UNIVERSITY OF CAMBRIDGE

Long-Term Prospects of Land Value Capture in Shanghai New Urban Sub-Centres

Tianren Yang (Ph.D. Candidate, AssocRTPI, LEED AP)

Martin Centre for Architectural and Urban Studies, University of Cambridge

1. Background: *LVC and its long-term prospects*

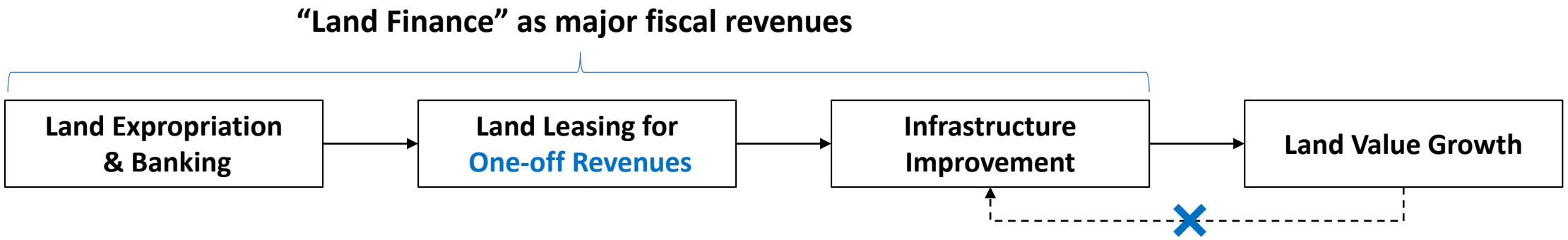
- **"Land value capture (LVC) is based on a simple premise - public action should generate public benefit."**

- **In Chinese cities, urban development policies often focus on new urban sub-centres where LVC is in desperate need.**
  - Over 110 new sub-centres are being promoted in those Chinese cities with a population over 5 million.
  - However, it is in urban sub-centres that the LVC tends to be the most uncertain.

- **The aim of this research is to fill the gap between effective LVC application and sub-centre construction.**
  - Particularly examining the long-term prospects because those sub-centres are expected to develop over many decades.


George W. McCarthy

1. Background: *LVC in China in past decades - through "land finance"*



- **Generating revenue from the land use right (LUR) transfer of arable land to urban uses.**
  - State/collective-owned land + rapid urbanisation in the past 40 years
  - The income is turned towards the building of urban infrastructure and upgrading of the built environment.

- **The heavy reliance on one-off revenues raises concerns.**
  - Unsustainable especially in low-demand areas (such as sub-centres) and for a long time span (when urbanisation slows down) - Ghost city phenomenon
  - Fail to capture the long-term value increase and to meet the need for recurrent financial support

1. Background: *Missing components of LVC in China when developing greenfield land*

1 Primary land market (monopolised by the State)

- Intrinsic land value is mainly **determined by land development potential, location, and (re)development costs** (incl. land expropriation fees and provisions of basic infrastructure).

2 Secondary land market (bid by developers)

- Currently based on **a one-off market valuation** (taking account into the promised public infrastructure/amenities investment) **at the start of estate development**.

3 What our new approach aims to achieve

- **A continuous valuation** over time based on changes in land, buildings, business markets, and consumer surplus.

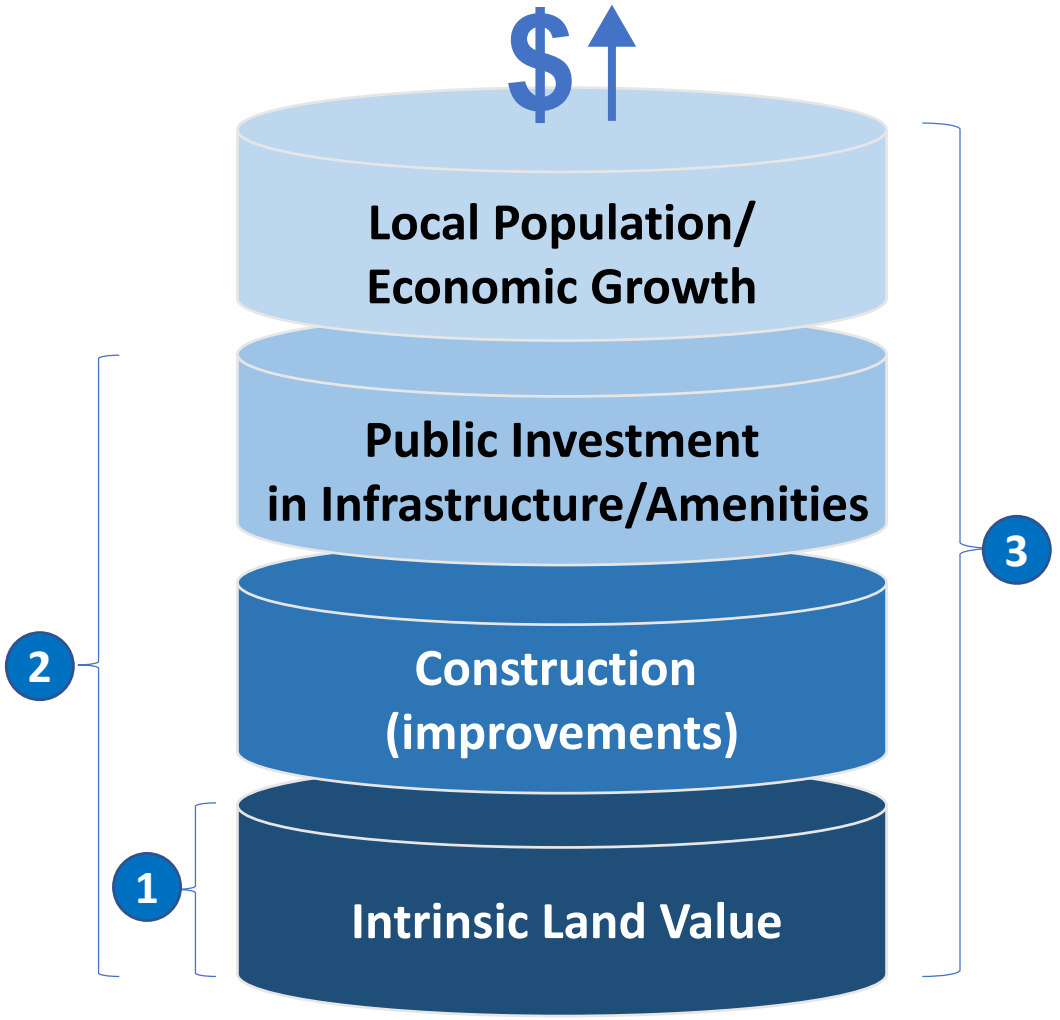


Fig. Land value components.
Adapted from Hong and Brubaker (2010)

2. Introduction: *Research questions and approaches*

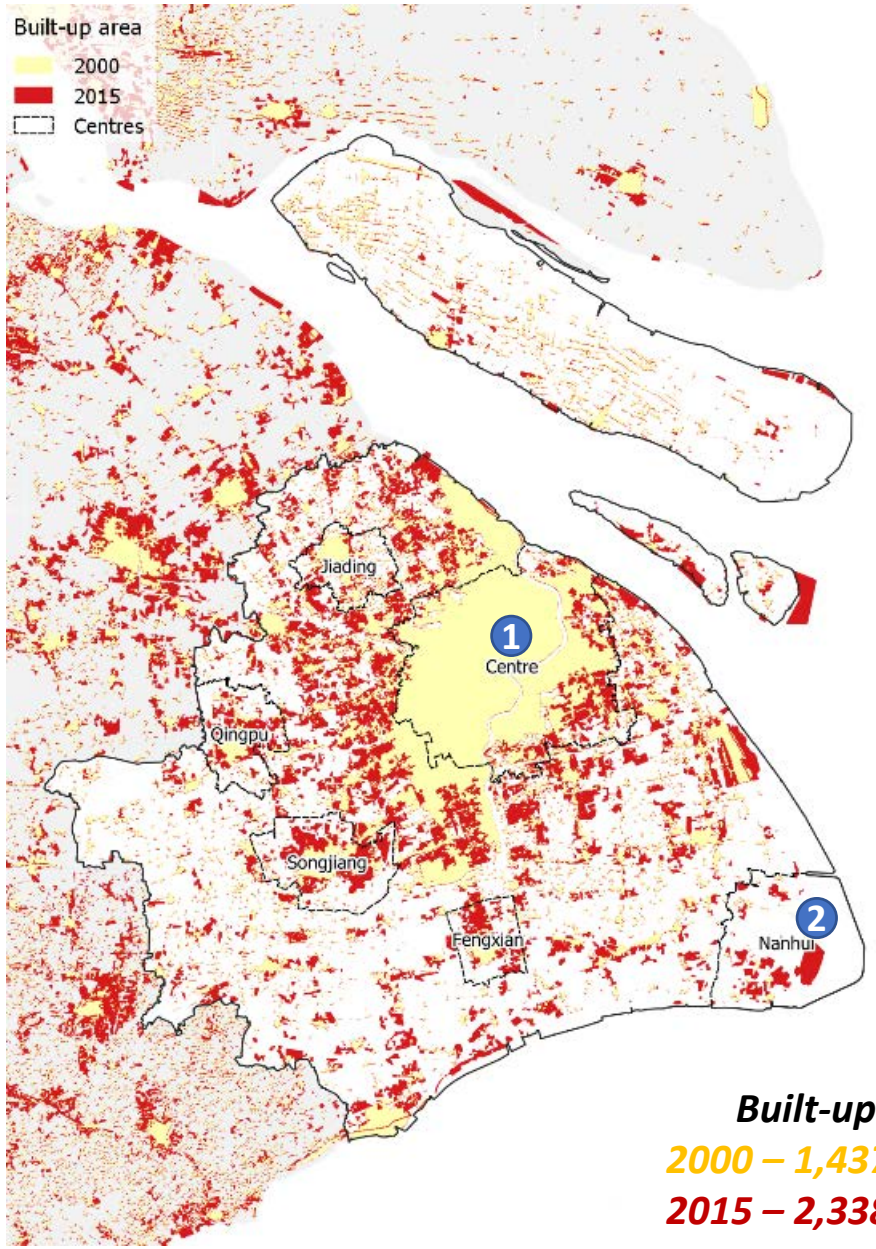
- **Local authorities should be able to capture the longer term benefits of major transport and other infrastructure projects.**
  - The use of LVC methods is often hampered by insufficient understanding of the land value effects of planned interventions in China.

- ***Can infrastructure-induced land value increments be better captured and the positive externalities (i.e., socio-economic benefits) be capitalised upon in planned new urban sub-centres?***

- **There needs to be an understanding on how real estate market in these sub-centres would perform over certain time period.**
  - The analytical approach needs to account for the **longer-term interactions** between land-use, built form, transport, other infrastructure developments, and place-making.
  - This is supported by **a new land-use and transport interaction model** that is capable of **measure**, **model**, and **predict** the urban growth in related to multiple market processes, policy interventions, and random events.

To what extent has land capitalisation realised in planned new urban sub-centres?

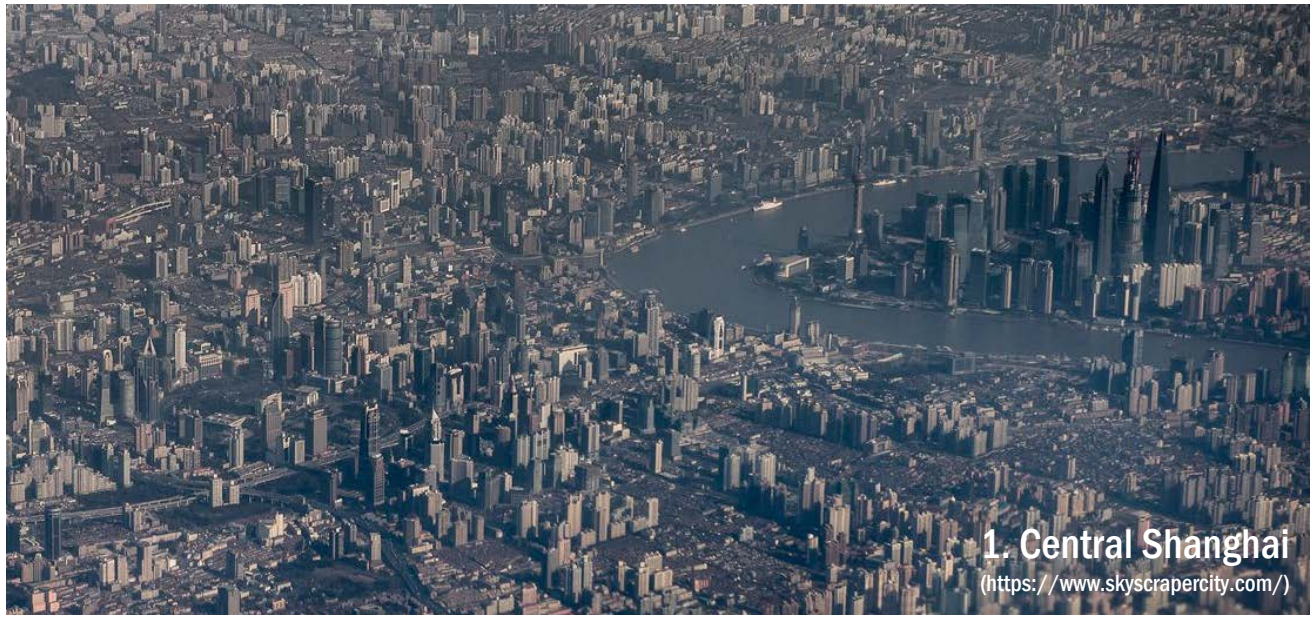
3. Measurement: *Urban expansion (2000-2015) – 62.7% increase in built-up area*



Built-up Area

2000 – 1,437 km²

2015 – 2,338 km²



3. Measurement: *Evidence from land market – land transaction records (2003-2017)*

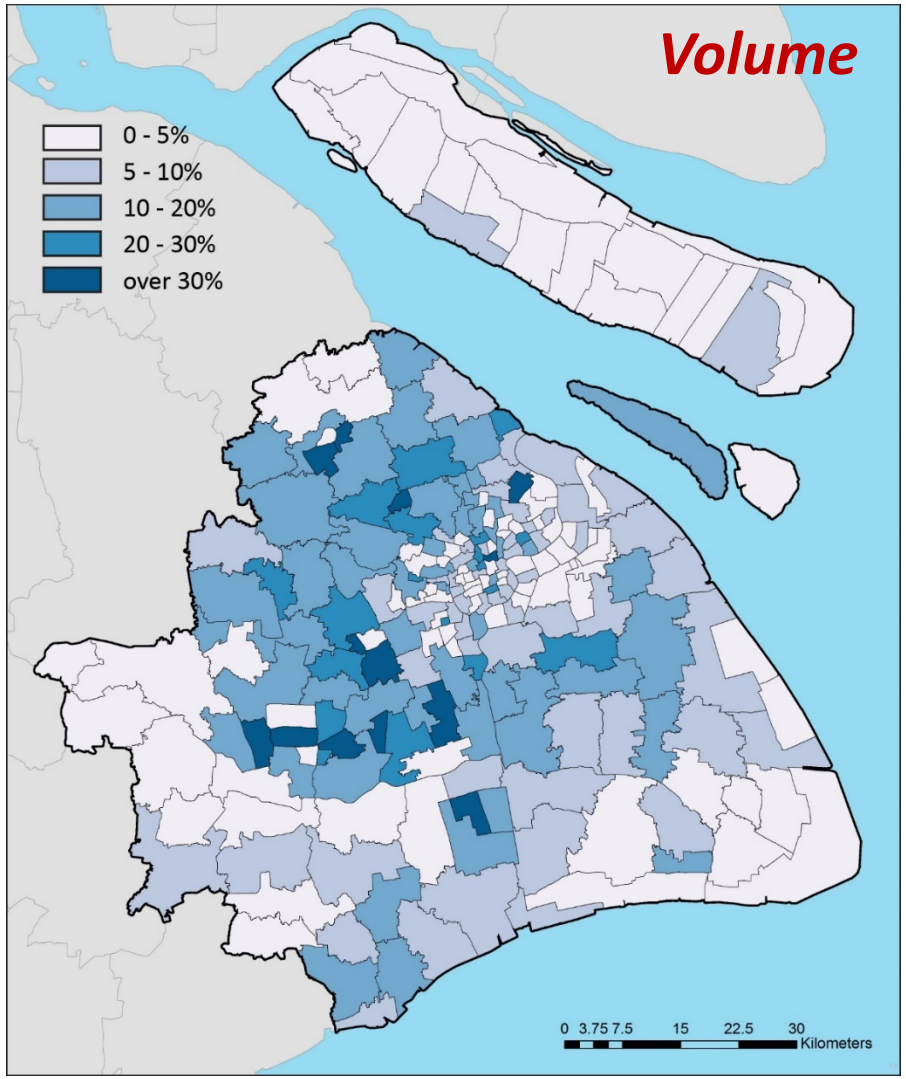


Fig. Land transaction by area by percentage.

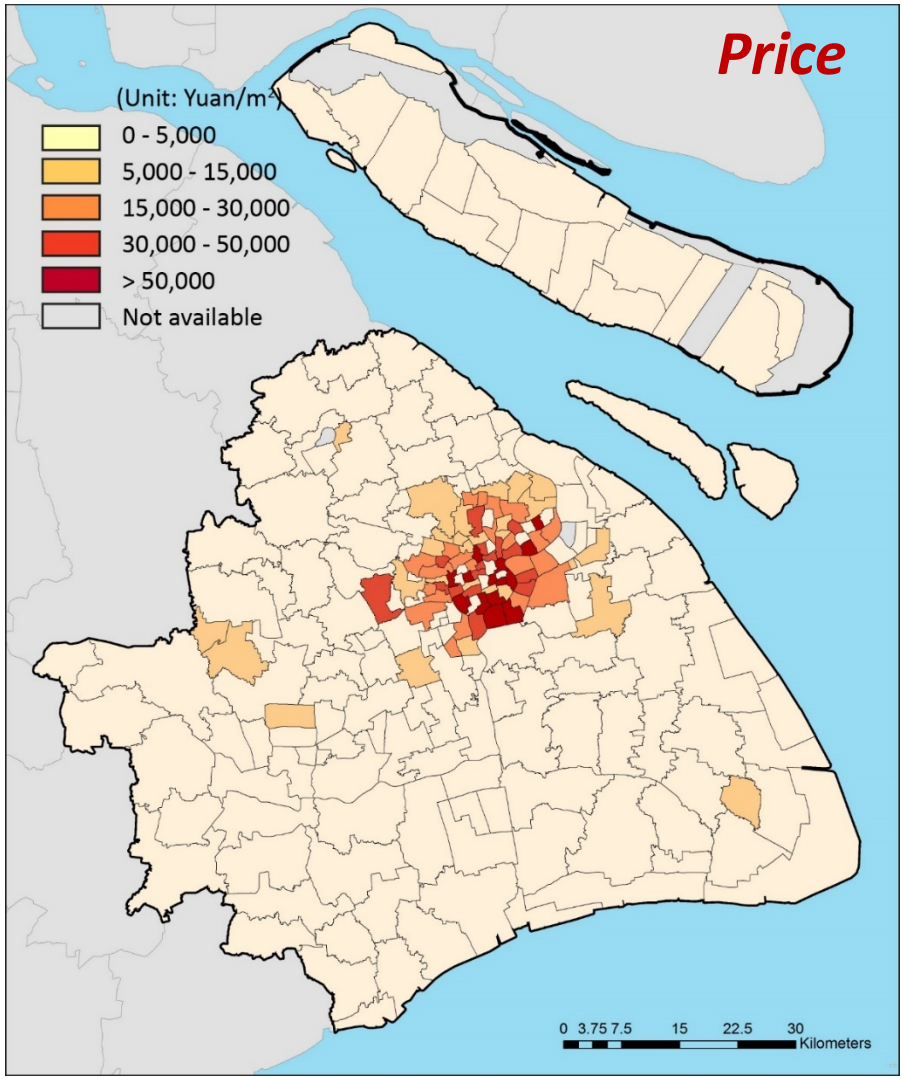
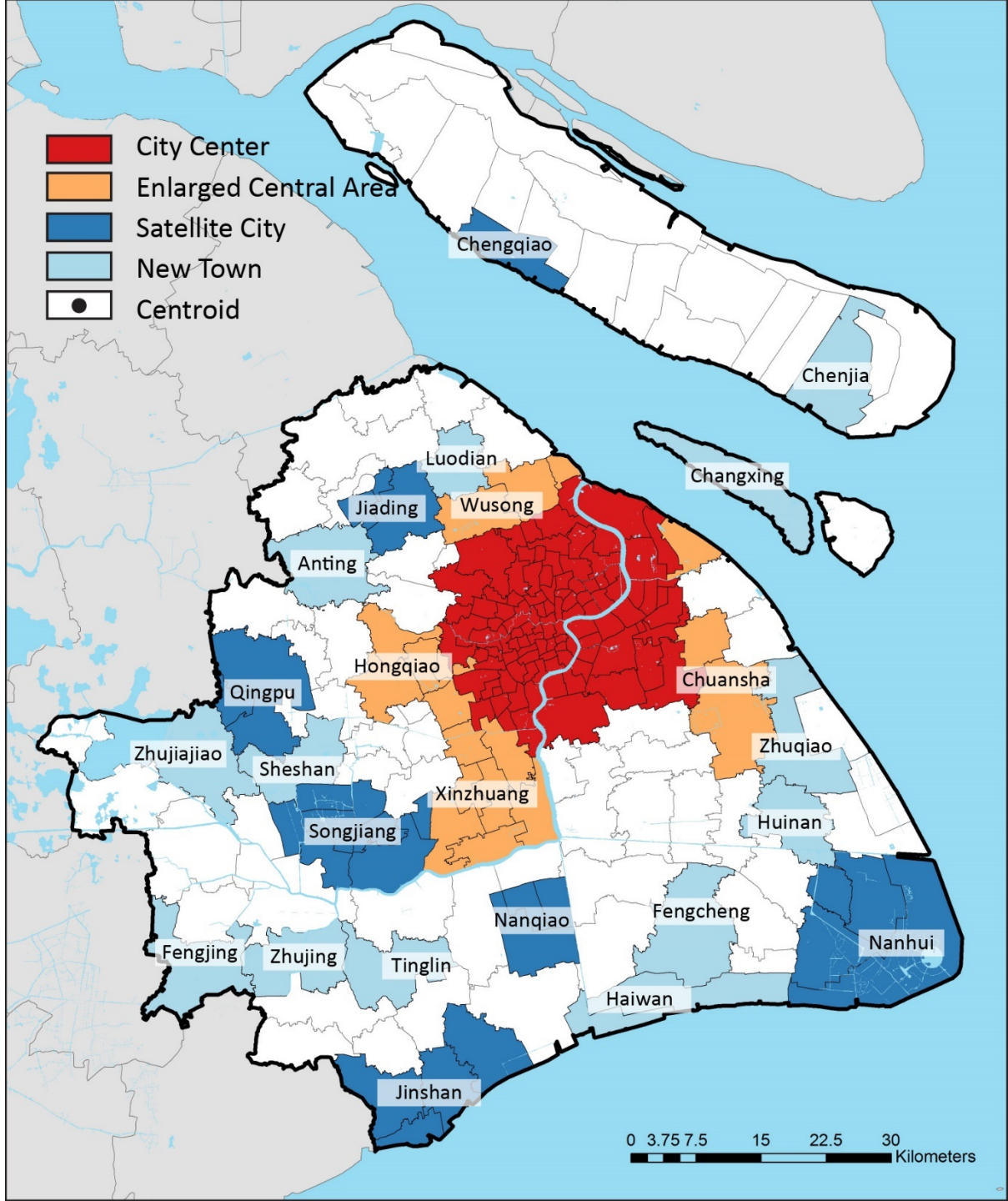


Fig. Land transaction by average price.

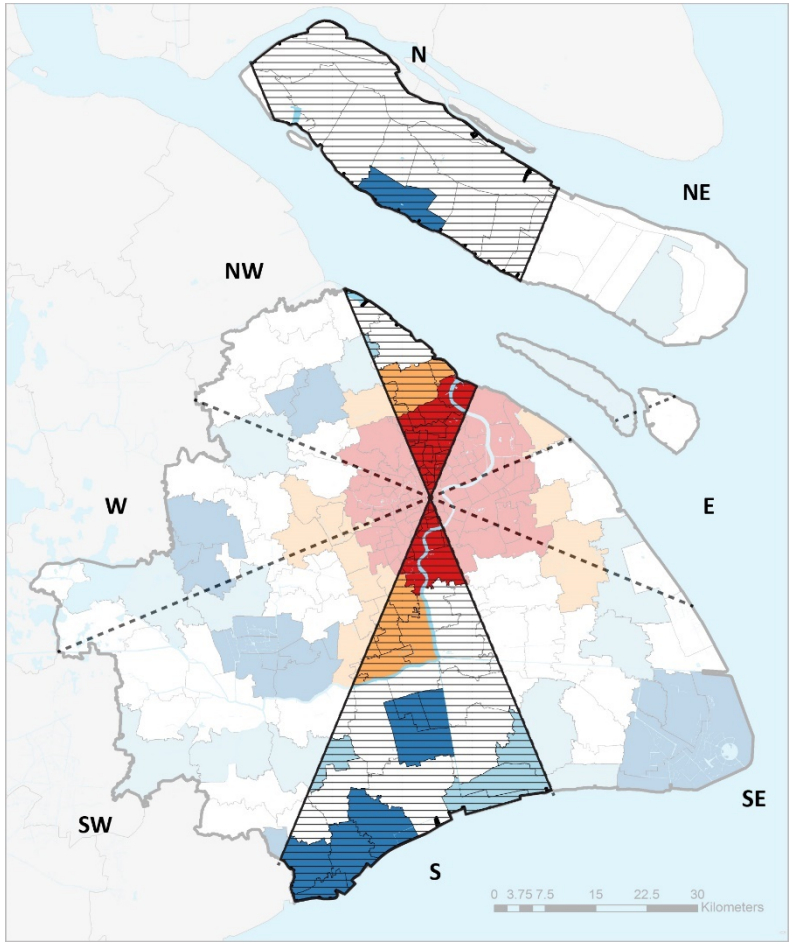
3. Measurement: *Evidence from land market*

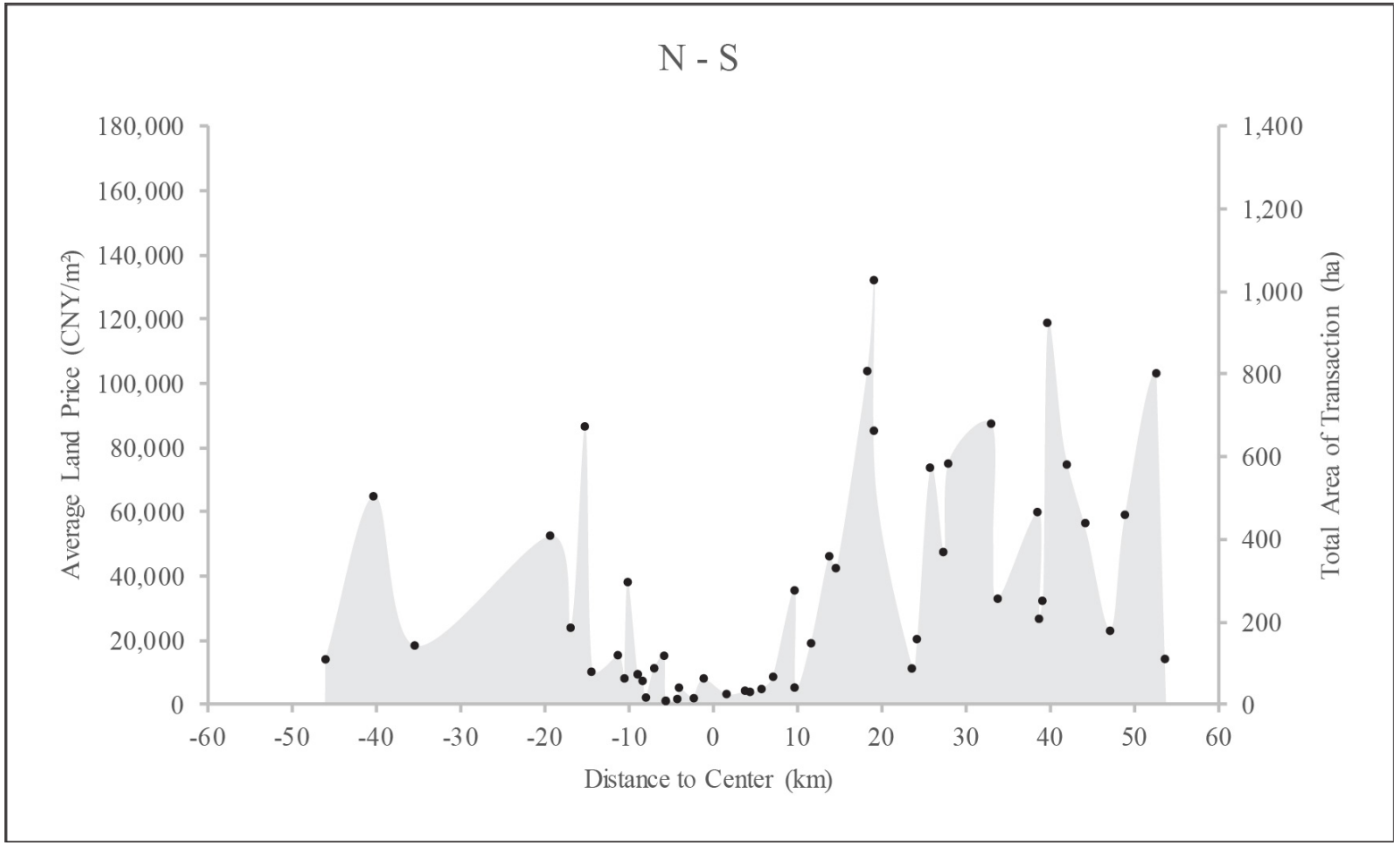
- **Planning policy:** Zonal categories defined in the latest **Comprehensive Plan of Shanghai (2017-2035)**
  - The delineation of sub-centres (particularly satellite city) has basically remained unchanged since the 2000s.

- **Sectional diagrams (4 pairs of circular sections) for further analysis**



3. Measurement: *Evidence from land market*





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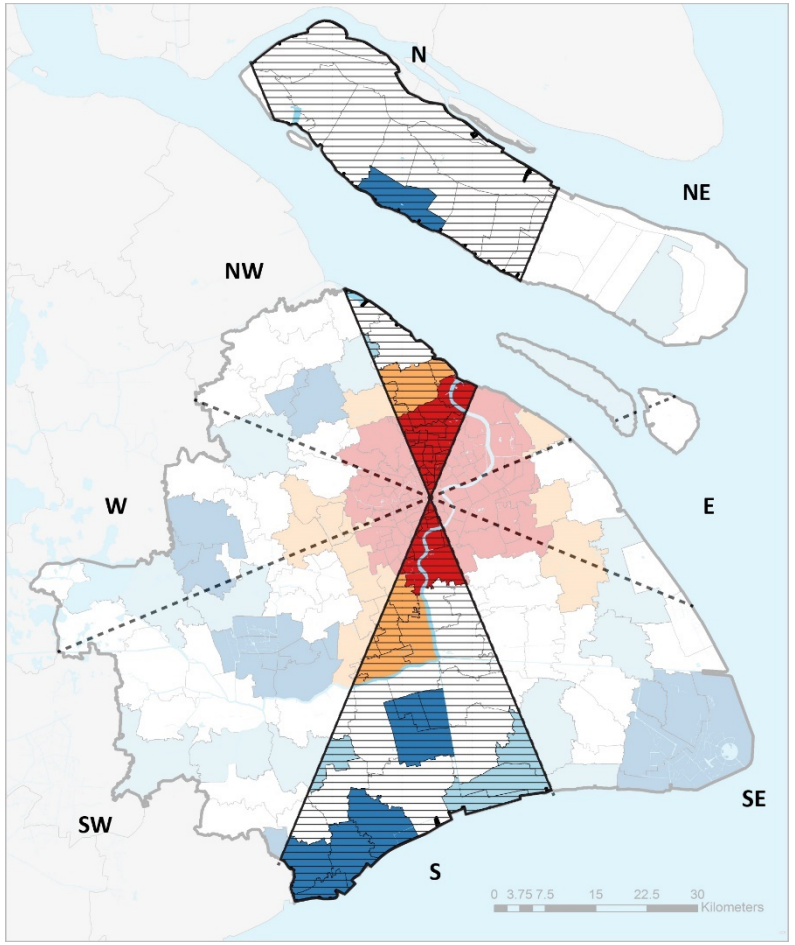
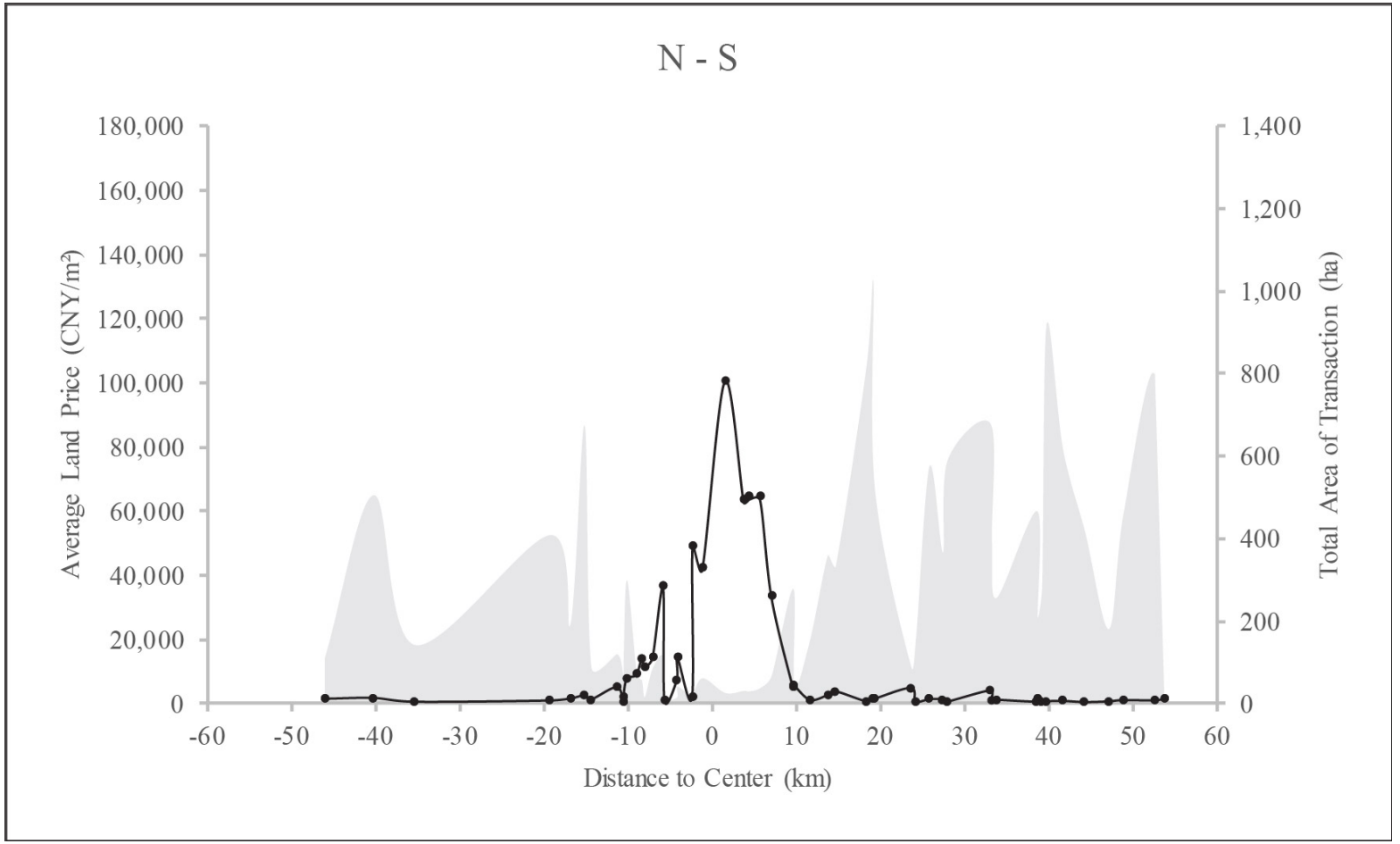
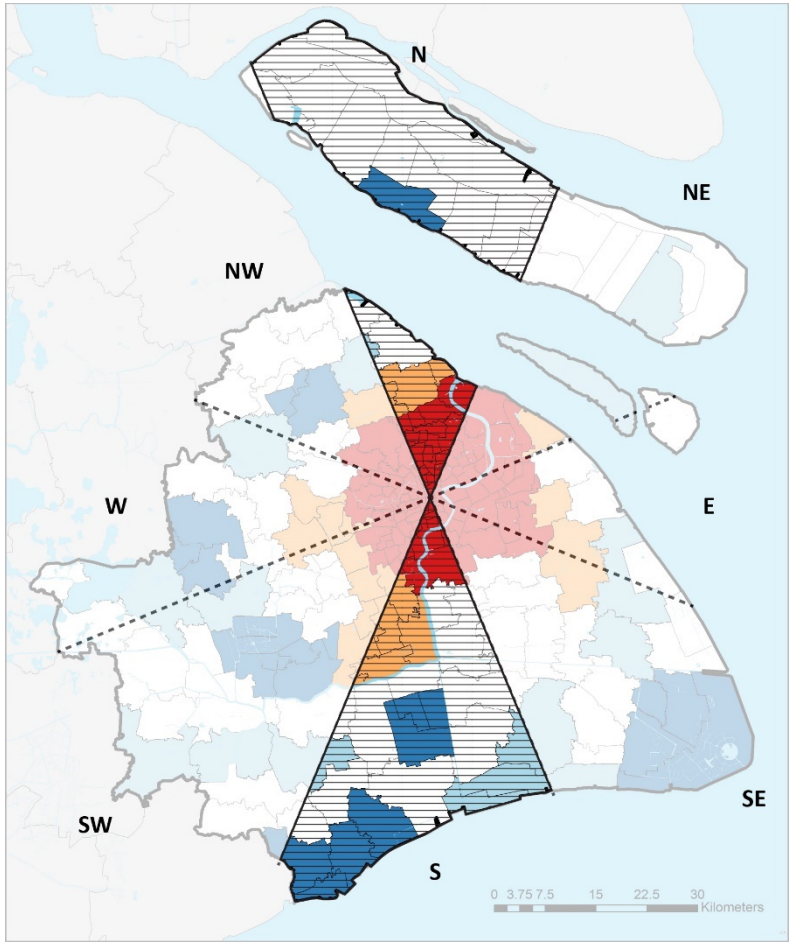
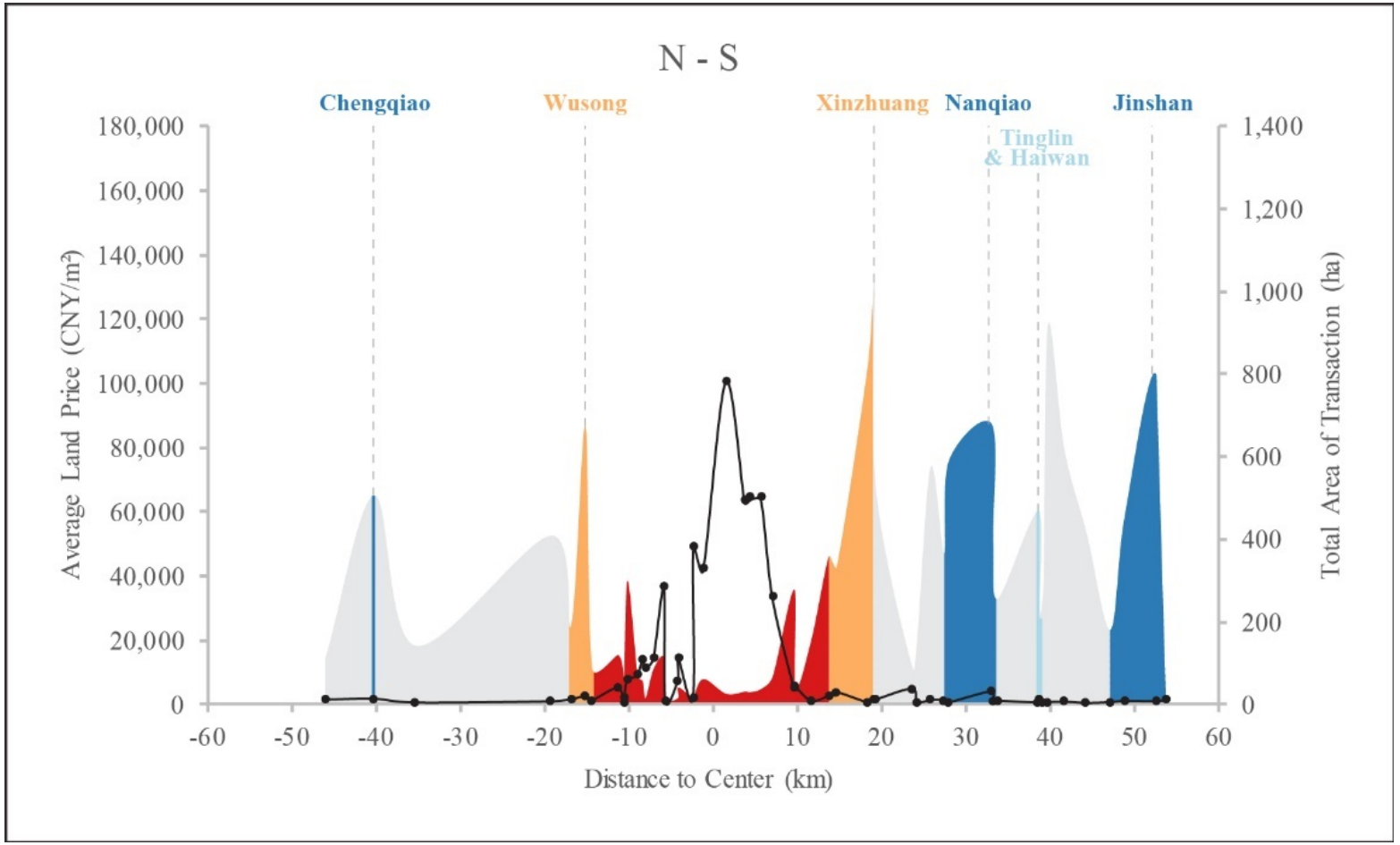




3. Measurement

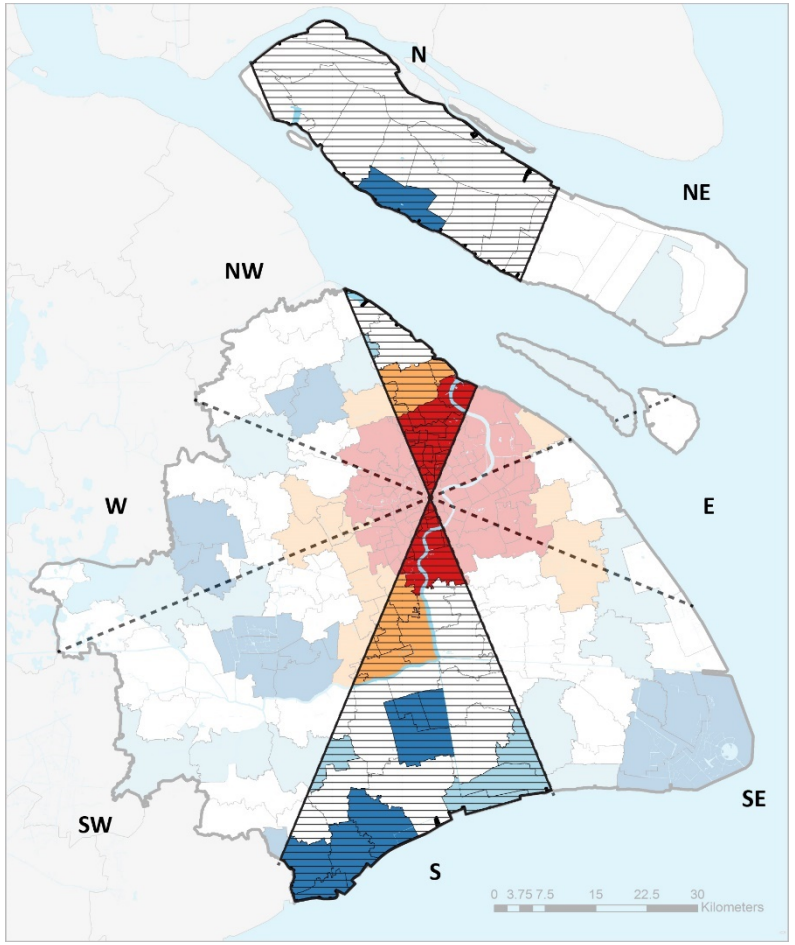


- **Active market in the remote areas** with the abundant and continuous release of land use rights.

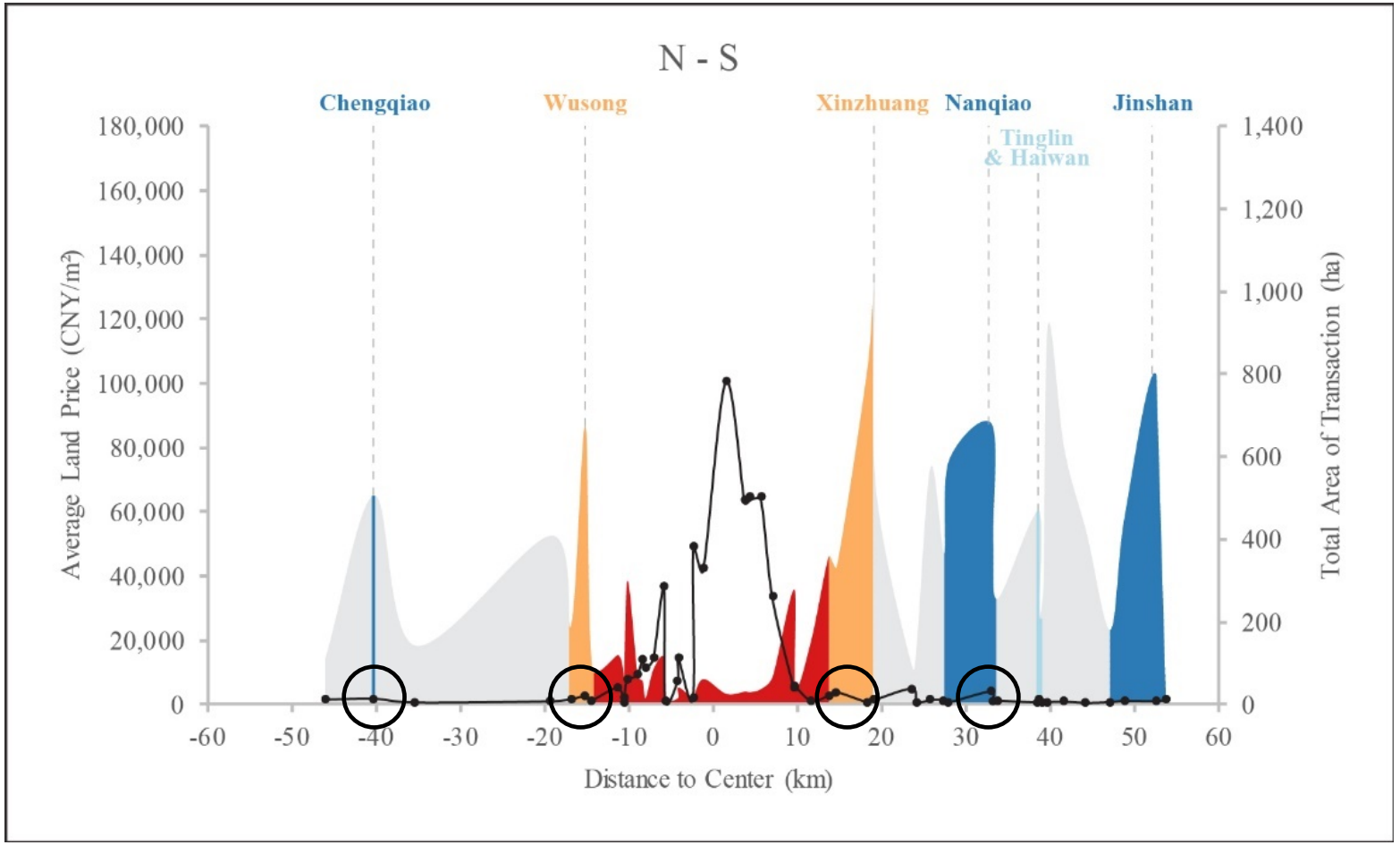


City Center | Enlarged Central Area | Satellite City | New Town

3. Measurement



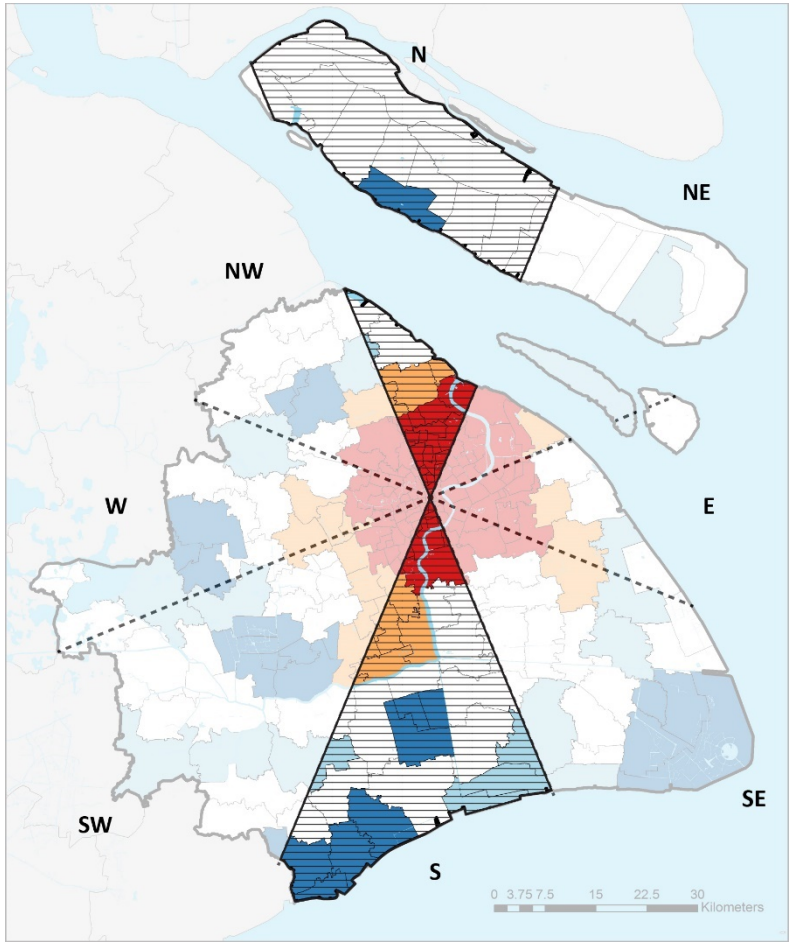
- ✓ Nevertheless, judging from the price movements, **the monocentric model is still dominant** in whichever axial direction.

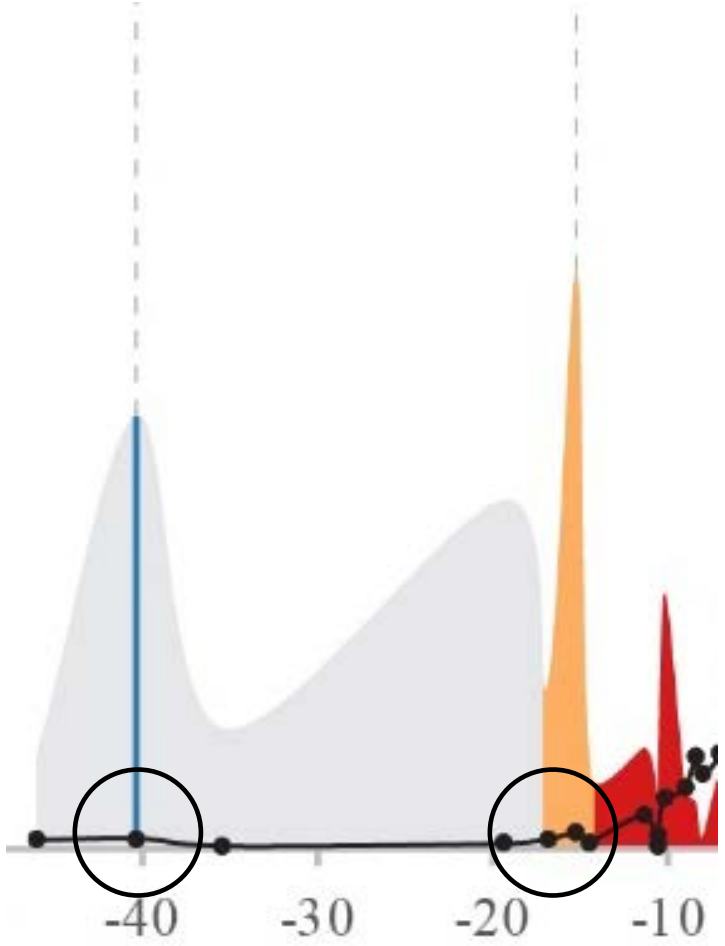


City Center | Enlarged Central Area | Satellite City | New Town

3. Measurement

- **Physical sub-centers** vs. **market mechanisms**

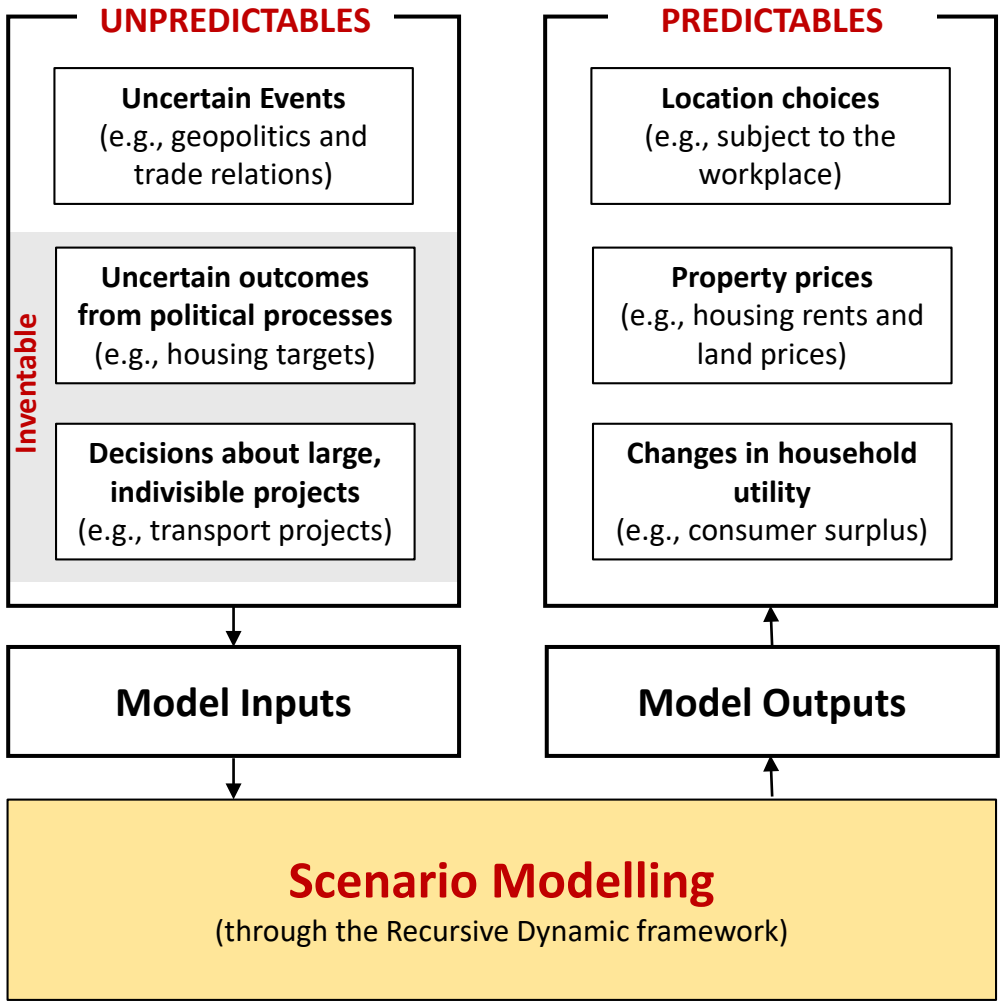




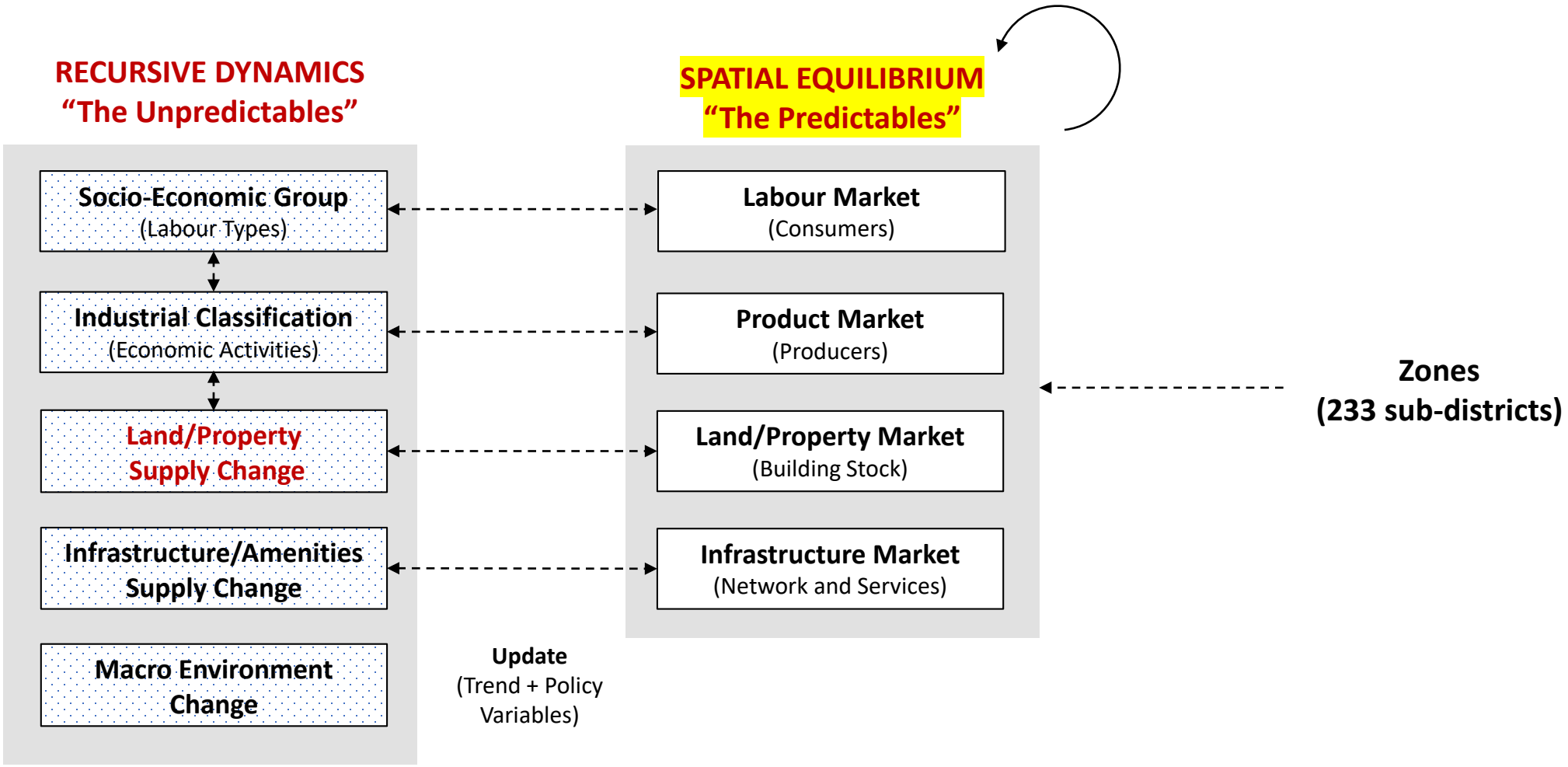
Can the land value increments be explained by theoretical urban models?

4. Modelling: *Dealing with the predictables and unpredictables*

- **The unpredictables**
  - **Some changes in the future are impossible to predict**, but are "inventable" (Batty, 2019).
  - We need to decide on to what extent such events/decisions will be taken into the modelling work.
- **The predictables**
  - **The law of large numbers** for businesses, institutions and citizens and their relative behavioural stability
  - Responses to the unpredictable change
- **The value of the model is not at precisely quantifying the predictable, but at understanding the impacts of different policy interventions.**



4. Modelling: *Recursive Spatial Equilibrium (SE+RD)*



4. Modelling: *Multi-source data fusion*

- **Official Statistics**
  - e.g., Population/Economic Census
- **Other Public Data**
  - From government, research institutes and leading companies
  - e.g., land transaction records, housing and business floorspace rents, etc.
  - **Crawled from websites where permitted**
- **Proprietary Digital Data**
  - e.g., Mobile Phone Data
  - **Sourced through research collaboration**

		Items	Major Source(s)
Infrastructure	Zoning	Zonal Division	Gaode Map & Local Statistical Bureau (2017)
		Centroid Definition	
	Building & Land Stock	Residential Floorspace	Population Census (2000, 2005, 2010 & 2015)
		Business Floorspace	Local Statistical Bureau (2000, 2005, 2010 & 2015)
		Land Use Change	Satellite Maps and Land Surveys (2000, 2005, 2010 & 2015)
	Transport	Time Cost of Travel	Google Maps Directions API & Baidu Map API
		Monetary Cost of Travel	
		Transport Network & Speed	Taxi GPS Traces / Gaode Map API
Business Activity	Production	Final Consumption / Gross Value Added	Local Input-output Tables (2000 & 2010)
	Income & Expenditure	Average Wage Income by Labour Type	Household Income & Expenditure Survey (2000 & 2010) & Local Statistical Bureau
		Average Wage Income Per Resident	
		Household Expenditure Patterns	
	Building & Land Market	Household Housing Consumption	Population Census 0.95‰ Microdata (2000 & 2010)
		Housing Rents	Lianjia (2010-2017) and 58 Website (2017)
		Business Floorspace Rents	Chinese Society of Real Estates
		Land Transaction	Land China Website (2001-2017)
Resident	Demography & Employment	# Residents	Population Census (2000, 2005, 2010 & 2015)
		# Employed/Non-Employed Residents	
		# Employed Workers	Economic Census (2001, 2004, 2008 & 2013)
	Socio-Economic Stratification	Stratification of Employed Residents	Population Census 0.95‰ Microdata (2000 & 2010)
		Stratification of Employed Workers	
		Household Composition	
	Time Utilisation	Average Labour Working Time	Chinese General Social Survey (2003 & 2013)
Social Network	Movements	Commuting Patterns	Mobile Phone Data
		Recreational Patterns	
Local Identity	Urban Form	Settlement Patterns and Street Layouts	Gaode Map
	Amenities	Diversity of Services	Points of Interests from Baidu Map

4. Modelling: *Key parameters, inputs, and outputs*

PARAMETERS

(1) Consumption and production
- Spending share of goods&services, housing, and leisure time
- Cost share of labour, business floorpsace, and capital

(2) Dispersion parameter
- For overall location choices

(3) Residual term
- Zonal residual attractiveness

INPUTS

(1) Population and Employment
- **Zonal workers (jobs)**
- Zonal %non-employed residents
- Zonal %industrial sector

(2) Housing and Economics
- **Housing floorspace**
- Commercial floorspace
- Price index (Macro-economy)

(3) Transport
- Weighted travel time matrix

For one given year

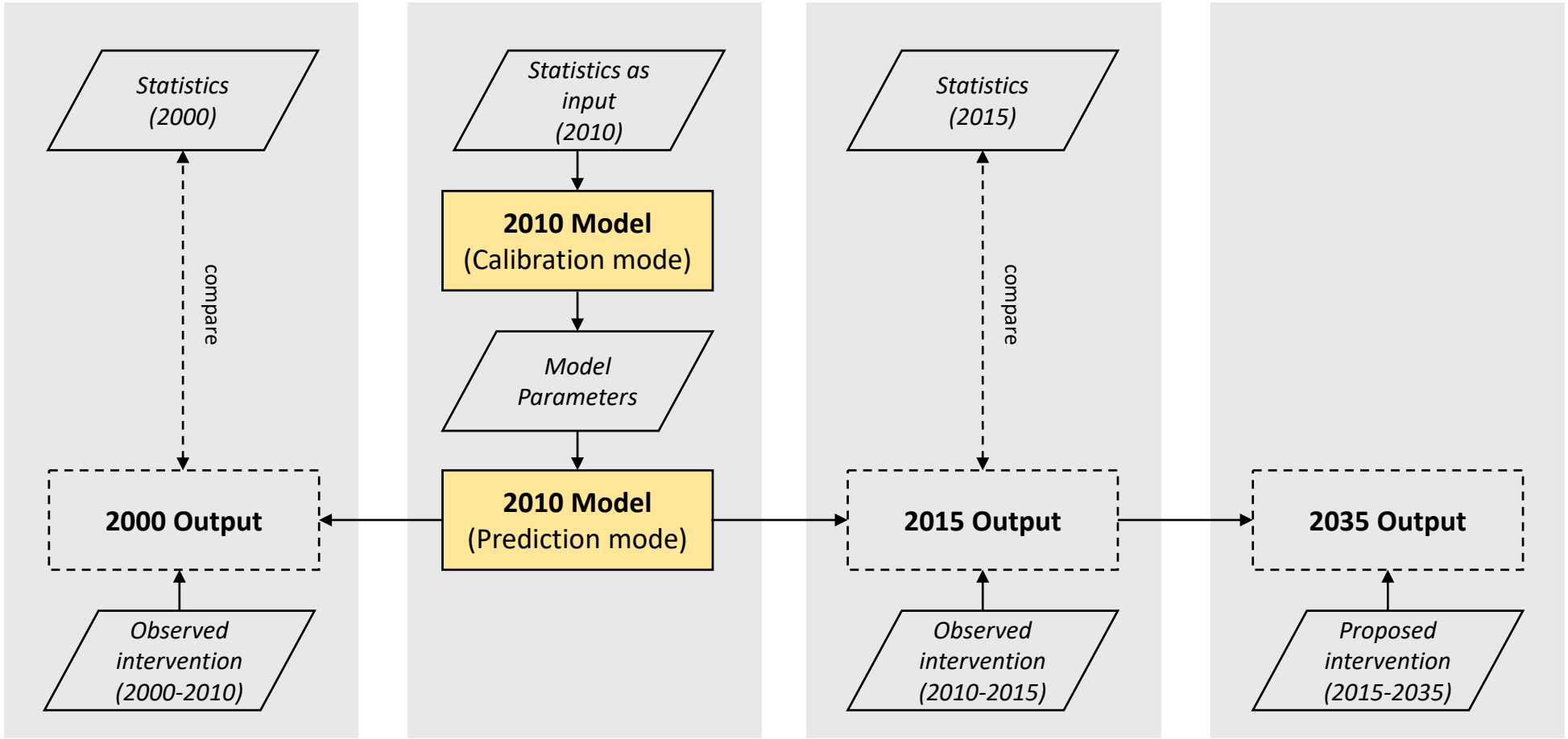
OUTPUTS

(1) Population and Employment
- **Zonal employed residents**
- Zonal population
- Zonal %socio-economic group

(2) Housing and Economics
- **Zonal housing rents & land prices**
- Zonal wages
- Zonal disposable incomes
- **Zonal household utility**

(3) Transport
- Commuting matrix

4. Modelling: *Steps for model development*

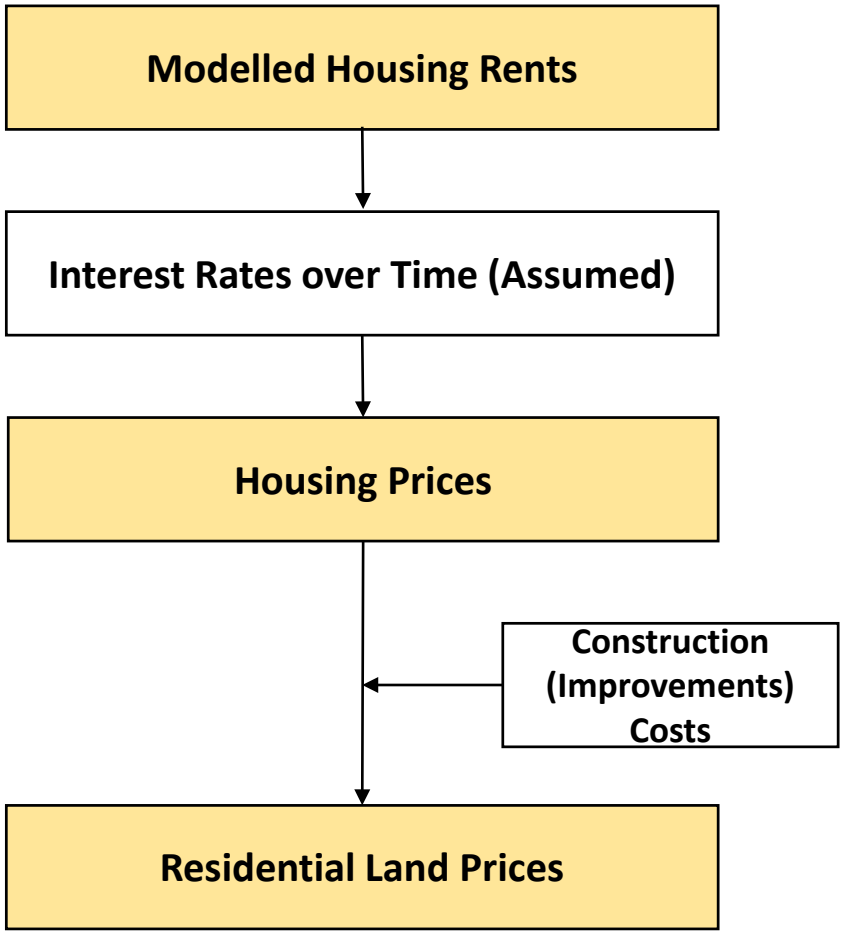


4. Modelling: *Imputation of residential land prices*

- **We only deal with residential land prices.**

- **What is residential land price composed of?**
  - Housing prices (as a function of housing rents) minus the cost of constructions on top of the land.

- **Housing rents**
  - In the **calibration year**, we derive the **zonal discount rate** from observed housing prices and rents, and **improvement costs** from the difference between observed land prices and housing prices.
  - In the **forecast year(s)**, we focus on the patterns of **housing rents**, where land prices can be calculated as shown on the right.



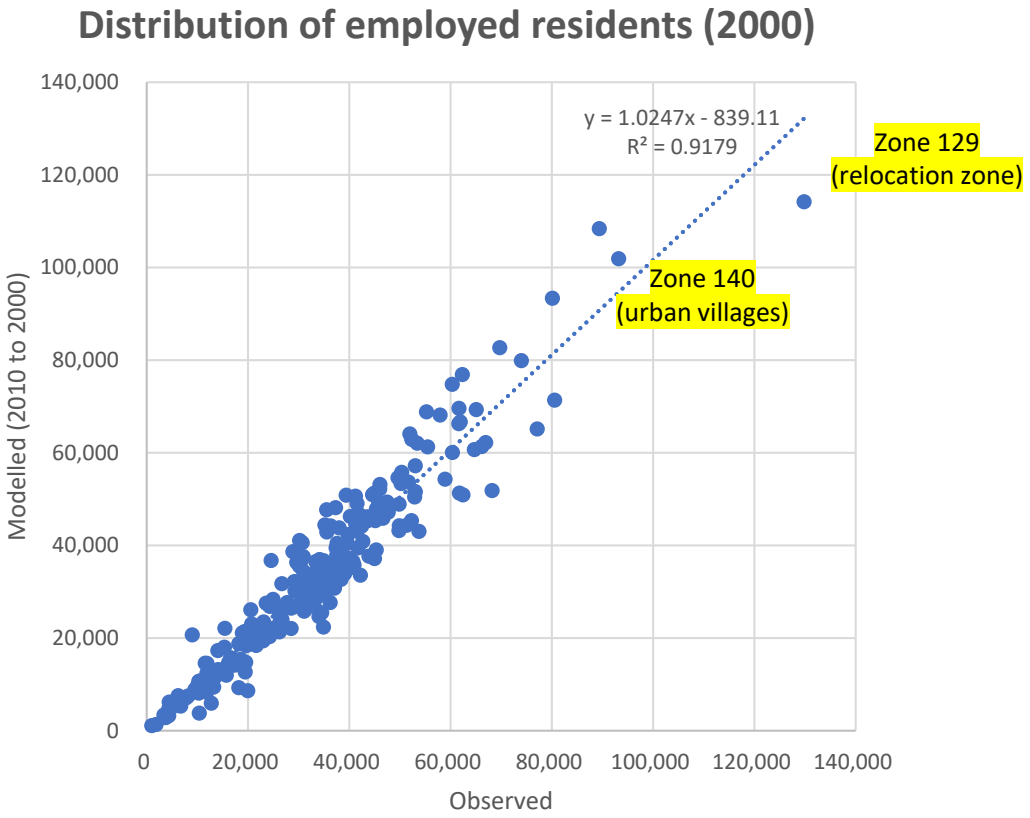
4. Modelling: *Calibration of housing rents and home-to-work commuting flows*

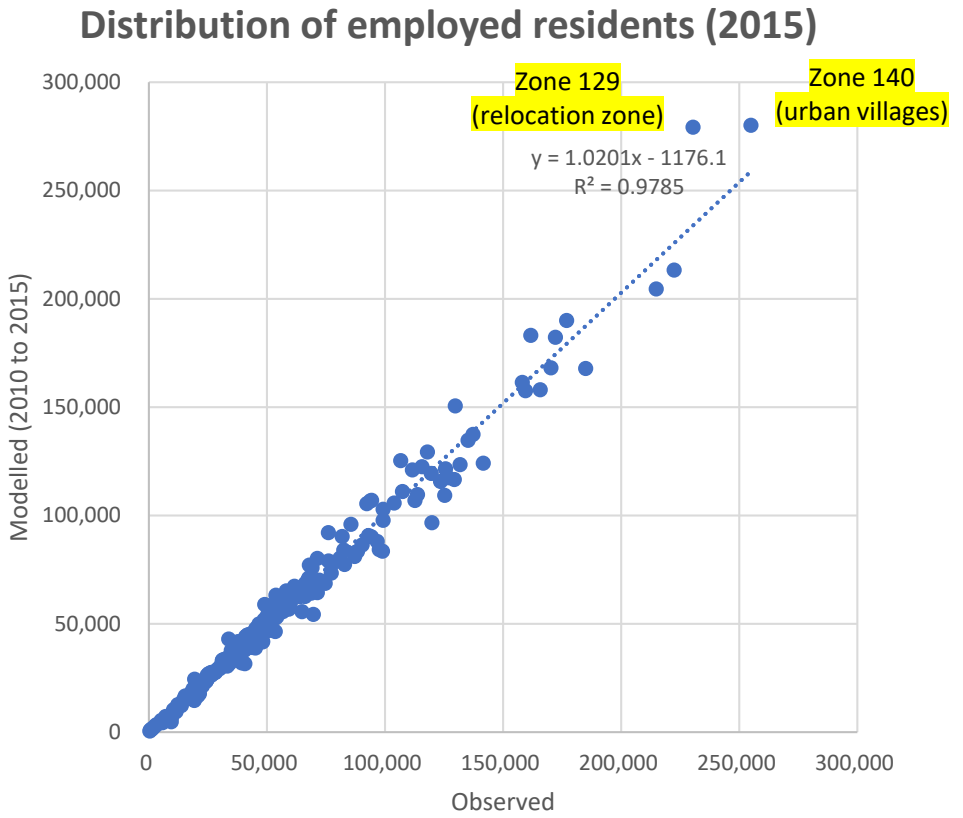
- **The keys to the calibration are the rents in the housing market and commuting patterns in the labour market.**

- **Housing rents**
  - We use online dwelling unit rents data to calibrate the model, taking into account the fact that the low-end dwelling units are under-represented in the sample.

- **Commuting patterns**
  - We use the Official Travel Survey to calibrate the overall average commuting distance, and cross-check the modelled OD matrix with the observed OD aggregated from Mobile Phone Data in more detail.

4. Modelling: *Cross-year validation*





- With **the location of jobs** and **the number of housing units** as the main inputs, **the predicted residents' location has a good fit with the observed one**, as the r-square reaches 0.92 (year 2000) and 0.98 (year 2015) respectively.
- Apart from zones with very dramatic changes, the model predicts well. In future scenario modelling, we will take into account those planned dramatic changes through additional analysis.

What are the impacts of alternative plans for development on land value capture?

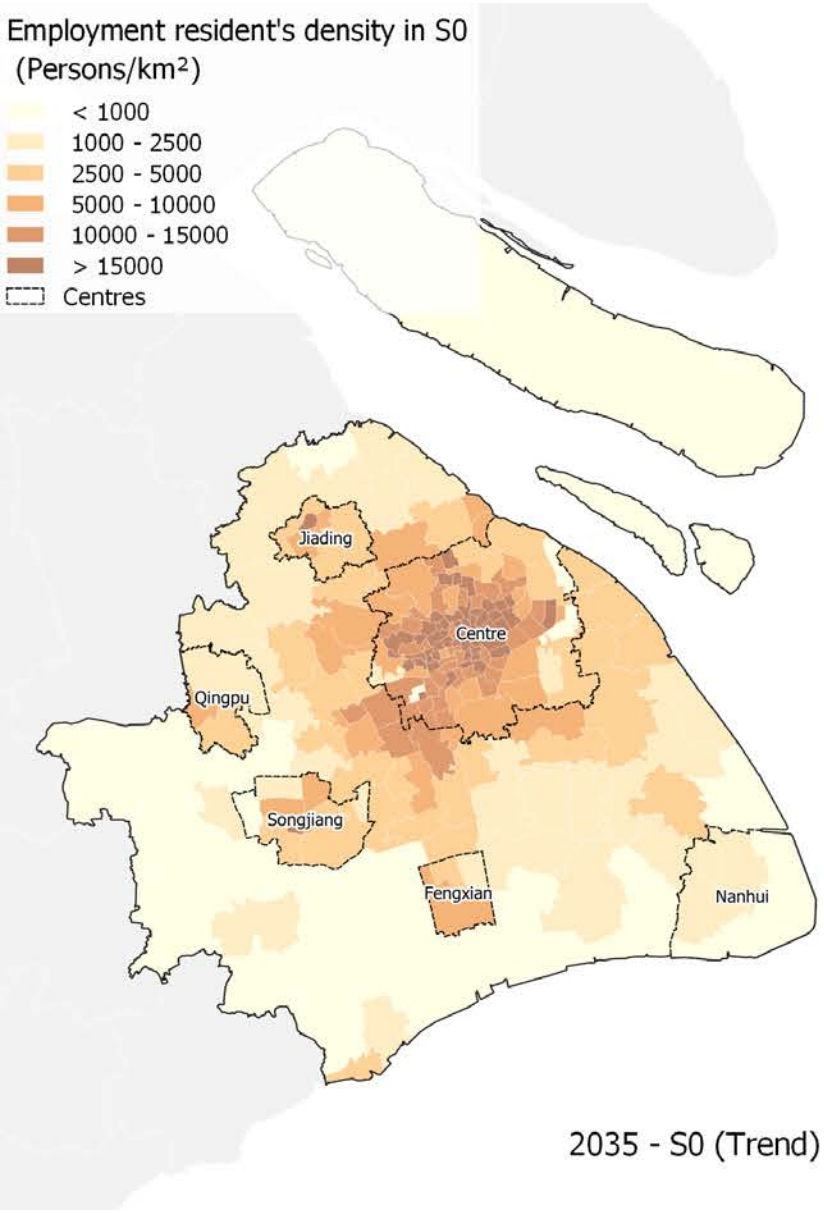
5. Predictions: *Scenario Settings ("the unpredictables")*

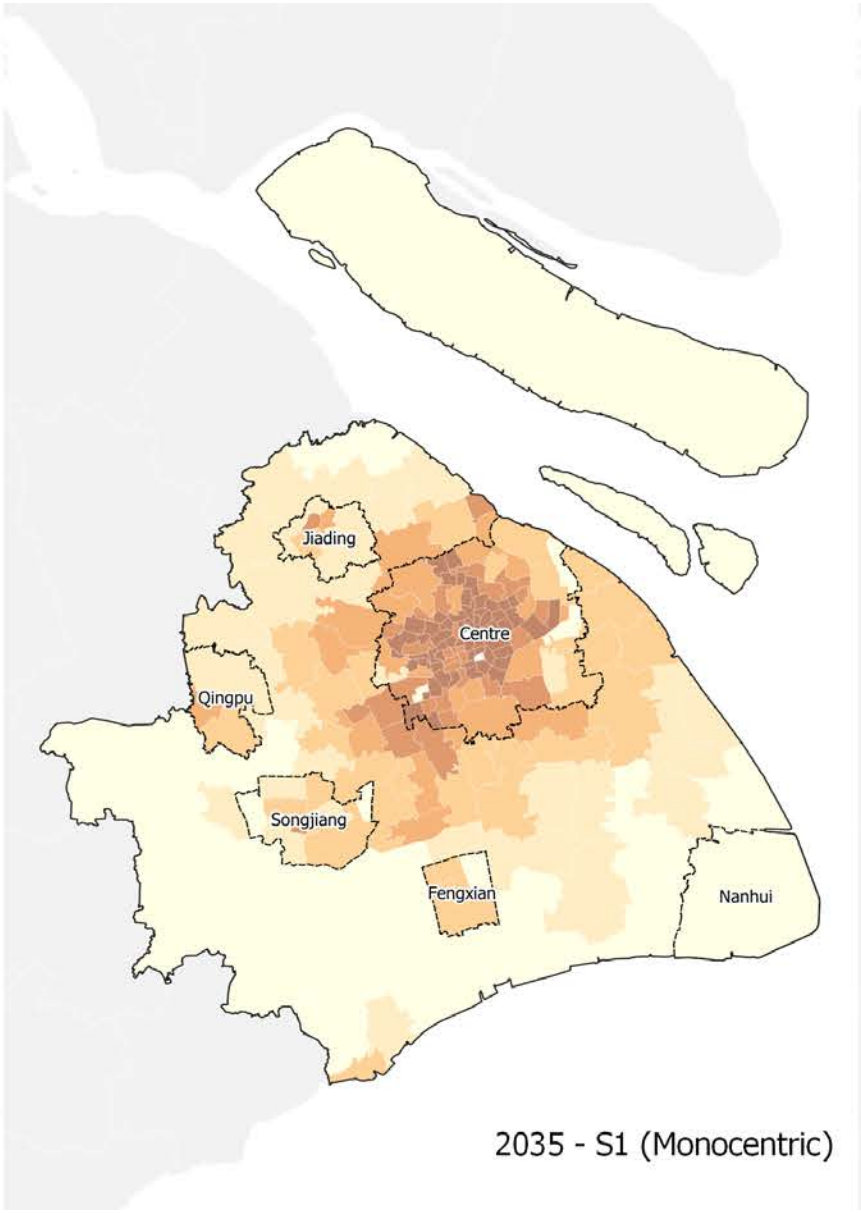
Table. Key inputs by categorical zones.

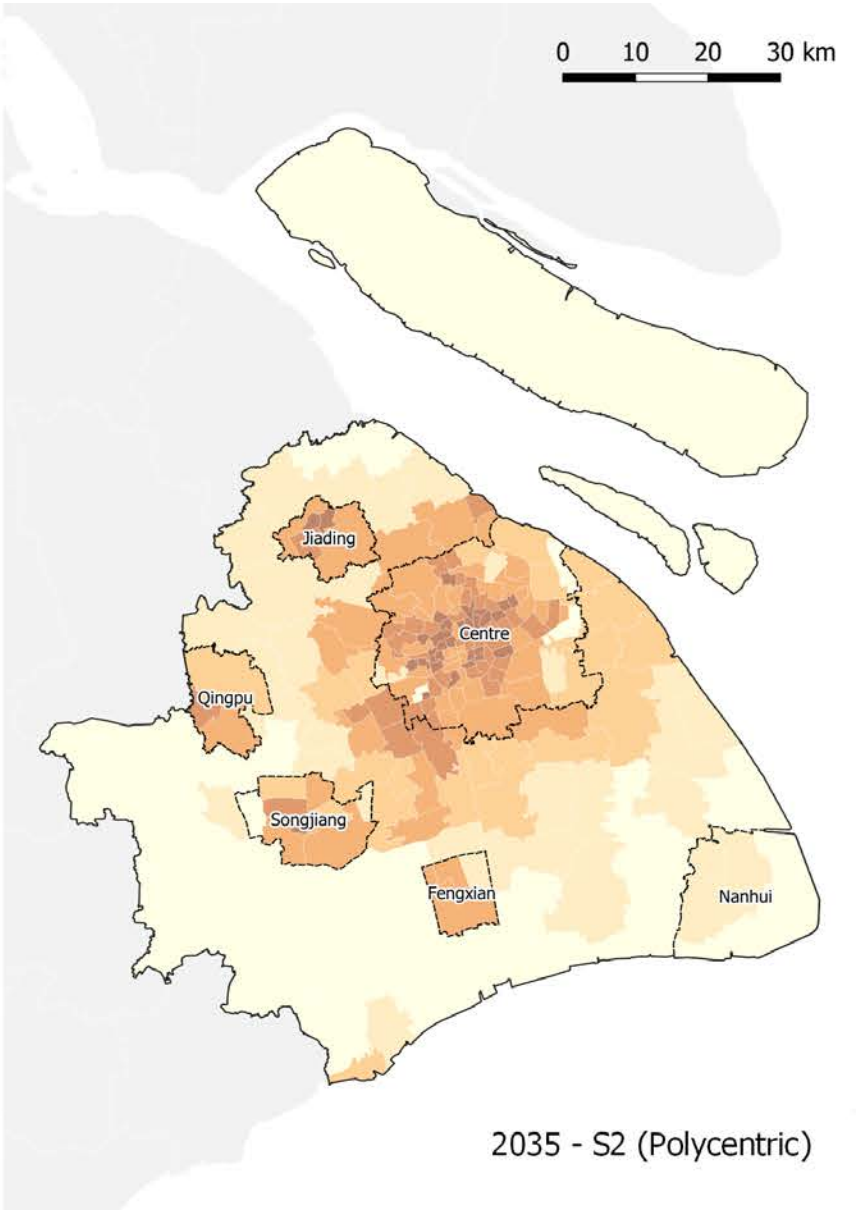
Scenarios	**Jobs** (annual growth rate)					**Housing supply** (annual growth rate)				
	Centre	Near suburb	Sub-centre	Far suburb	All	Centre	Near suburb	Sub-centre	Far suburb	All
2000-2015	2.9%	5.2%	2.0%	3.4%	**3.7%**	1.9%	6.6%	6.4%	4.4%	**3.6%**
2015-2035 | **S0 - Trend**	0.8%	1.6%	2.0%	0.9%	**1.1%**	0.4%	1.9%	1.8%	1.1%	**1.1%**
2015-2035 | **S1 - Monocentric**	**1.3%**	**2.3%**	0.0%	0.0%	**1.1%**	**1.2%**	**2.1%**	0.0%	0.0%	**1.1%**
2015-2035 | **S2 - Polycentric**	0.0%	**2.5%**	**4.1%**	0.0%	**1.1%**	0.0%	**2.3%**	**3.9%**	0.0%	**1.1%**

- The future growth trajectories are likely to be very different. All the scenarios **share the same macroeconomic and population growth assumption** at the city-regional level.
- The model incorporates **the key long-term goals reflected in the 2035 Plan.** Although no specific growth number is given to certain zones currently, this model helps the planners to understand the impacts of different development patterns.

5. Predictions: *Residents' choices of where to live ("the predictables")*







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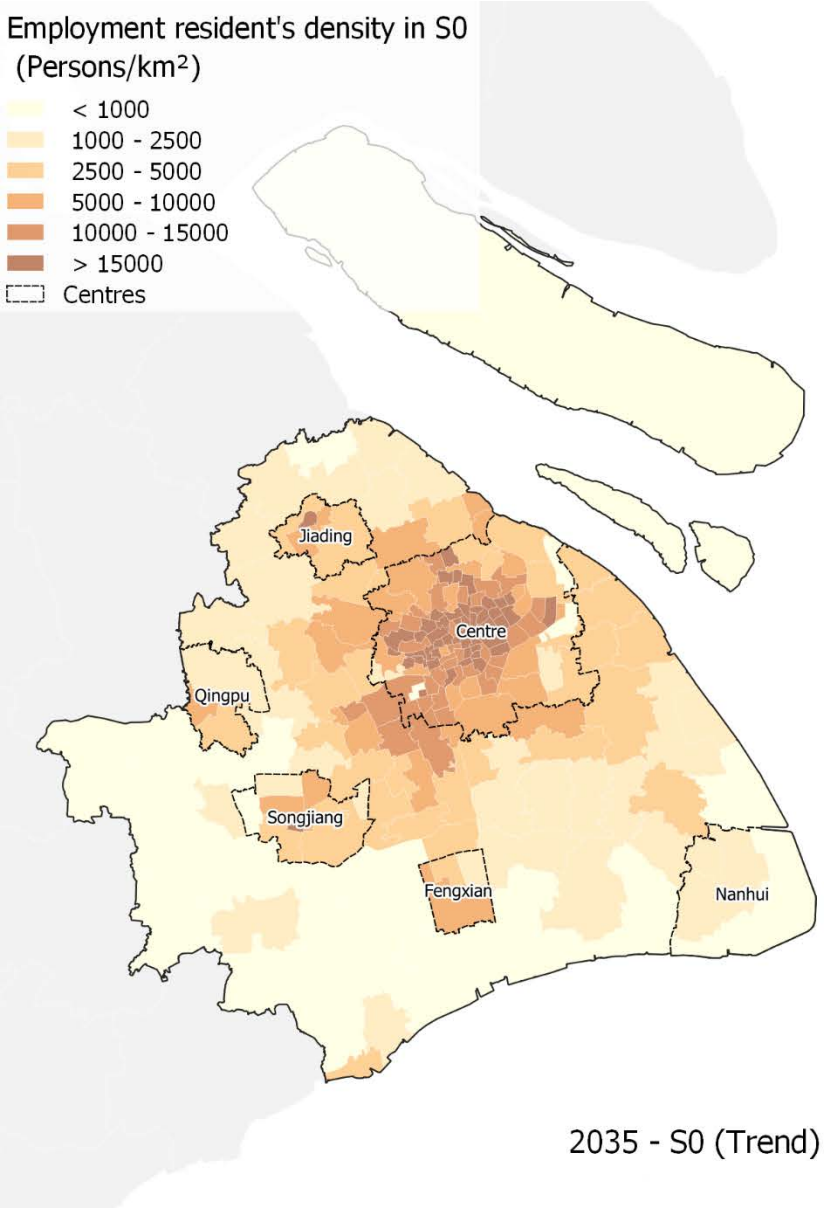
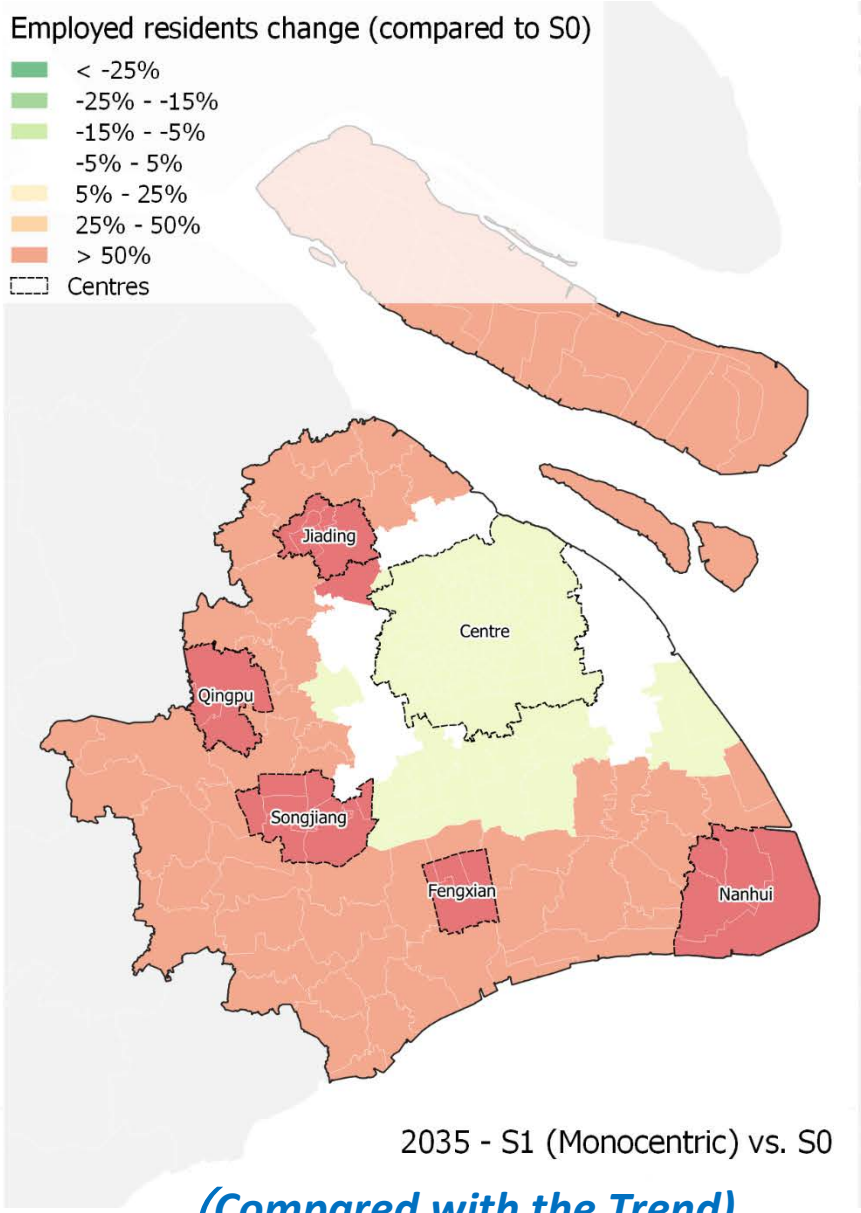
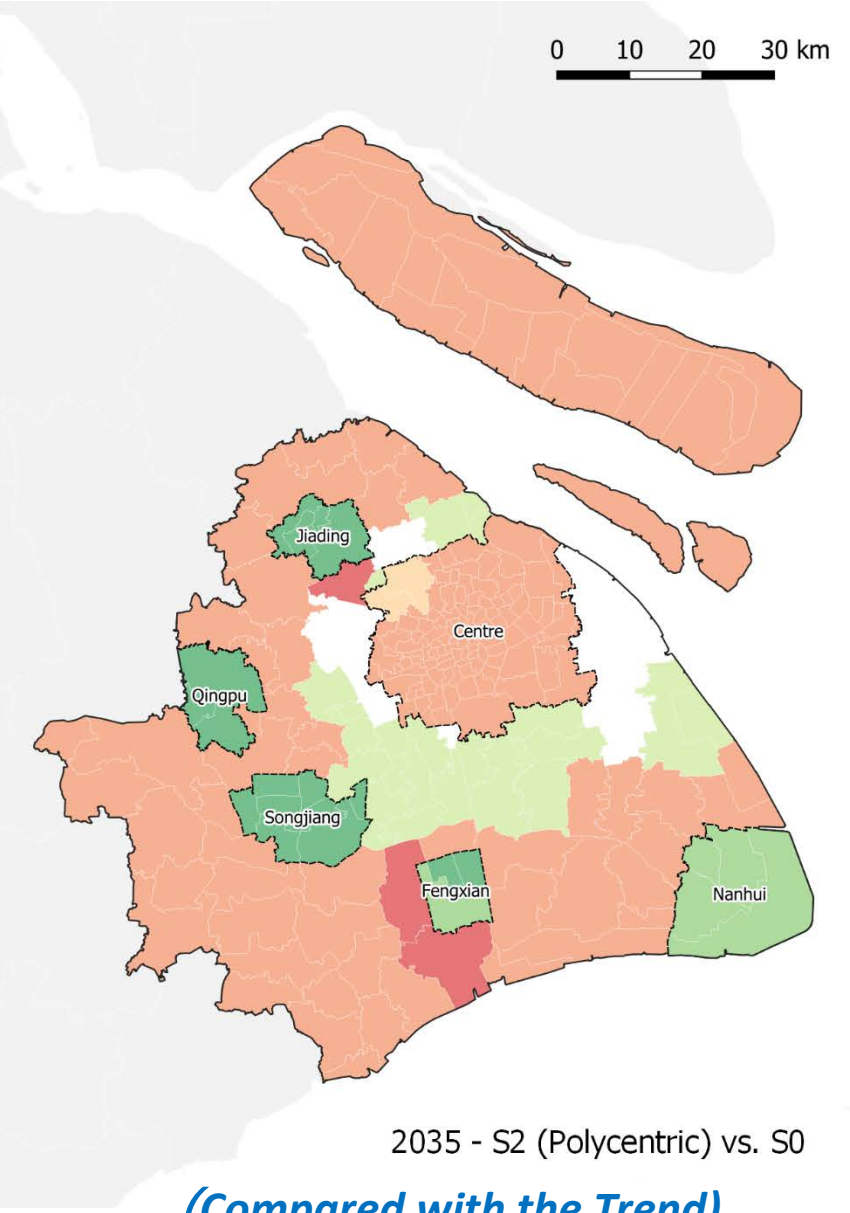


2035 - S0 (Trend)



2035 - S1 (Monocentric) vs. S0

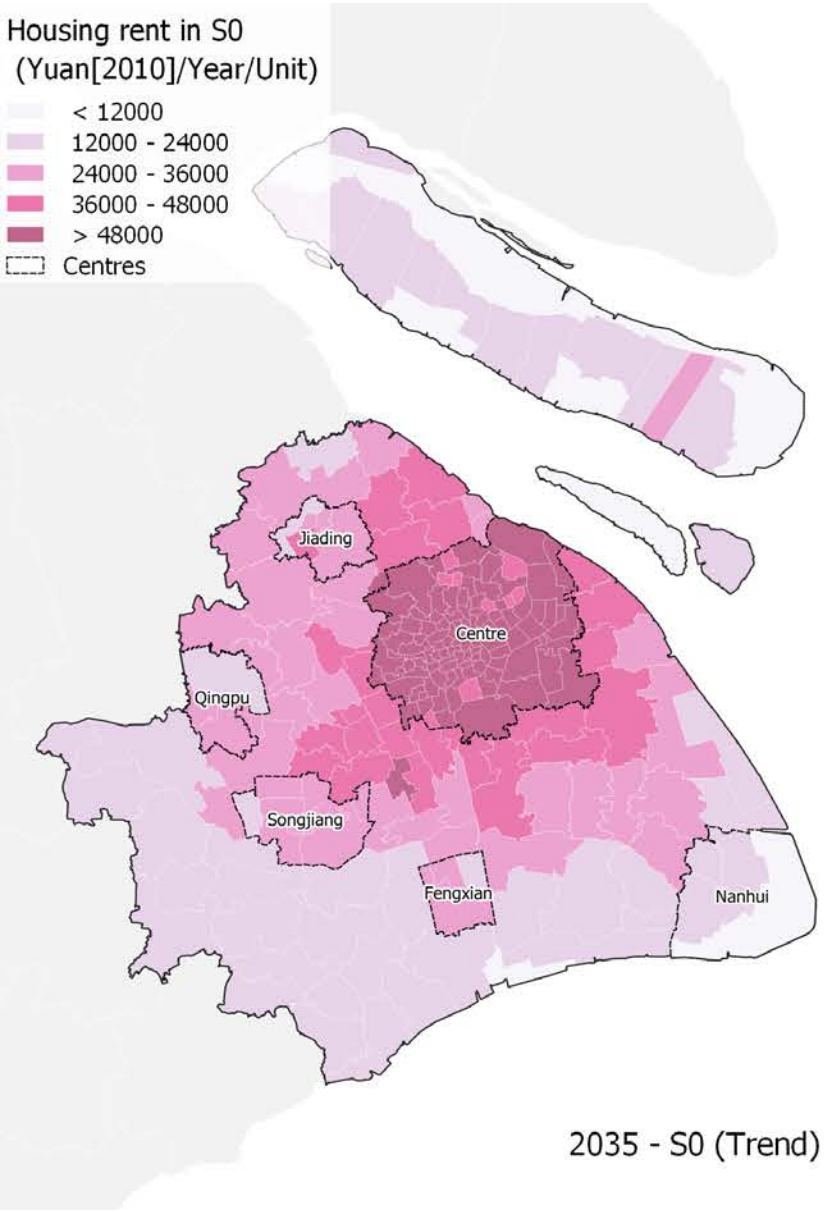
(Compared with the Trend)



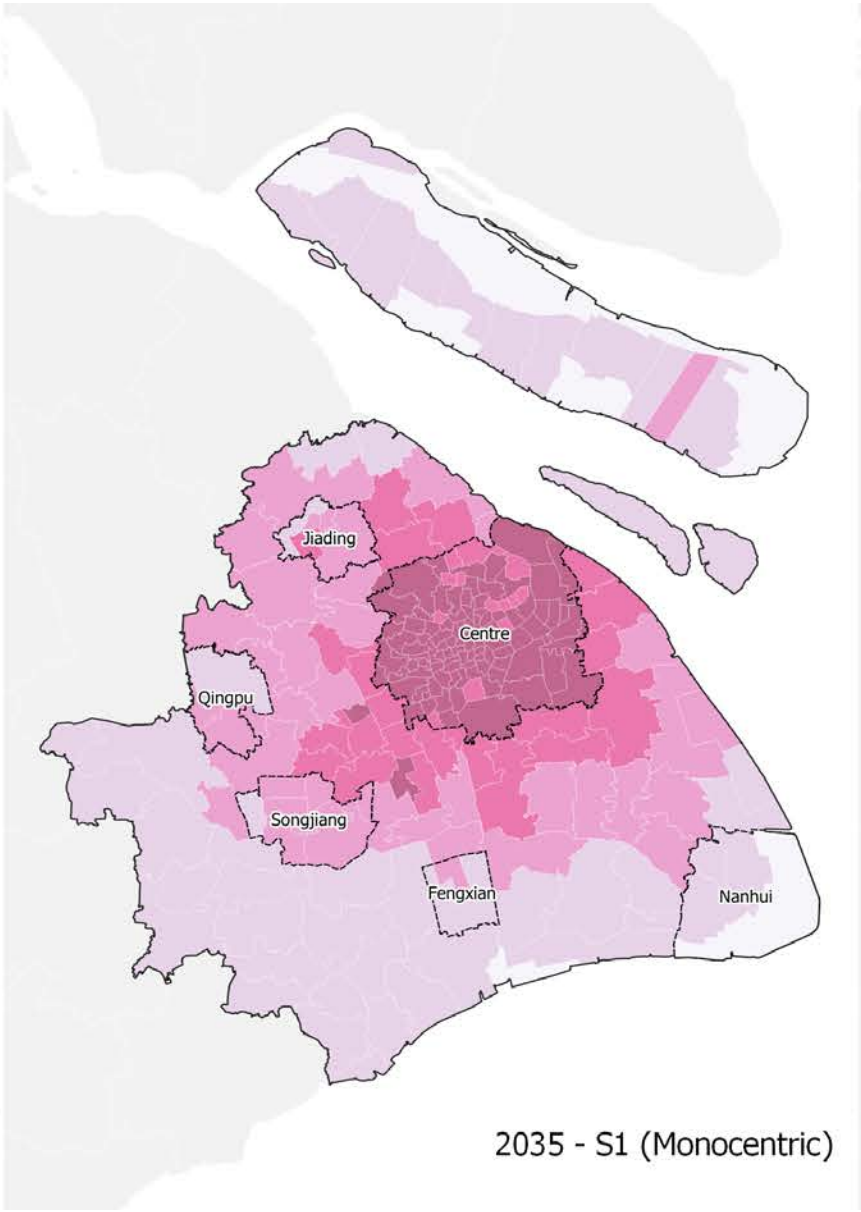
2035 - S2 (Polycentric) vs. S0

(Compared with the Trend)

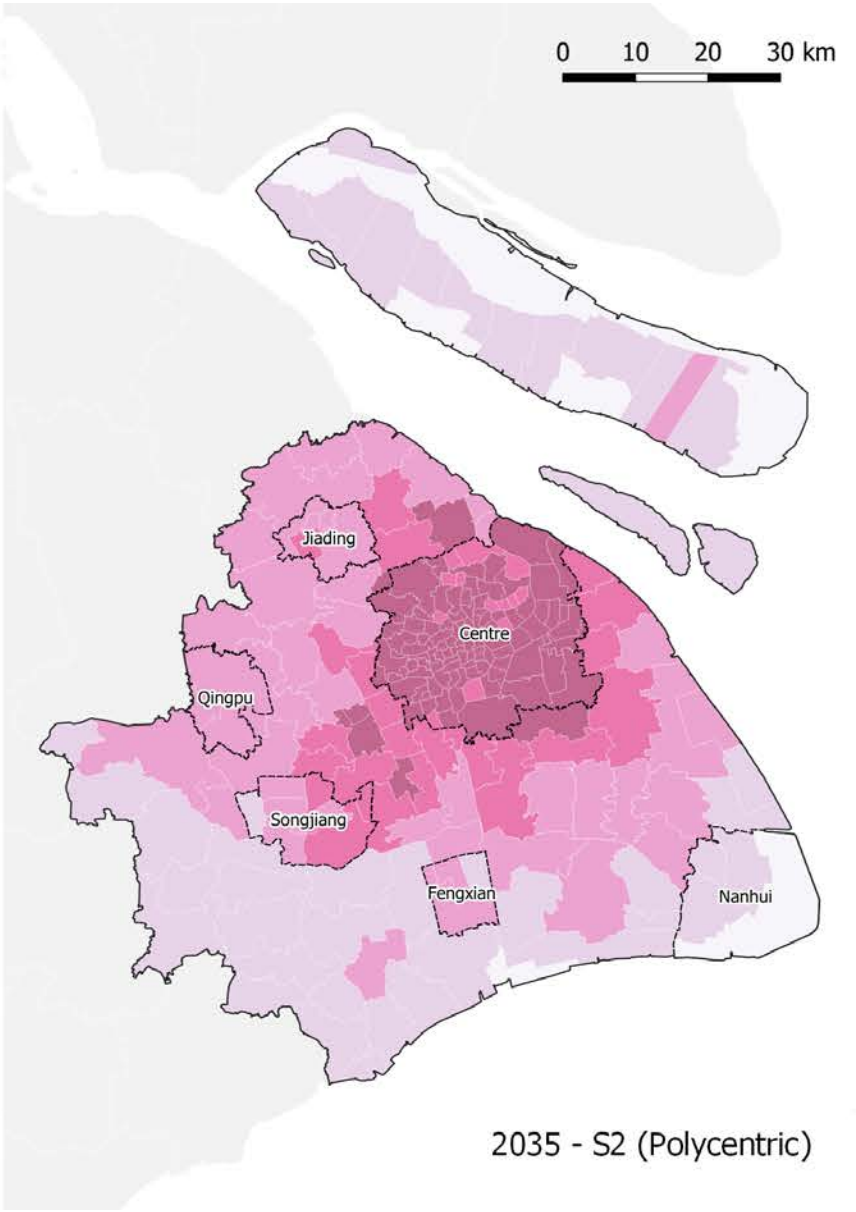
5. Predictions: *Housing rents*



2035 - S0 (Trend)

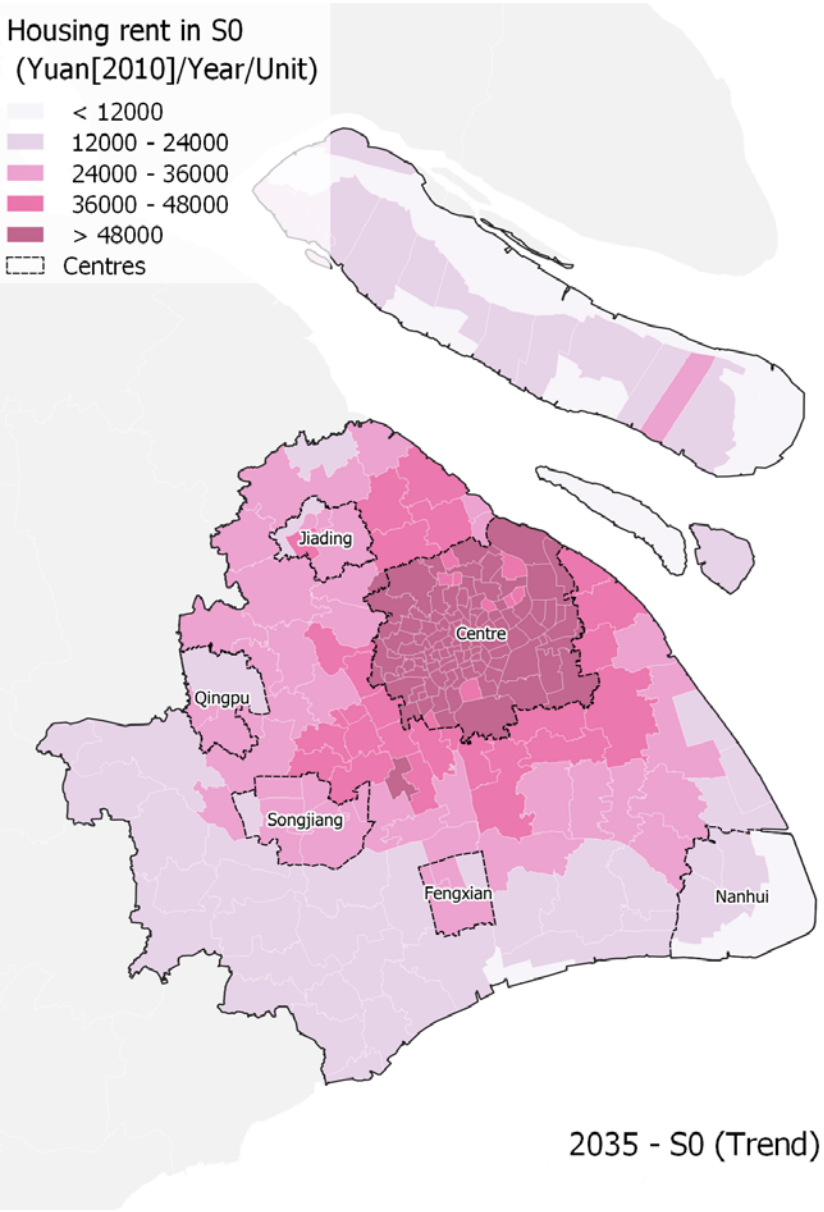


2035 - S1 (Monocentric)

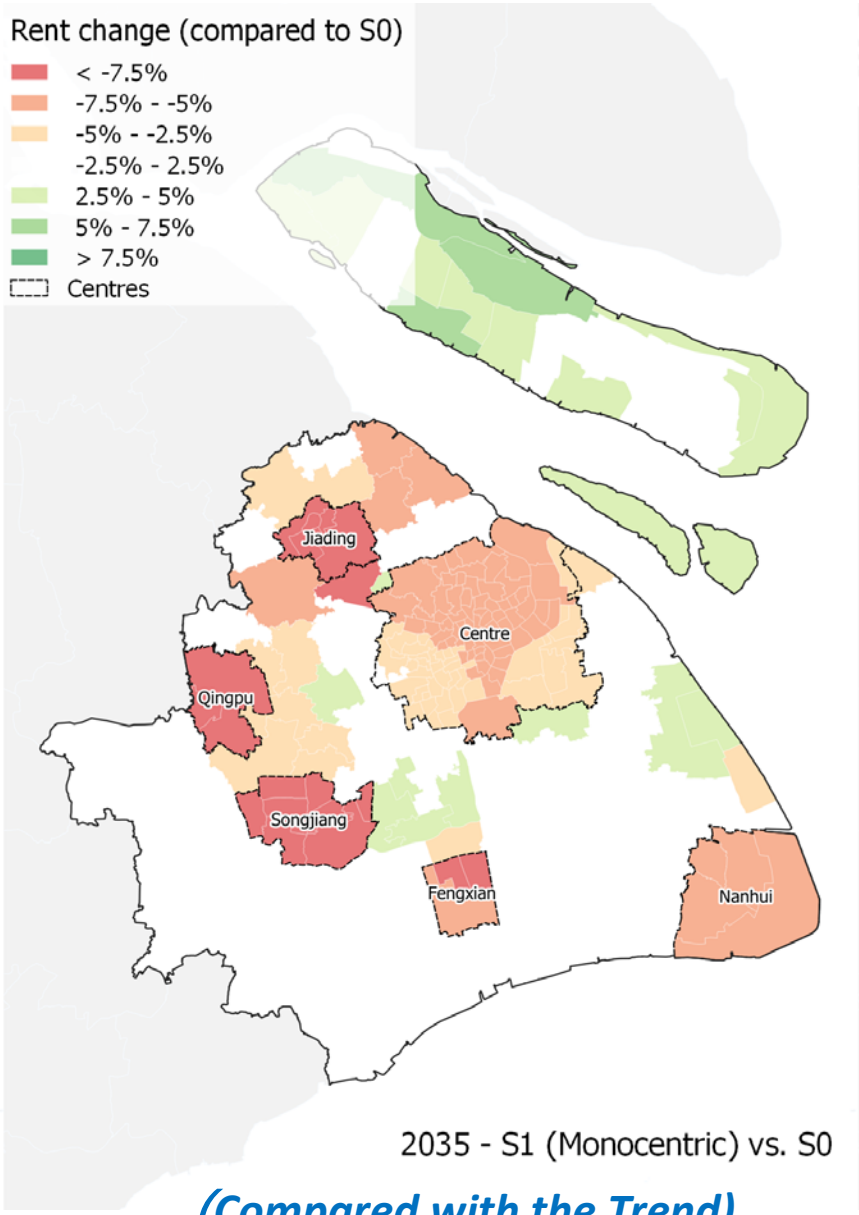


2035 - S2 (Polycentric)

5. Predictions: *Housing rents*

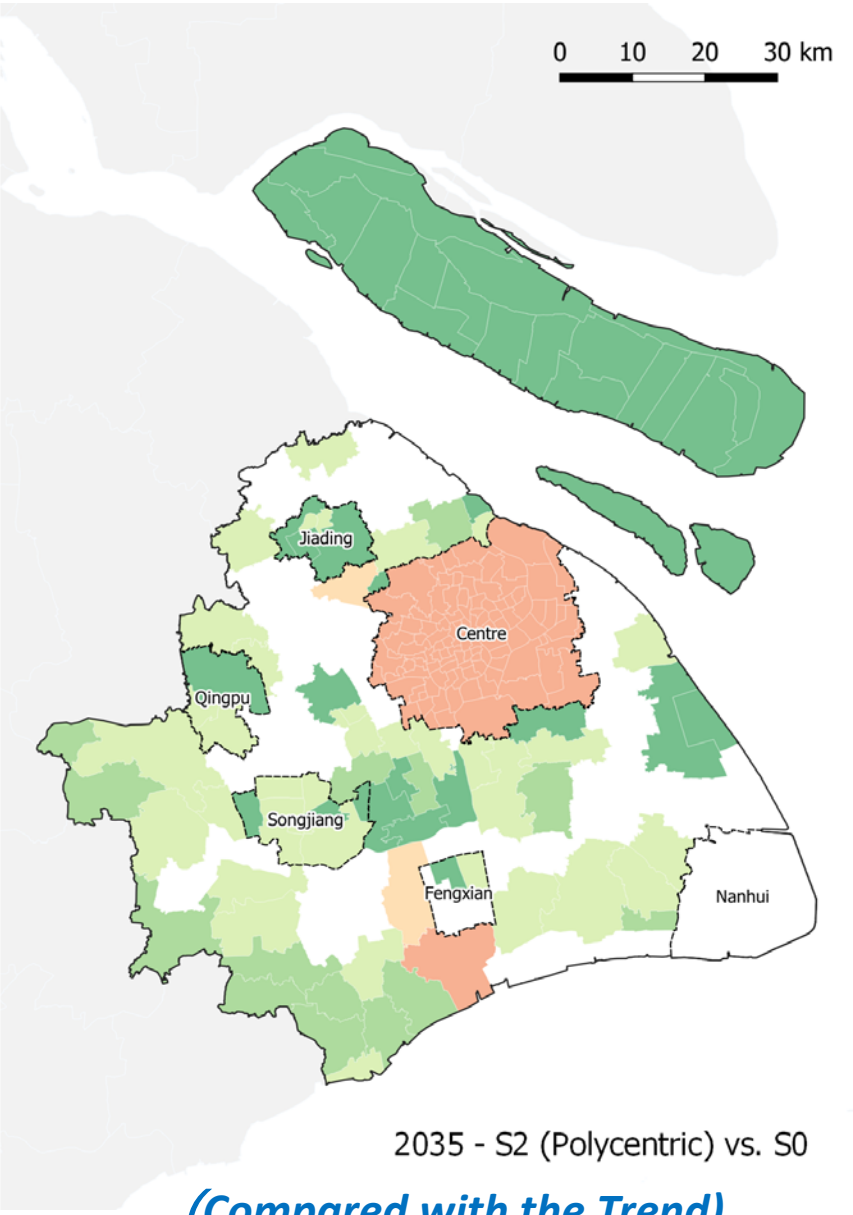


2035 - S0 (Trend)



2035 - S1 (Monocentric) vs. S0

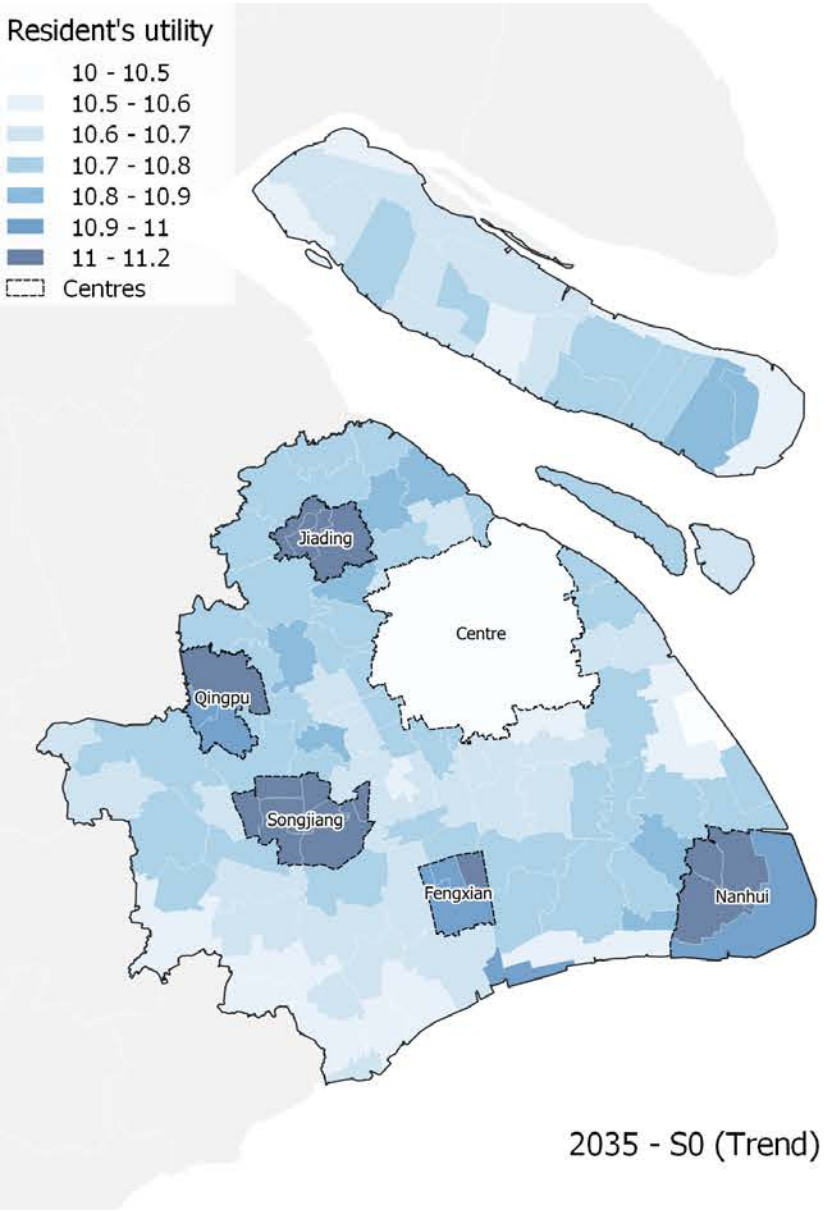
(Compared with the Trend)

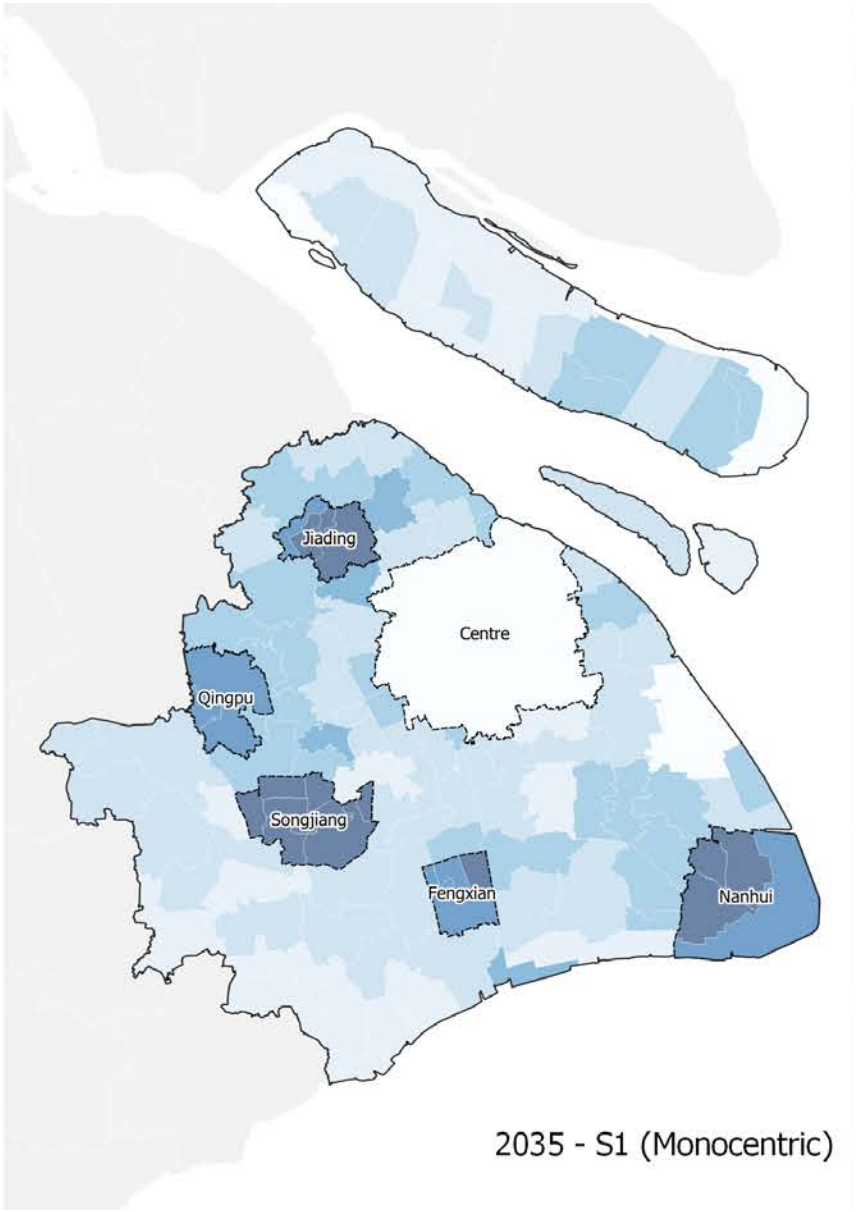


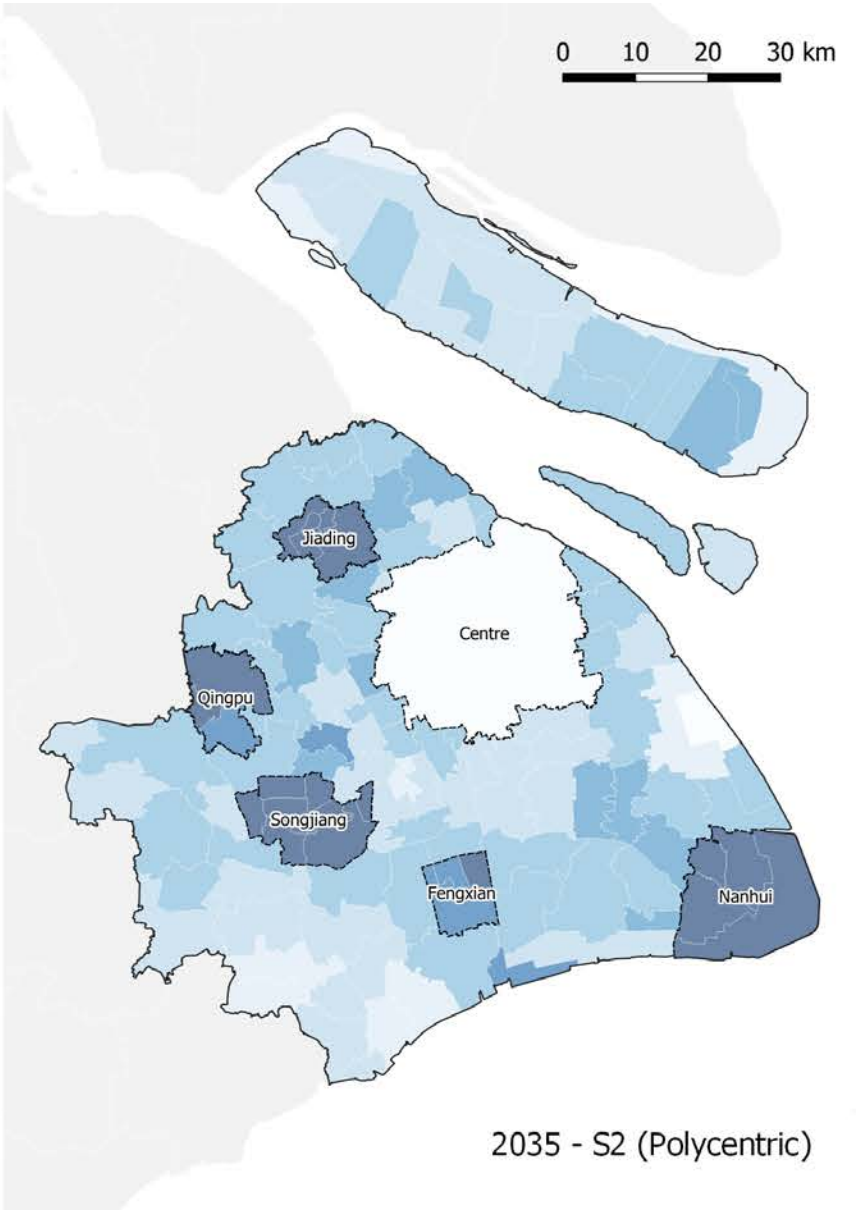
2035 - S2 (Polycentric) vs. S0

(Compared with the Trend)

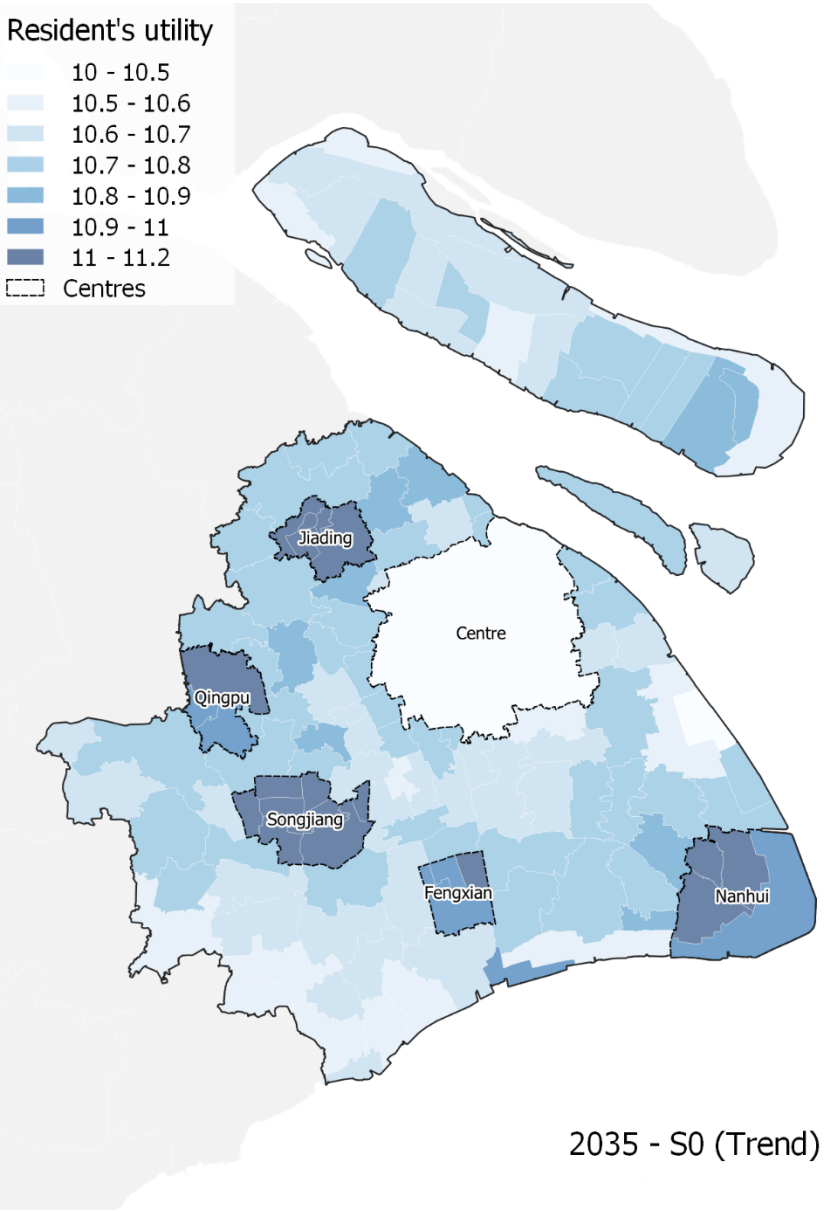
5. Predictions: *Residents' utility (consumer welfare)*



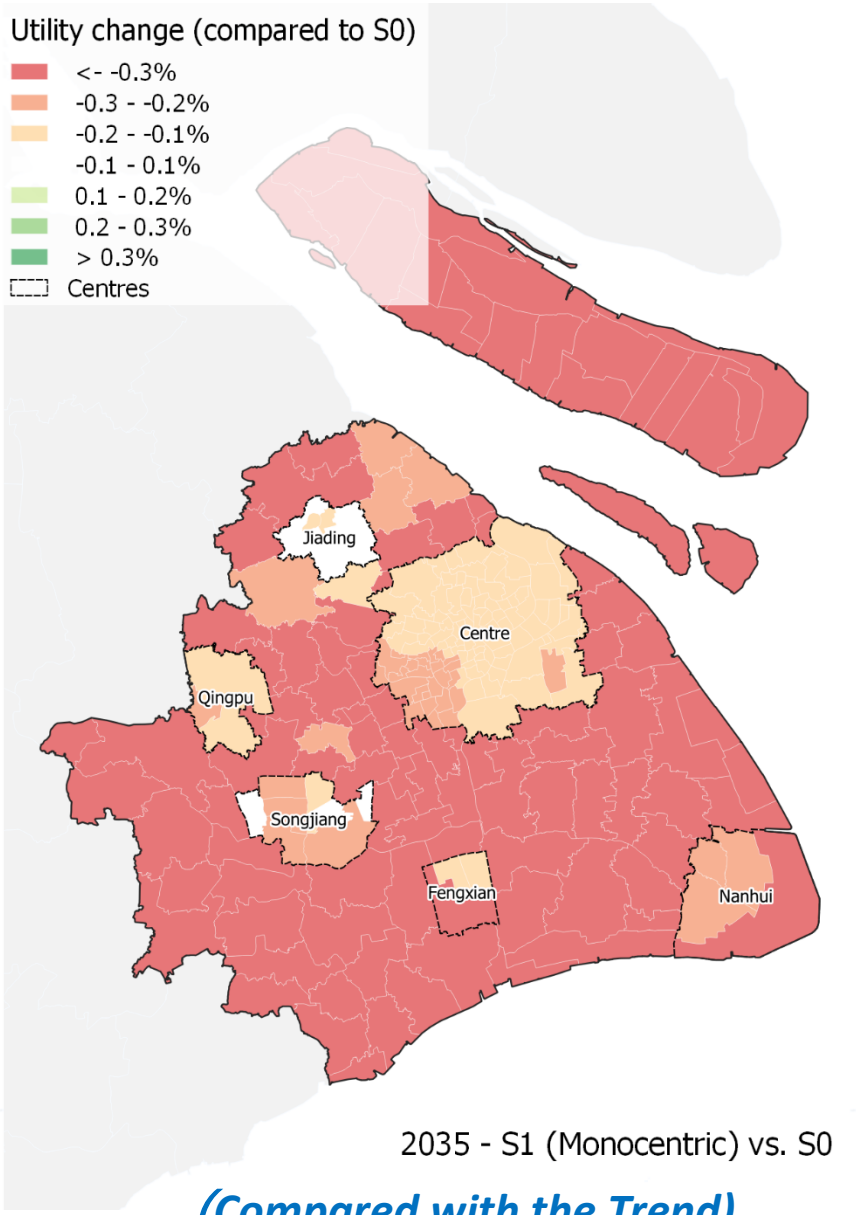




5. Predictions: *Residents' utility (consumer welfare)*

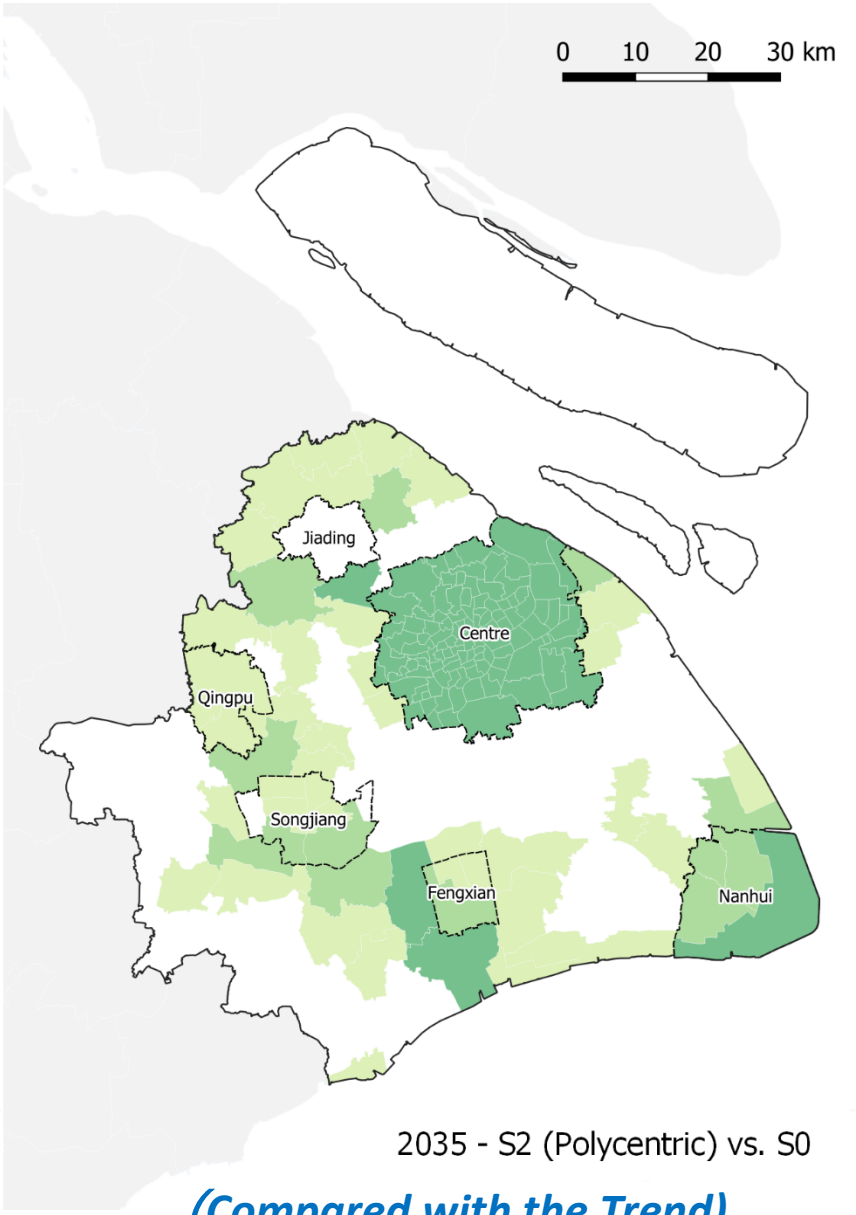


2035 - S0 (Trend)



2035 - S1 (Monocentric) vs. S0

(Compared with the Trend)

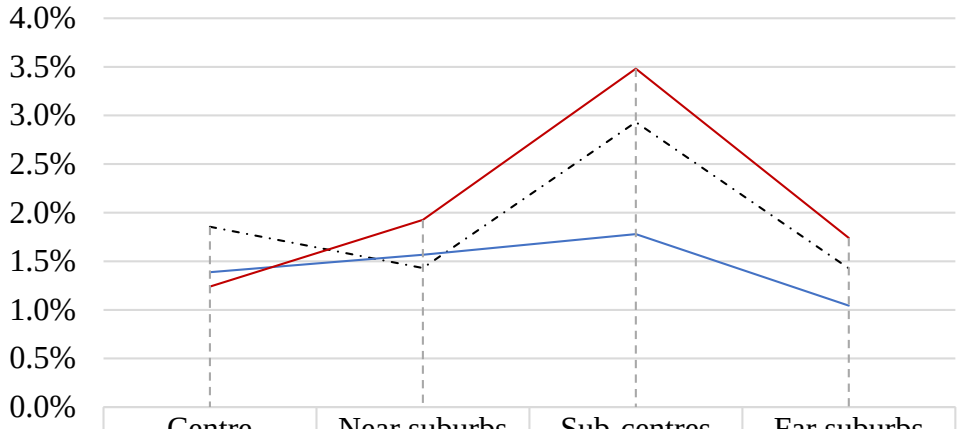


2035 - S2 (Polycentric) vs. S0

(Compared with the Trend)

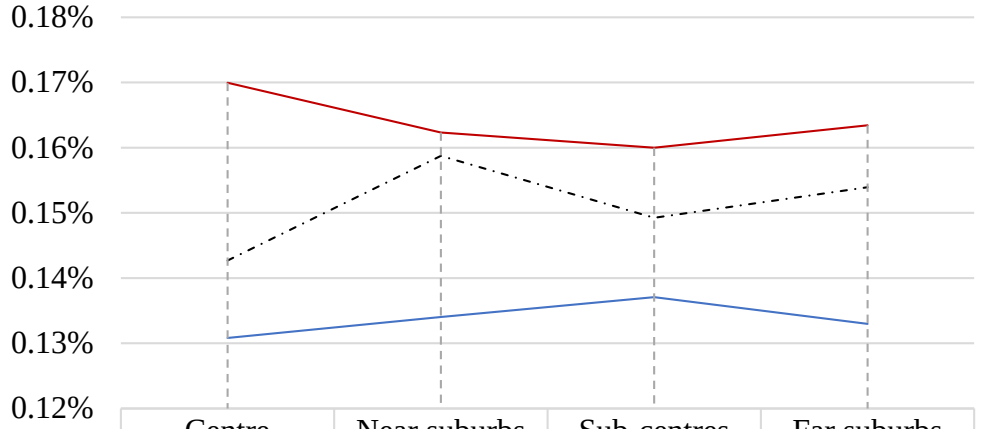
5. Predictions: *Growth comparisons by categorical zones*

Land price annual growth rate



	Centre	Near suburbs	Sub-centres	Far suburbs
S0 (Trend)	1.9%	1.4%	2.9%	1.4%
S1 (Mono)	1.4%	1.6%	1.8%	1.0%
S2 (Poly)	1.2%	1.9%	3.5%	1.7%

Utility annual growth rate



	Centre	Near suburbs	Sub-centres	Far suburbs
S0 (Trend)	0.14%	0.16%	0.15%	0.15%
S1 (Mono)	0.13%	0.13%	0.14%	0.13%
S2 (Poly)	0.17%	0.16%	0.16%	0.16%

5. Predictions: *Capitalisation*

Table. Capitalisation of land value uplifts and socio-economic benefits.

	Land value uplift (trillion ¥)			**Land conveyance** (trillion ¥)			**Consumer surplus** (trillion ¥)			**Total** (trillion ¥)		
	S0	*S1*	*S2*	*S0*	*S1*	*S2*	*S0*	*S1*	*S2*	*S0*	*S1*	*S2*
Centre	2.9	2.0	1.8	0.8	2.2	0.0	0.2	0.2	0.2	3.8	4.4	2.0
Near suburbs	0.7	0.8	1.0	1.3	1.5	1.8	0.1	0.1	0.1	2.1	2.4	2.9
Sub-centres	**0.4**	**0.2**	**0.5**	**0.4**	**0.0**	**1.1**	**0.0**	**0.0**	**0.1**	**0.8**	**0.2**	**1.7**
Far suburbs	0.3	0.2	0.3	0.3	0.0	0.0	0.1	0.0	0.1	0.6	0.2	0.4
Total	3.6	3.8	3.4	3.3	3.1	3.1	0.4	0.3	0.5	7.4	7.3	7.0

6. Conclusion and Discussion: **Main Findings**

- **(1) THE MEASUREMENT PHASE: Expectations for residential land rent uplift in new sub-centres have been low, but local planners carry on regardless.**
  - The delineation of sub-centres has had a great influence on the construction of housing there, but very muted (if anything) in attracting jobs.
  - It is worth noting that **novel datasets such as online sources on rents or mobile phone traces of commuters reflect a firmer picture on historic central city than on the far suburbs, and a composite picture was synthesised using a combination of traditional and novel datasets via modelling.**

6. Conclusion and Discussion: **Main Findings**

- (1) THE MEASUREMENT PHASE: Expectations for residential land rent uplift in new sub-centres have been low, but local planners carry on regardless.

- **(2) THE MODELLING & PREDICTIONS PHASES: The model outputs suggest that the spatial balance between jobs and housing is critical to higher land and socio-economic value creation.**
  - Polycentric growth yields not only higher **higher property value**, but also **higher residents' utility** across the city.
  - It is **insufficient job opportunities** rather than housing development that is the central challenge in planned sub-centres. (S0 vs. S2)
  - The model findings will be examined in each sub-centre to learn from what works and what doesn't work through comparisons among them.

6. Conclusion and Discussion: **Main Findings**

- (1) THE MEASUREMENT PHASE: Expectations for residential land rent uplift in new sub-centres have been low, but local planners carry on regardless.

- (2) THE MODELLING & PREDICTIONS PHASES: The model outputs suggest that the spatial balance between jobs and housing is critical to higher land and socio-economic value creation.

- **(3) SUMMARY: The studies so far highlight the importance to consider longer term residential land rent profiles across the city, in order to enable successful LVC projects outside the historic centre.**

  - Urban planners, land developers, and decision-makers would all benefit from understanding the revealed **relationships among spatial planning, property development and market feedback** while optimising sustainable and efficient LVC schemes **through timely decisions.**

6. Conclusion and Discussion: **Research Agenda**

- **Next steps**
  - To understand and measure the policy outcome differences between the five new planned sub-centres.
  - Introduction of different types of dwelling units and labour
  - Exploration into development phasing

- **Wider implications of LVC**
  - LVC options can be regarded beyond a financing instrument as a wider policy apparatus to promote **social equity, economic competitiveness and environmental sustainability.**

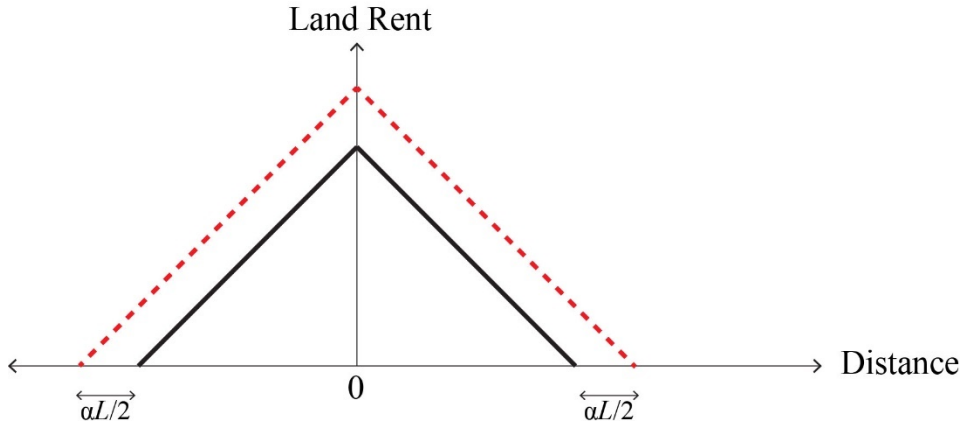


Fig. Trend growth in the existing centre.

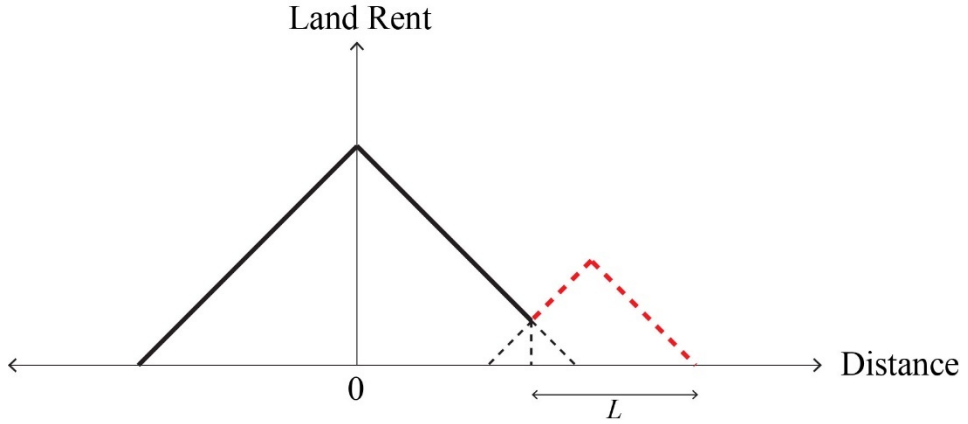


Fig. Introduction of a new employment centre.
(adapted from Fujita and Thisse (2013))

LINCOLN INSTITUTE OF LAND POLICY

UNIVERSITY OF CAMBRIDGE

CAMBRIDGE COMMONWEALTH EUROPEAN AND INTERNATIONAL TRUST

Thank you!

Tianren Yang

ty290@cam.ac.uk