How High-Speed Rail Affects Local Land Prices:
An Evidence from Taipei, China

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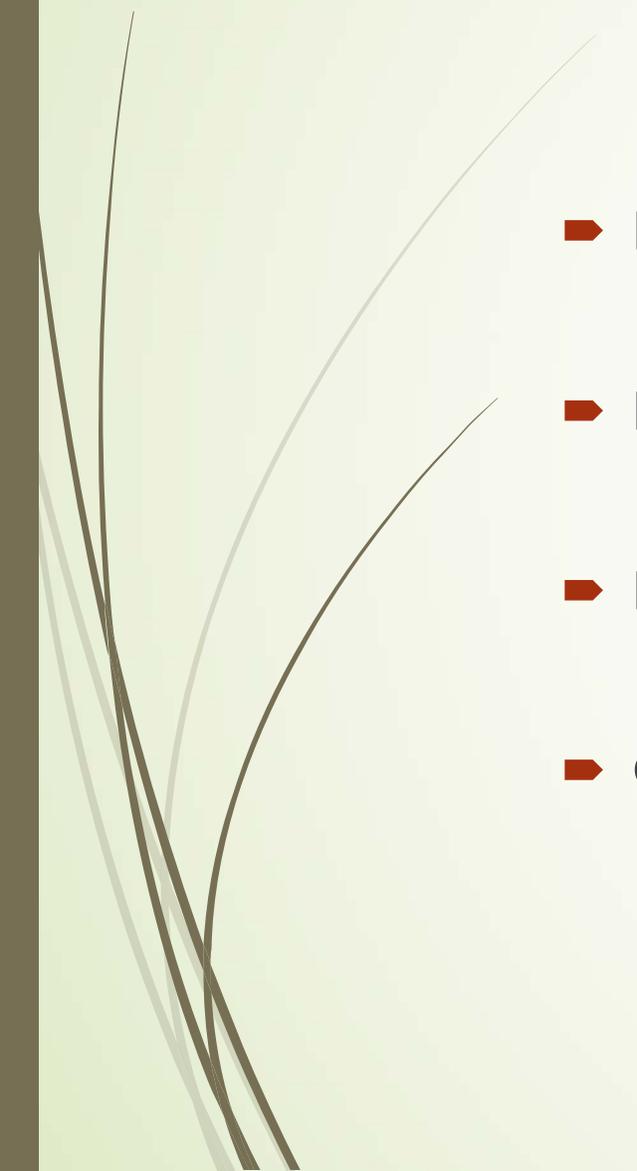
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Background:
High-Speed Rail in Taipei, China

- The geographic feature of Taipei, China with the rugged central mountainous terrain separates the island into the West Coast area and the East Coast area.

- Despite only covers half of the island, the West Coast area is concentrated with the most of the population.

- Increasing demand for a more efficient North-South intercity transportation system.

- High-Speed-Rail (THSR) provides the best solution.

Background:
High-Speed Rail in Taipei, China

- High-Speed-Rail (THSR) began its construction from March 2000,

- and its first operation started in 2007 from Banqiao (Taipei City) to Zuoying (Kaohsiung City),

- After the station construction of Miaoli, Changhua, and Yunlin was completed, the entire line was open in 2016.

- This 349.5km THSR route connects most of the main cities that located in the West Coast area

- and it only takes 2 hours from Nangang (Taipei City) to Zuoying (Kaohsiung City), which greatly improves the efficiency in the intercity and regional daily commuting and business trips.

Land-Price Dynamics and Economy

- Land prices serve as a very important indicator of the future economic performance.

- Increasing land prices have a positive effect on firm's business investment (Liu, Wang, and ZHA 2013).

- Increasing land prices also boost household consumption (Iacoviello 2005, Iacoviello and Neri 2010).

- Chen (2001) also finds that real estate prices (mostly determined by land prices) have played an important role in amplifying the bank lending in Taipei, China.

- To show more evidence of the important role of land prices in the economy of Taipei, China, I conduct a structural vector autoregression (VAR) model to estimate the effect of land-price movements on the GDP.

The Structural VAR Model

**The Structural VAR Model:** $A(L)X_t = \varepsilon_t$

- where $A(L)$ is the lag operator matrix, $X_t = (y_t, m_t, i_t, lp_t)$ is vector of endogenous variables , ε_t is a vector of shock disturbances

Data (September 1992 to March 2018) :

- y_t, : log data of real GDP (semi-annual), Statistical Bureau.
- m_t : log data of the monetary base (semi-annual), the Central Bank of Taipei, China .
- i_t : the interest rate (semi-annual), average interbank call rate of the Central Bank of Taipei, China.
- lp_t : log data of real land prices index (semi-annual), calculated from Urban Land Price Indexes (base-year=1993) provided by the Department of Land Administration, M.O.I.
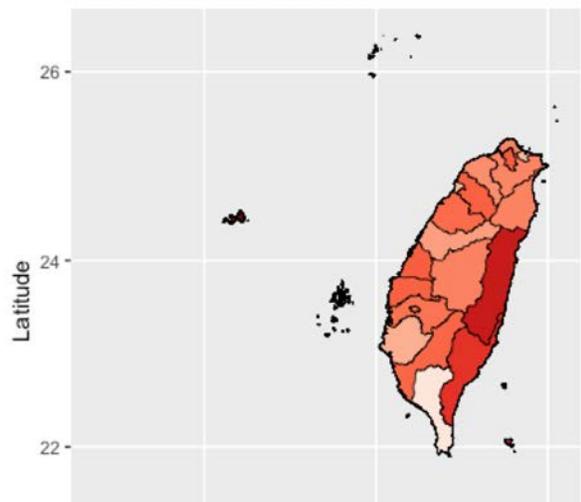
Empirical Results: Impulse Responses

A 3.8% increase in real land prices leads to a 2% growth in real GDP (Fourth Column)
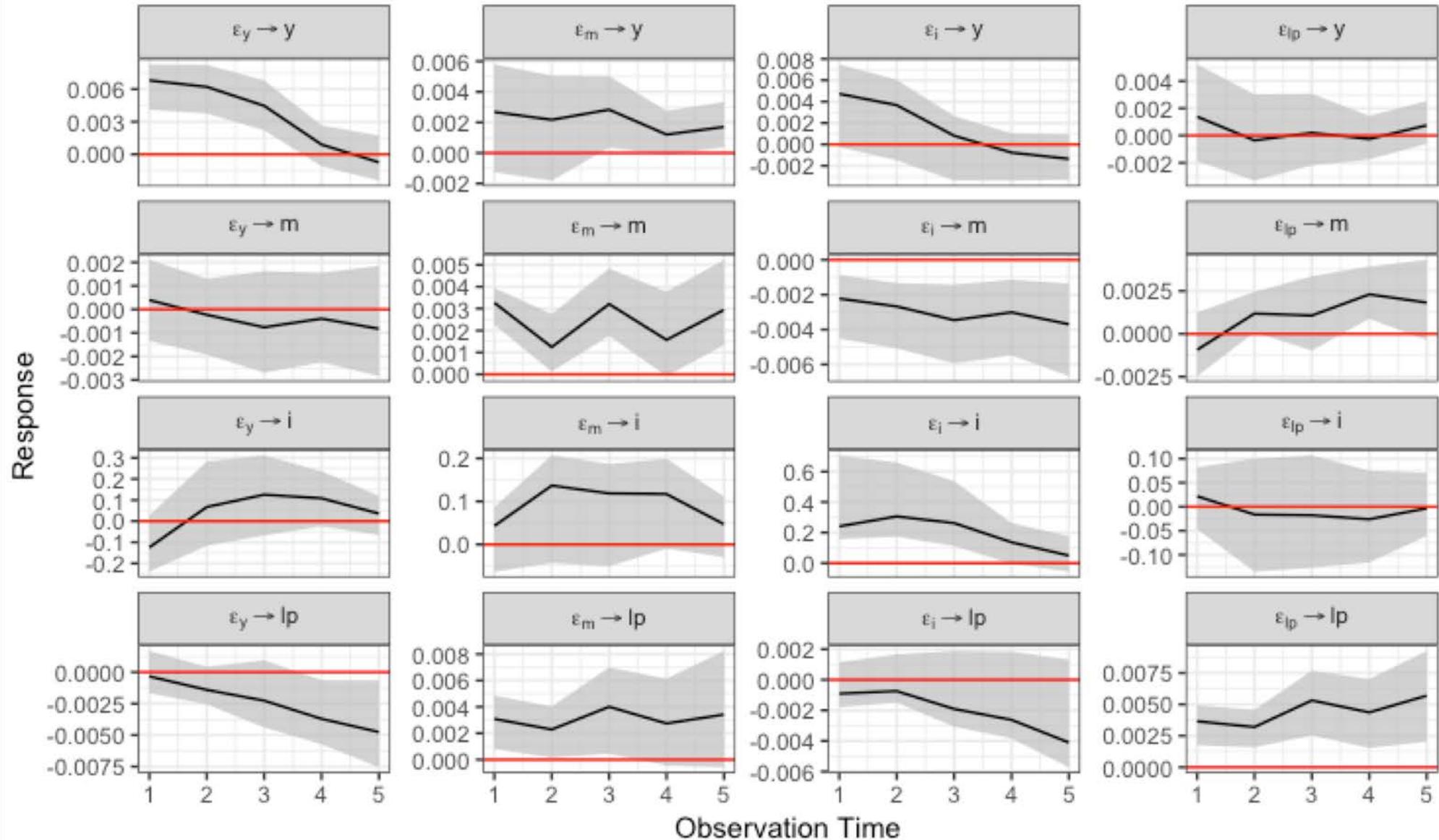
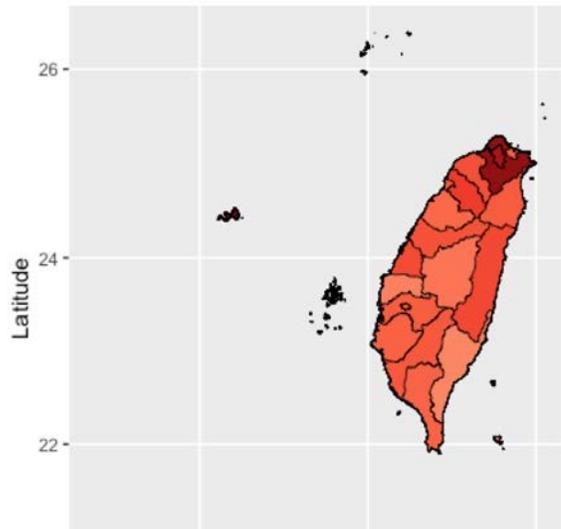# Land-Price Movements in Taipei, China

Real Land Prices in 1998

Real Land Prices in 2010

Real Land Prices in 2004
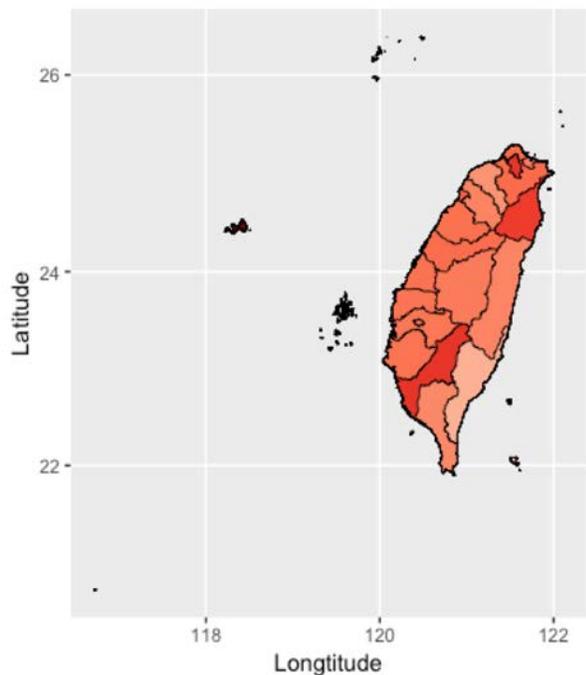
Real Land Prices in 2017
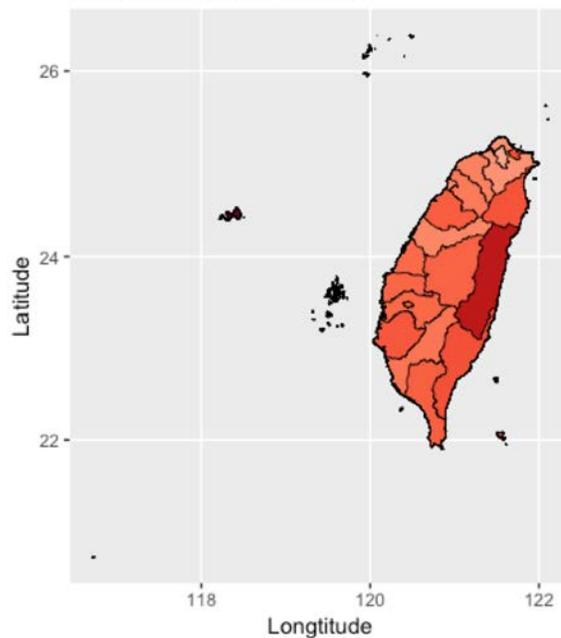
➡ THSR seems to have a positive effect on local land prices

North(Treated)
South(Treated)
Mid(Treated)
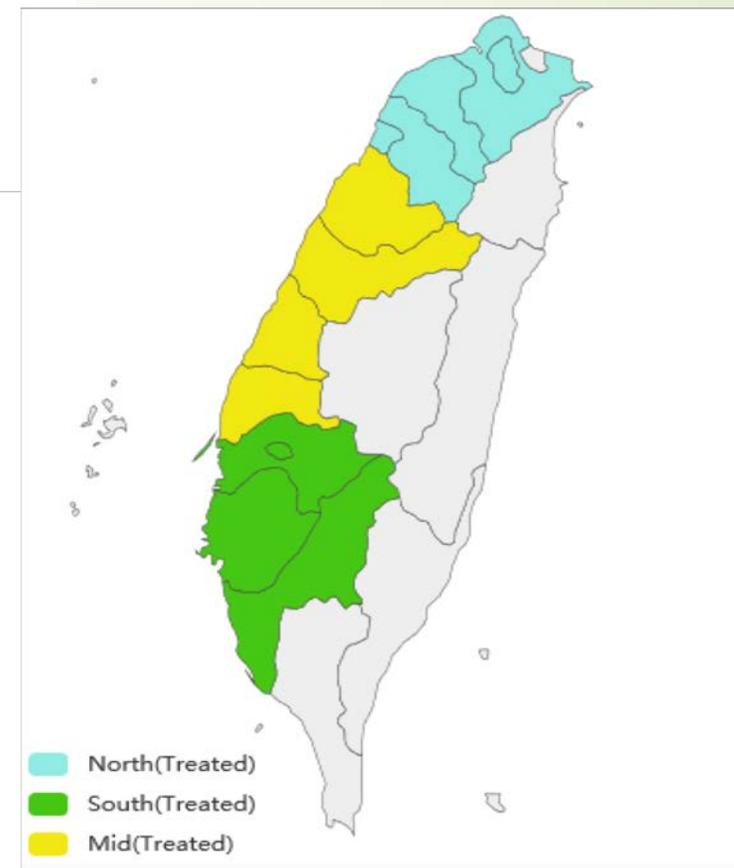
Land-Price Movements in Taipei, China Cont.

- After the construction of the THSR, regions with the THSR witnessed a faster growth in land prices than those regions without the THSR.
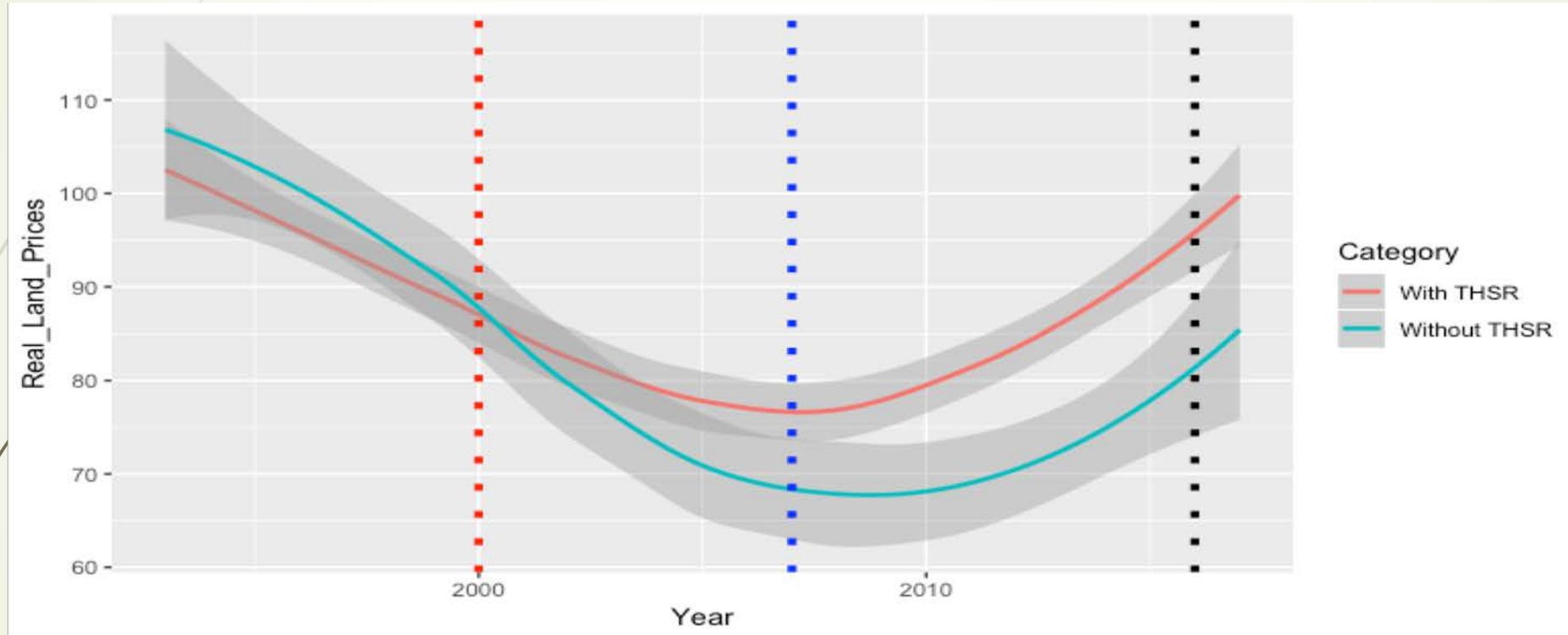
- **Red**: the start of THSR's construction in 2000.
- **Blue**: the start of THSR's first operation in 2007.
- **Black**: the start of THSR's second operation in 2016.

Land-Price Movements in Taipei, China, Cont.

- The average all-prefectural data may mask some heterogenous movements among different regions.

- Divide the regions with THSR into North, Mid, South, and Passing (no station-located).

- North region has a higher growth rate than other areas.

- No apparent higher growth rate in Mid and South region compared to regions without the THSR.
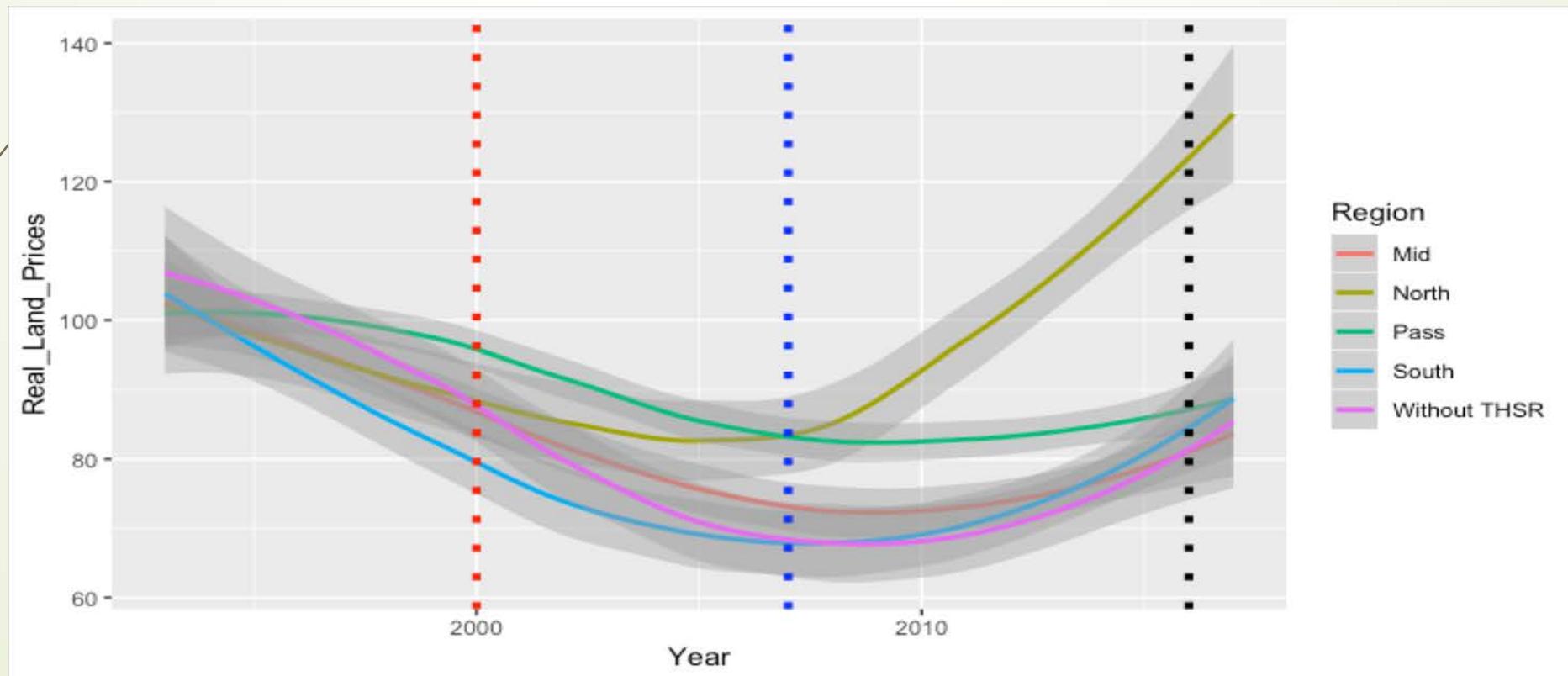
Methodology: Difference-in-Difference (DID) Estimation

Research Design:

- Compare the difference between the land-price changes in regions with THSR and the land-price changes in regions without THSR.

- Divide data samples into a treated group (regions with THSR) and a control group (regions without THSR),

- and make the time framework into pre-project and post-project.

Care about regional heterogeneity:

- Although the average land prices in regions with the THSR grow faster than those without the THSR, some cities or prefectures perform different land-price movements.

- Regional factors should be considered in the estimation.

- Analysis using regional sample instead of all-prefectural sample also needs to be conducted.

Methodology: DID Estimation Cont.

- The DID estimation equations are following traditional Card and Krueger (1994) form:

Check the effects from THSR on land prices in station-located regions

- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{construction} \cdot d_{station}) + X'_{it}\beta + \varepsilon_{it}$
- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{1st} \cdot d_{station}) + X'_{it}\beta + \varepsilon_{it}$
- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{2nd} \cdot d_{station}) + X'_{it}\beta + \varepsilon_{it}$

Check the effects from THSR on land prices in route-passing regions

- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{construction} \cdot d_{route}) + X'_{it}\beta + \varepsilon_{it}$
- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{1st} \cdot d_{route}) + X'_{it}\beta + \varepsilon_{it}$
- $\ln LP_{it} = \gamma_i + \lambda_t + \delta(T_{2nd} \cdot d_{route}) + X'_{it}\beta + \varepsilon_{it}$

Error-term that is independent over time

Control variables to lower the bias of omitted variables: Population growth, Real household consumption, Unemployment rate, Interest rate

Interaction term of two binary variables indicating whether the observation belongs to the treated group after certain time periods.

Log real land prices

Time-invariant prefectural effect

Year-specific effect

Baseline Results

- The THSR significantly increases the local land prices of the station located regions by 17.8% during the first operation.

- These positive effects are even larger in the route passing regions where a 19.9% increase in local land prices is observed during the first operation period.

- Despite of no statistical significance, positive impacts on local land prices from the THSR are estimated.

Baseline	Station-Located			Route-Passing		
	Construction	First Operation	Second Operation	Construction	First Operation	Second Operation
Effect of THSR	0.045	0.178**	0.168	0.120	0.199*	0.191
	(0.071)	(0.087)	(0.109)	(0.079)	(0.106)	(0.121)
R^2	0.432	0.360	0.154	0.452	0.352	0.156

*p<0.1, **p<0.05, ***p<0.01

Regional Results

- The THSR has a significant effect on local land prices in North region that is larger than the case of baseline results.

- The THSR significantly increases the local land prices of the station located regions by 34.7% during the first operation and 43% during the second operation.

- These positive effects are even larger in the route passing regions where a 20.3.% increase in local land prices is observed during the construction period, a 38.4% growth during the first operation, and a 42.6% during the second operation.

North	Station-Located			Route-Passing		
	Construction	First Operation	Second Operation	Construction	First Operation	Second Operation
Effect of THSR	0.133	0.347***	0.430***	0.203**	0.384***	0.426***
	(0.096)	(0.114)	(0.137)	(0.079)	(0.106)	(0.121)
R^2	0.409	0.397	0.324	0.452	0.352	0.156

*p<0.1, **p<0.05, ***p<0.01

Regional Results Cont.

- On the other hand, the THSR didn't show a significant effect on local land prices in Mid and South compared to North counterparts.

- This may indicate the regional inequality of land-price movements, which raises the concern of "straw effects" that potentially occurred in Mid and South areas caused by the THSR with a better connection to the northern developed areas.

Mid	Station-Located			Route-Passing		
	Construction	First Operation	Second Operation	Construction	First Operation	Second Operation
Effect of THSR	-0.060	0.156	0.051	0.114	0.147	0.051
	(0.065)	(0.107)	(0.123)	(0.098)	(0.096)	(0.123)
R^2	0.507	0.425	0.284	0.511	0.438	0.284

South	Station-Located			Route-Passing		
	Construction	First Operation	Second Operation	Construction	First Operation	Second Operation
Effect of THSR	0.023	0.073	0.122	0.100	0.108	0.094
	(0.098)	(0.130)	(0.133)	(0.091)	(0.117)	(0.133)
R^2	0.523	0.414	0.298	0.551	0.422	0.293

*$p<0.1$, **$p<0.05$, ***$p<0.01$

Implications

- The evidence of the positive impact of the THSR on local land prices while the growth of land prices have heterogeneous movements among regions.

- Since the increase in land prices related to increase in tax revenues, using some parts of these extra revenues may support THSR's finance.

- "Straw effects" issue also needs to be carefully considered by the policy makers for that if there is a new plan of extending THSR route to eastern areas of Taipei, China.