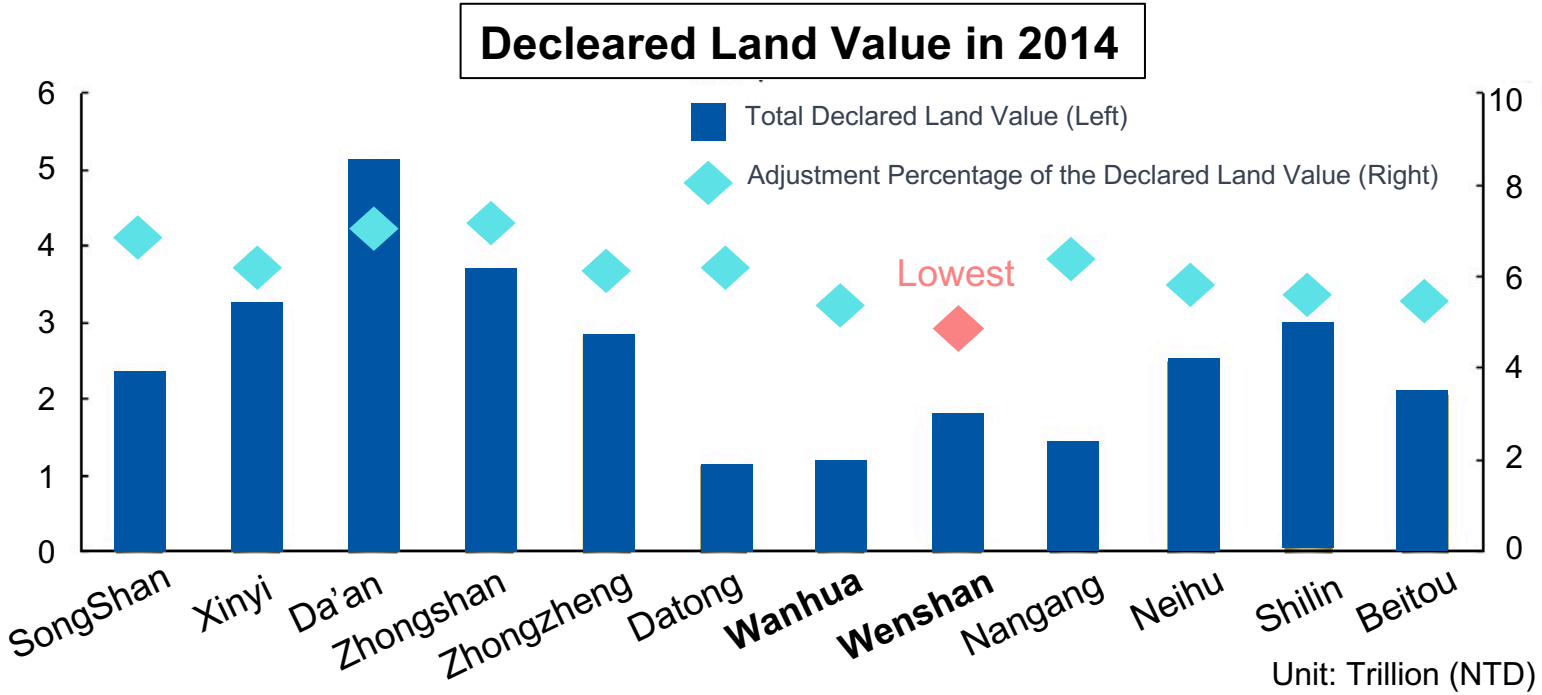
Multi ^{1} * Datong District ^{d}	0.002
	(0.023)
Multi ^{1} * Zhongshan District ^{d}	-0.033
	(0.026)
Multi ^{1} * Zhongzheng District ^{d}	-0.037
	(0.033)
Multi ^{1} * Xinyi District ^{d}	-0.016
	(0.032)
Multi ^{1} * Da'an District ^{d}	-0.020
	(0.030)
Multi ^{1} * Songshan District ^{d}	-0.036
	(0.031)
Multi ^{1} * Wenshan District ^{d}	-0.048*
	(0.028)
Multi ^{1} * Neihu District ^{d}	-0.031
	(0.026)
Multi ^{1} * Nangang District ^{d}	-0.0004
	(0.035)
Multi ^{1} * Beitou District ^{d}	-0.026
	(0.027)
Multi ^{1} * Shilin District ^{d}	0.018
	(0.029)

Multi ^{1} x Districts ^{d}

0.066-0.048*= **0.18***

Land Present Value and Its Adjustments across Taipei City Districts in 2014

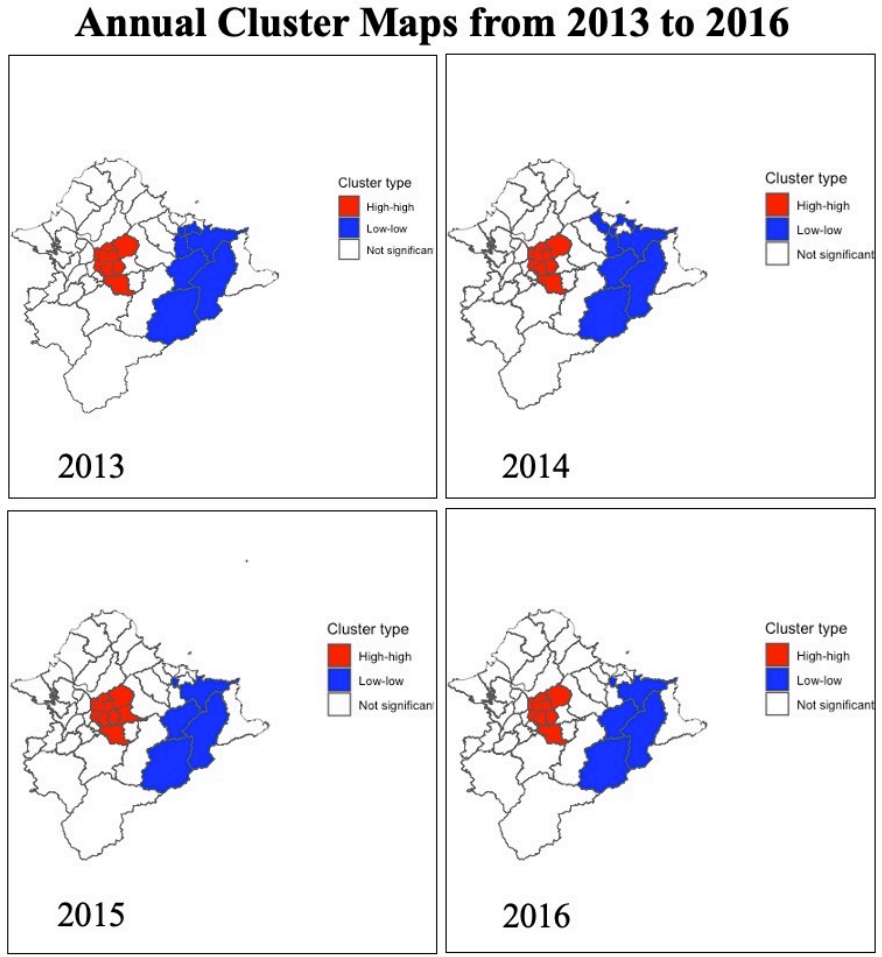
Key Factor
Tax Base



Source: Key Statistics Report in 2014,

Department of Budget, Accounting and Statistics, Taipei City Government

Supplement- Spatial Analysis



High-High Cluster-
Almost covers Taipei City

Low-Low Cluster-
Matches the Definition of Surburbs from M.O.I

1 Introduction

2 Datasets and Variables

3 Equations

4 Empirical Study

5 **Conclusion**

6 Suggestions for Further Studies

Conclusion

1. The multi-house tax policy did not lower housing prices as intended, but instead caused an increase in prices.

2. From a local economic standpoint, there is no indication of positive fiscal capitalization within the Greater Taipei Metropolitan Area.

3. The presence of socio-economic heterogeneities at the district level reveals a unclear correlation between housing affordability and housing prices.

4. **Mansion > Residential Building > Suite > Condominium**

   Fiscal capitalization is evident among collectives of property owners.

5. The adjustment of land value directly impacts the cost of property hoarding and subsequently affects housing prices.

Suggestions for Further Studies

Micro-Level Research

The study aims to explore the comprehensive impact of the multi-house tax policy, requiring further research on tax inequality and its implications.

Spillover Effect on Housing Prices

-Spatial regression analysis with Moran's I allows studying spillover effects on neighboring districts caused by increasing housing prices.

-Alternatively, separate multiple regressions can be employed for New Taipei and Keelung.

Accurate datasets for Local Economic Status

Utilize median income tax as a local economic indicator. Include longitude and latitude in the Actual Price Registration dataset for accurate analysis of average income tax at the Li level.

Rigorous Redesign for Interactions

Redesign the dummies for local economic status where Multi^{1} interacts, ensuring that the interacted dummies are not assigned to those under Multi ^{0}.

Variation of National-Level Policy

The impact of the "integrated house and land policy 2.0" hasn't been taken into account in this paper. It's suggested to consider incorporating a binary dummy to capture its effects.

Thank You