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Working Paper Faster, taller, better: Transit improvements and land use policies

ADB Economics Working Paper Series, No. 702

Provided in Cooperation with: Asian Development Bank (ADB), Manila

Suggested Citation: Chen, Liming; Hasan, Rana; Jiang, Yi; Parkhomenko, Andrii (2023) : Faster, taller, better: Transit improvements and land use policies, ADB Economics Working Paper Series, No. 702, Asian Development Bank (ADB), Manila, https://doi.org/10.22617/WPS230480-2

This Version is available at: https://hdl.handle.net/10419/298148

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APPENDIXES

Faster, Taller, Better: Transit Improvements and Land Use Policies

Liming Chen, Rana Hasan, Yi Jiang, and Andrii Parkhomenko

ADB Economics Working Paper No. 702 November 2023

Appendix A Data

A.1 Travel time estimates

In this section, we describe how we estimate travel times between wards for different modes of transportation. We first compute travel times by bus and driving, both between wards and between wards and metro stations. Then we compute the travel times by metro between each pair of stations. Finally, we combine the estimates for bus and driving ward-to-station with metro travel times to obtain the travel times by transit. Our procedure is described in detail below.

A.1.1 Data on bus and driving travel times

- We collected Google Maps (GM) driving and bus travel time data for Bengaluru for ward-to-ward, ward-to-metro station, and metro station-to-ward origin-destination (OD) pairs for the morning and evening peak hours on a normal working day.³⁷
- The working day selected for the collection data are Wednesday, 27 October 2021 for driving trips and Wednesday, 2 March 2022 for bus trips. We identified 8:30–9:30 a.m. and 6–7 p.m as morning and evening peak hours, respectively. The peak hours are based on data from the 2015 Bengaluru Travel Survey. See Figure A.1.
- 3. To construct the OD pairs, we used the ward coordinates (based on 2015 NTL cells with the highest luminosity value) and the metro station coordinates. There are 198 wards and 125 metro stations in Bengaluru. From these, we created $198 \times 198 = 39,204$ ward-ward OD pairs and excluded the 198 self-links, leaving us with a total of 39,006 pairs. Also, there are $198 \times 125 = 24,750$ ward-to-metro station and $125 \times 198 = 24,750$ metro station-to-ward OD pairs.
- 4. We prepared input files for collection, which included unique ID, the query time, the OD pair coordinates, and the day of collection. Then, for driving, we used the input files to run the query to GM using Amazon Web Services (AWS); for the bus, we initiated the query using GM's Distance Matrix API.
- 5. In Table A.1, we describe the data collected. GM did not return travel time information for a small number of AM and PM driving and bus trips, as described in Table A.2. We impute the missing OD data as follows. For driving, we conducted a simple imputation by regressing the log of time on the quadratic log of distance for the AM and PM ward-ward, as well as the AM and PM ward-station samples. Then, these coefficient estimates and the distance between missing ODs were used to predict the speed. Table A.3 shows the regression results. Meanwhile, for bus trips, we identified the OD pairs with missing travel information and also conducted a simple imputation. The following procedures are applied in imputing missing travel time by bus:

³⁷Transit mode with bus preference was selected in the GM API query.

- (a) Ward-ward: for ward #150, time of ward #150 to ward #86 + time from ward #86 to the missing wards + 10 minutes waiting time.
- (b) Ward-station: for ward #150, time of ward #150 to ward #86 + time from ward #86 to missing stations + 10 minutes waiting time.
- (c) Ward-station: for station #53, time of a nearby ward #190 to station #53 + time from all the missing wards to the nearby ward + 10 minutes waiting time.
- (d) Ward-station: for station #102, similar to the above, the nearby ward is #86.
- (e) Station to ward: for station #53, time of station #53 to ward #190 + time from ward #190 to ward #191 + 10 minutes waiting time.
- (f) Station to ward: for station #102, similar to above, the nearby ward is #86.
- (g) Station to ward: for station #118, similar to above, the nearby ward is #9.



Figure A.1: Distribution of Starting Hour of All Commuting Trips

Note: Calculated from the 2015 Bengaluru Travel Survey.

A.1.2 Data on metro travel times

- First we generated metro station-to-station travel times for all metro lines (existing, under construction, and proposed). We used the published average speed of metro trains (34 kilometers per hour) and inter-station distance. The inter-station distance was spatially calculated from the digitized metro line shapefiles. Table A.4 lists the details of metro alignment and stations.
- Based on public information, a train stop time of 40 seconds for interchange stations and 30 seconds for other stations were applied to the computed inter-station travel time. Train stop time is defined as the time it takes for a train to stop on a certain station for alighting passengers to disembark.
- 3. For routes that involved a change of metro line, a 5-minute transfer time was added to travel time. Transfer time was defined as the time it takes to transfer from one

	With	Without	
	Travel Data	Travel Data	Total
Driving			
Ward to Ward*			
AM	38,992	14	39,006
PM	38,870	136	39,006
Ward to Metro Station			
AM	24,746	4	24,750
PM	24,682	68	24,750
Bus			
Ward to Ward*			
AM	38,811	195	39,006
PM	38,811	195	39,006
Ward to Metro Station			
AM	24,534	216	24,750
PM	24,455	295	24,750
Metro Station to Ward			
AM	24,731	19	24,750
PM	24,681	69	24,750

Table A.1: Distribution of Collected Data

Note: The table describes routes with and without data from Google Maps. Source: Authors' estimates.

Table A.2: Ward and Stations with	n Missing Travel	Information
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With Missing Data											
	AM	PM	Remarks								
Ward-Ward OD											
Ward #150 to	195 wards	195 wards	with data to #s 86 and 149								
Ward-Metro Station OD											
Ward #150 to	120 stations	120 stations									
to Station #53	95 wards	172 wards									
to Station #102	2 wards	4 wards	AM: #s 6 and 16; PM: #s 3, 54, 83, and 84								
Metro Station-Ward OD											
Station #53 to	1 ward	1 ward	#191 both for AM and PM								
Station #102 to	12 wards	5 wards									
Station #118 to	6 wards	63 wards									

OD = origin-destination.

Note: The table describes routes with missing data from Google Maps.

Source: Authors' estimates.

metro line to another, including getting off a train, walking to another station, and waiting for another train.

4. The computed inter-station travel times were then used as the basis for creating the Bengaluru metro travel time matrix. Using the Bengaluru metro line and metro station shapefiles as a guide, the routes, especially those across different lines, were visually checked.

	(1)	(2)	(3)	(4)
	Ward	-ward	Ward-	station
Dep. variable	Log time	Log time	Log time	Log time
	AM	PM	AM	PM
Log distance	0.902***	1.041***	1.106***	1.193***
	(0.00495)	(0.00508)	(0.00844)	(0.00864)
Log distance	-0.0254***	-0.0605***	-0.0771***	-0.101***
squared	(0.00114)	(0.00116)	(0.00173)	(0.00177)
Constant	1.457***	1.542***	1.219***	1.355***
	(0.00540)	(0.00558)	(0.0102)	(0.0105)
Observations	38,992	38,870	24,746	24,682
R-squared	0.920	0.914	0.873	0.860

Table A.3: Regression Results for Imputation

Note: The table describes regression results that are used to impute commute time for routes with missing information in Google Maps.

Source: Authors' estimates.

Line	Phase	No. of stations	s Terminal Stations				
		6	Baiyappanahalli	Mahatma Gandhi Road			
	Phase 1	6	Magadi Road	Mysore Road			
		5	Mahatma Gandhi Road	City Railway			
East-West Line/ Purple Line		10	Baiyyappanahalli	Sitharama Palya			
	Dhasa 2	15	Kundalahalli	Whitefield			
	Phase 2	C	Mysore Road	Pattanagere			
		D	Mysore Road	Challaghatta			
		7	Yeshwanthpura	Sampige Road			
	Phase 1	3	Peenya Industry	Yeshwanthpura			
		3	Nagasandra	Peenya Industry			
North Courth Line / Crossed Line		5	National College	Rashtreeya Vidyalaya Road			
North-South Line/ Green Line		3	Rashtreeya Vidyalaya Road	Yelachenahalli			
		3	Sampige Road	National College			
	Dhasa 2	5	Yelachenahalli	Silk Institute			
	Phase Z	3	Nagasandra	Madavara			
Pink Line	Phase 2	16	Dairy Circle	Nagawara			
	Dhara 2	10	Bommasandra	HSR Layout			
Yellow line	Phase 2	18	HSR Layout	RV Road			
Dive line	Phase 2A	13	Central Silk Board	KR Puram			
Blue line	Phase 2B	17	KR Puram	Kempegowda International Airport			

Table A.4: Bengaluru Metro Station Alignment Information

Source: Bengaluru Metro Rail Corporation Limited.

A.1.3 Combined transit travel times

Transit trips that include metro involve getting to metro station first, then taking metro, and then traveling from the metro station to a final destination. To obtain combined transit travel times, we followed these steps.

- 1. First, we found the nearest (in terms of travel time) station for each ward and each travel time (AM and PM). Then, we merged the ward origin-station file with the origin ward origin ID and the ward destination-station file with the destination ward ID. This step adds four variables in the ward-ward data: ward-station travel time, station-ward travel time, departure station ID, and arrival station ID.
- 2. Then, the dataset was merged with the transit timetable with the departure station ID and arrival station ID. This adds station-station travel time to the data.
- 3. Finally, the total transit time between wards is generated for AM and PM, respectively, by adding (a) origin ward-station travel time, (b) station-to-station travel time, (c) station-destination ward travel time, and (d) an assumed 7 minutes at the terminals (5 minutes for departure station and 2 minutes for arrival station).

A.2 Building heights data

A.2.1 Data inputs

We collected ZY-3 multi-view satellite images in Bengaluru, and carried out data preprocessing steps including radiometric correction, ortho-rectification, image-to-image registration, and pan-sharpening (Liu et al. 2019). The Chinese ZY-3 stereo satellite constellation is composed of three satellites, i.e., ZY-3 01, 02, and 03, launched in 2012, 2016, and 2020, respectively. Each satellite can simultaneously acquire multi-spectral images (with a spatial resolution of 5.8 m) and multi-view images with nadir (2.1 m), +22° forward (2.5 3.5 m), and -22° backward (2.5 3.5 m) viewing angles. All the ZY-3 images were resampled to the spatial resolution of 2.5 m (Figure A.2).

A.2.2 Method

Our method consists of two steps: (1) model development, and (2) model transferring. First, we trained a multi-spectral, multi-view, and multi-task deep network, also known as M3Net (Cao and Huang 2021), with ZY-3 multi-view images to estimate building heights at the spatial resolution of 2.5 m. To optimize the network, we collected a total of 4,723 reference building height samples that are randomly distributed in 42 Chinese cities, where each sample has a size of 400 × 400 pixels. Then, the trained model was transferred to the ZY-3 images over Bengaluru. Our method is summarized in Figure A.3.

The structure of the M3Net network is shown in Figure A.4. The network consists of one branch for learning multi-spectral images and the other for multi-view images. Each branch is sequentially composed of two parts: (1) the encoder that compresses the input of arbitrary size into a feature representation and captures multi-level context information; and (2) the decoder that recovers spatial details and predicts the output of the same size as the input from the feature representation.

Some details should be noted as follows.

1. *Advantages of ZY-3 multi-view images.* ZY-3 satellites can simultaneously acquire high-resolution multi-spectral (5.8 m) and multi-view images with nadir (2.1



Figure A.2: ZY-3 Multi-Spectral Images and Land Use Map of Bengaluru

Note: Panel (a) shows the ZY-3 multi-spectral images of Bengaluru. Panel (b) shows the land use map. Source: ZY-3 multi-view satellite images of Bengaluru (panel a); Digitized land use map of Bengaluru in 2015 (panel b).

m), +22° forward (2.5-3.5 m), and -22° backward (2.5-3.5 m) viewing angles over the same area. Predicting building height from single view images is an ill-posed and challenging problem (Amirkolaee and Arefi 2019). By contrast, multi-view images can lower the uncertainty of height estimation, and describe the vertical attribute of ground objects. Compared to existing methods using 10-m Sentinel-1 images (Frantz et al. 2021; Li et al. 2020a,b), our method utilizes the ZY-3 multi-view observation mode, and can obtain a building height map with a spatial resolution of 2.5 m. In addition, the adopted end-to-end network can directly estimate the building height from images, which can alleviate the error accumulation of the traditional multi-step estimation strategy, e.g., DSM-to-nDSM (Liu et al. 2017).

- 2. Transferability of the M3Net. We directly transferred the model trained with the training set of the People's Republic of China (PRC) to predict the building height in Bengaluru. The training set of the PRC is distributed in 42 major cities and contains diverse buildings with different colors, shapes, sizes, and height, which ensures the generalization ability of our method. In the transferability experiment (Cao and Huang 2021), it can be observed that even when the PRC model was directly applied to the three US cities (without any sample from the US), the accuracies, i.e., RMSE values, for all the cities are satisfactory (3.3 m on average), indicating the robustness of the model in the case of spatial transferability.
- 3. *Advantages of ZY-3 multi-view images.* The predicted building height corresponds to the normalized DSM (nDSM), i.e., the height of buildings relative to the ground. The unit of height is meters.





Note: The figure describes the building height prediction algorithm. Source: Processed from ZY-3 multi-view satellite images of Bengaluru.

A.2.3 Results

By using the method described above, we obtained the building height map with 2.5-m resolution (panel a of Figure A.5). Based on the provided land use map (panel b of Figure A.2), we calculated the mean, medium, maximum, and minimum height values for each land use block. The mean building height for each land use block is shown in panel b of Figure A.5.

A number of examples are given in Figure A.6. For comparison, we also show the predicted building height using Sentinel-2 images (with a spatial resolution of 10 meters). It can be observed that the building heights predicted by ZY-3 images contain much more spatial detail than those predicted by Sentinel-2 images. In particular, the predicted height data from the two methods show that the former is more capable of detecting high buildings.

In summary, the raw data consists of 2.5x2.5 m resolution height data and with corresponding land use. We then aggregate the 2.5m resolution building height data for each type of land use at the ward level weighted by area to arrive at the final height data.



Figure A.4: The Structure of the M3Net Network

Note: The figure illustrates the structure of the M3Net network. Source: Adopted from Cao and Huang (2021).









Note: The figure shows predicted building heights by the M3Net (panel a) and the map of building heights in Bengaluru obtained by combining the M3Net results with the land use map (panel b). Source: Processed from merging ZY-3 multi-view satellite images and digitized land use map of Bengaluru.



Figure A.6: A Set of Predicted Building Height Results

Note: The figure shows several examples of ZY-3 images, predicted heights, mean heights obtained by combining the M3Net results with the land use map, and Sentinel-2 predictions. Source: Processed from ZY-3 multi-view satellite images, Sentinel-2 satellite images, and digitized land use map of Bengaluru.

Appendix B Quantification

B.1 Model Inversion

We invert the model to obtain the values of X_i^s , ω_j^s , ψ_j , ϕ_{fi} , a_j , and E_j^s using the following sequence of steps.

1. First, we solve for $\tilde{X}_i^s \equiv X_i^s q_i^{-\gamma}$, the residential shifter; $\tilde{E}_j^s = E_j^s w_j^s$, the employment shifter; and B_m , the transportation mode shifter. These three sets of parameters are solved numerically using the following three sets of moments.

First, the observed employment by residence and skill in the data, $N_{Ri,data}^{s}$, must be equal its counterpart in the model:

$$N_{Ri,data}^{s} = \sum_{j \in \mathcal{I}} \sum_{m \in \mathcal{M}} \pi_{mij}^{s} N^{s}.$$
 (B.1)

That is, we use equation (4.11) and set \tilde{X}_{i}^{s} (which determines π_{mij}^{s} via equations (4.5)–(4.9)) at the level so that the right-hand side of (4.11) equals observed employment in the data.

Second, the observed employment by residence and skill in the data, $N_{Wj,data}^{s}$, must also be equal its counterpart in the model:

$$N_{Wj,\text{data}}^{s} = \sum_{i \in \mathcal{I}} \sum_{m \in \mathcal{M}} \pi_{mij}^{s} N^{s}.$$
 (B.2)

That is, we use equation (4.12) and set \tilde{E}_{j}^{s} (which determines π_{mij}^{s} via equations (4.5)–(4.9)) at the level so that the right-hand side of (4.12) equals observed employment in the data.

Finally, we set B_m so that the observed fraction of workers who choose private vehicles, as opposed to public transportation, equals this fraction in the model:

$$\sum_{i\in I}\sum_{j\in I}\sum_{s\in\{L,H\}}\pi^s_{mij}N^s.$$
(B.3)

2. ω_i^s : skill-specific productivity. We can rearrange equation (4.23) as

$$\frac{\omega_j^H}{\omega_j^L} = \frac{w_j^H}{w_j^L} \left(\frac{N_{Wj}^H}{N_{Wj}^L} \right)^{\frac{1}{\xi}}.$$
(B.4)

Since we observe local wages and local employment by skill, we can solve for the ratio ω_i^H/ω_i^L .³⁸ Note that, without loss of generality, we can normalize ω_i^L and ω_i^H so

³⁸We only observe average local wages by workplace. To obtain wages by skill, we assume that the skill premium is 1.727, the average skill premium in large Indian cities.

that $\omega_j^L + \omega_j^H = 1$ in all locations. Thus, finding the ratio ω_j^H / ω_j^L is sufficient.

3. Next, we construct the variable $\psi_j \equiv A_j^{\frac{1}{\alpha}} q_{Wj}^{-\frac{1-\alpha}{\alpha}}$ by rearranging equation (4.24) as follows

$$\psi_{j} = \frac{w_{j}^{L}}{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}} \left(\omega_{j}^{L}\right)^{\frac{\xi}{\xi-1}}} \left[1 + \left(\frac{\omega_{j}^{H}}{\omega_{j}^{L}}\right)^{\xi} \left(\frac{w_{j}^{L}}{w_{j}^{H}}\right)^{\xi-1}\right]^{-\frac{1}{\xi-1}}.$$
(B.5)

- 4. Recall that floorspace prices, q_{Ri} and q_{Wj} , are unobserved. However, we can identify them using known parameters and data by first finding demand (equations 4.32 and 4.33) and then solving for prices (equation 4.34). Note that the variable ψ_j that we found in the previous step is necessary to identify commercial floorspace demand. We identify prices under two cases: binding FAR and nonbinding FAR.
- 5. ϕ_{fi} : construction productivity. We can recover construction productivity of residential developers in wards where the FAR limits are not binding by using the data on observed heights. The relationship between heights, floorspace supply, and land area is: $h_{fi} = H_{fi}/(v_{fi}\Lambda_i)$. Then ϕ_{fi} can be recovered using equation (4.31) and model-predicted floorspace demand. For wards where FAR limits are binding, we assign the average value of ϕ_{fi} in nonbinding wards. In some wards, this means that the value of ϕ_{fi} is such that the equation (4.34) takes the value of the second argument of the max operator, a contradiction because the ward is assumed to have a binding FAR limit. There are 13 wards that have this issue with residential prices and 33 with commercial prices. For these wards, we increase ϕ_{fi} to the level that makes both arguments of the max operator equal to each other.
- 6. Next, we can identify TFP, A_j by using the definition of ψ_j and known floorspace prices: $A_j = \psi_i^{\alpha} q_{W_i}^{1-\alpha}$.
- 7. Then, we recover local amenities using known wages and floorspace prices: $E_j^s = \tilde{E}_i^s / w_i^s$ and $X_i^s = \tilde{X}_i^s q_{Ri}^{\gamma}$.
- 8. Finally, we can find the exogenous component of productivity by using equation (4.26):

$$a_j = A_j \left(\frac{N_{Wj}}{\Lambda_j}\right)^{-\lambda}.$$
 (B.6)

9. In a version of the model with endogenous residential amenities (see Section 6.6), we can find the exogenous component of amenities by using equation (6.2):

$$x_j = X_j \left(\frac{N_{Ri}}{\Lambda_j}\right)^{-\chi}.$$
(B.7)

Appendix C Additional Figures and Tables



Figure C.1: Evolution of Bengaluru metro

Note: The maps show the evolution of the constructed metro network. Source: Bangalore Metro Rail Corporation Limited.



Figure C.2: Land Use Map of the Southeasternmost Ward (#149 Varthuru)

Note: The map compares land use between the 2015 and the 2031 plans for Varthuru, one of the most southeast wards in Bengaluru. Its residential land increases from 381 hectares in 2015 to 1,019 hectares in 2031. Only a small amount of the increase is from rezoning commercial land, while the majority comes from the previously unallocated land.

Source: Processed from merging digitized land use map of Bengaluru in 2015 and planned land use map of Bengaluru in 2031.





Note: The map shows the wards inside the Outer Ring Road in dark yellow and outside the road in light yellow.

Inside Ward Outside Wa

Source: Digitized land use maps of Bengaluru in 2015.

Model Variables/parameter	Data Source
Employment at residential ward	Primary Census Abstract (PCA) 2011
Employment at workplace ward	PCA 2011 and Origin-destination from Travel Survey 2015
Skill shares at workplace and residential ward	Travel survey. Corroborated with PFLS 2018-19
Wage at residential or workplace ward	Monthly income data from Travel Survey 2015
Travel time (driving, ward-to-ward)	Google Maps API and nighttime lights data
Travel time (transit, ward-to-station-to-station-to-ward)	Google Maps API, nighttime lights, and estimated metro network timetable
Land use area by ward	Digitized land use planning maps from Master Plan 2015 and 2031
Building height by ward and land use	ZY-3 satellite remote sensing data 2020
Share of housing consumption	Estimates from NSS Consumer Expenditure Survey (CES) 2011-12

Table C.1: Data Sources for Model Variables and Parameters

Note: This table reports data sources used to build model variables and parameters.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	N	mean	s.d.	min	p1	p10	p25	p50	p75	p90	p99	max
Labor												
Employment by res. ward	198	18,648	6,631	8,297	9,230	12,259	14,153	16,842	21,182	28,278	41,385	42,330
Employment by work. ward	198	18,110	18,442	0	1,139	3,434	6,828	12,296	20,204	45,193	90,653	92,241
Monthly income by res. ward (rupees)	198	23,267	9,011	9,534	10,472	12,464	16,327	22,049	30,063	35,111	50,795	56,944
Monthly income by work. ward (rupees)	197	20,894	5,374	8,941	10,939	14,026	16,717	20,833	24,859	27,889	34,600	37,250
Monthly transport expenditure (rupees)	198	2,483	879.7	935.8	1,043	1,475	1,767	2,332	3,143	3,813	4,978	5,294
Share of high-skilled by res. ward	198	0.45	0.13	0.16	0.17	0.28	0.37	0.45	0.54	0.62	0.74	0.74
Share of high-skilled by work. ward	197	0.40	0.16	0.06	0.07	0.19	0.29	0.38	0.52	0.63	0.74	0.87
High-skilled emp't by work. ward	197	8,909	12,274	111.8	119.9	778.6	2,149	4,135	8,652	24,050	60,196	65,455
Low-skilled emp't by work. ward	197	9,293	6,968	542.7	714.8	2,146	4,288	7,772	12,440	19,809	34,799	35,067
High-skilled emp't by res. ward	198	8,348	3,773	2,325	2,520	4,488	5,863	7,292	9,894	13,989	21,028	22,545
Low-skilled emp't by res. ward	198	10,300	4,666	3,896	3,967	5,317	6,727	9,644	12,142	16,312	27,218	27,457
Commute time												
Drive time by ward pair (min)	39,006	41.1	17.4	2.4	7.1	18.2	28.1	40.6	53.3	64.7	80.6	97.4
Drive + metro time by ward pair (min)	39,006	63.9	25.3	11.0	19.9	33.7	46.4	61.2	77.4	96.0	142.6	170.0
Land Use												
Building height, commercial land use (m)	198	2.59	0.63	0.62	0.86	1.81	2.18	2.67	2.99	3.27	4.20	5.12
Building height, residential land use (m)	198	2.88	0.43	1.43	2.02	2.34	2.62	2.88	3.09	3.40	4.14	4.24
FAR value commercial land use	198	0.94	0.23	0.22	0.31	0.65	0.80	0.97	1.09	1.19	1.53	1.86
FAR value residential land use	198	1.05	0.16	0.52	0.74	0.85	0.95	1.05	1.12	1.24	1.51	1.54
Area of commercial land use (1000s sqm)	198	336	419	38	40	77	111	199	398	705	2,556	2,930
Area of residential land use (1000s sqm)	198	936	776	119	133	320	454	702	1,066	2,019	4,148	5,266

Table C.2: Summary Statistics of Data Inputs for Modeling

Notes: (i) There is no individual reporting ward #107 (Shivanagara) as their workplace, resulting in zero employment by workplace and unavailable monthly income data in this ward. It is the also the only ward with high-skilled share not defined. (ii) The drive/transit time by ward pair is the average time of mirrored pairs of corresponding travel mode. For example, if the GM driving time is *x* minutes in the AM peak hour from ward A to B and *y* minutes in the PM peak hour from ward B to A, we use (x + y)/2 as the driving commute time for A-B origin destination pair. (iii) We compute FAR value of by dividing remote sensing building height by 2.75 m, the regulatory average height of habitable rooms according to National Building Code of India 2016. N refers to the number of observations, s.d. is standard deviation, and p*x* refers to the *x*-th percentile.

Source: Authors' estimates.



Panel (c): Jobs, low-skilled



Panel (e): Residential floorspace prices



Panel (d): Jobs, high-skilled



Panel (f): Commercial floorspace prices



Note: The maps show the distribution of residents, jobs, and floorspace prices. Panels (a) and (b) show the density of low- and high-skilled residents. Panels (c) and (d) show the density of low- and high-skilled jobs. Panels (e) and (f) show residential and commercial floorspace prices. Red lines represent the metro network and red crosses are metro stations. Source: Authors' estimates.

Figure C.4: Residents, Jobs, and Floorspace Prices in the Benchmark Economy

Panel (a): Residents, low-skilled

Panel (b): Residents, high-skilled





Panel (e): Total factor productivity



Note: The maps show the values of residential amenities X_i^s , employment amenities E_i^s , and productivity A_i in the benchmark model. Panels (a) and (b) show residential amenities for low- and high-skilled workers. Panels (c) and (d) show employment amenities for low- and high-skilled workers. Panel (e) shows total factor productivity. Red lines represent the metro network and red crosses are metro stations. Source: Authors' estimates.

Figure C.5: Amenities and Productivity in the Benchmark Economy

Panel (b): Residential amenities, high-skilled



Panel (c): Employment amenities, low-skilled Panel (d): Employment amenities, high-skilled





Figure C.6: Changes in Land Use: 2031 Plan

Note: The maps show percentage changes in total land (panel a), residential land (panel b), and commercial/industrial land (panel c) in a counterfactual where the 2031 Land Use Plan was implemented compared to the benchmark economy.

Source: Authors' estimates.



Figure C.7: Binding and Nonbinding FAR Limits (Introduction of the Metro and TOD)

FAR = floor-to-area ratio, TOD = transit-oriented development.

Note: The figure shows wards where FAR limits are not binding in the BM and CF economies ("never bind"), wards where FAR limits bind in BM but do not bind in CF ("bind to non-bind"), wards where FAR limits do not bind in BM but bind in CF ("non-bind to bind"), and wards where FAR limits bind in both BM and CF ("always bind").

Source: Authors' estimates.

Appendix D Additional Results and Sensitivity Checks

Introduce metro): —	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark
Increase FAR next to stations	s: –	-	\checkmark	\checkmark	-	-	_	-
Increase FAR within the ORR	2: –	-	-	-	\checkmark	\checkmark	_	-
2031 land use plan	n: —	-	-	-	-	-	\checkmark	\checkmark
Panel A: Employr	ment, wag	ges, prio	ces, ar	nd we	lfare			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Residents, % chg		5.1	-	_	_	_	-13.9	-9.5
low-skilled		5.0	_	_	_	_	-15.2	-10.9
high-skilled		5.3	-	_	_	_	-12.4	-7.8
Shares, p.p. chg								
residents within ORR		-0.5	_	_	_	_	-3.3	-3.9
jobs within ORR		-0.6	_	_	_	_	-1.5	-2.1
residents next to stations		0.6	-	_	_	_	0.8	1.3
jobs next to stations		0.3	-	_	_	-	6.5	6.9
Wages, % chg		0.3	-	-	-	-	-2.9	-2.6
low-skilled		0.4	-	_	_	-	-4.0	-3.6
high-skilled		0.2	-	_	_	_	-2.9	-2.8
Residential floorspace prices, % chg		1.3	-	_	_	-	-3.6	-2.8
Commercial floorspace prices, % cho	g	2.7	-	-	_	_	24.2	26.4
Land prices, % chg		5.4	-	-	-	-	19.8	26.4
Welfare, % chg		1.7	_	-	_	_	-4.8	-3.2
low-skilled		1.6	-	-	_	_	-5.4	-3.8
high-skilled		1.7	-	-	—	-	-4.3	-2.7
Panel E	3: Comm	uting pa	tterns					
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean time to work, min.	21.6	23.4	_	_	_	_	22.3	24.0
Private mode use, %	60.4	59.3	_	_	_	_	60.3	59.2
Transit use, %	39.6	40.7	_	_	_	_	39.7	40.8
bus	39.6	24.9	_	_	_	_	39.7	24.4
metro	0.0	15.9	_	_	_	_	0.0	16.3
low-skilled	39.8	40.9	_	_	_	_	39.9	40.9
high-skilled	39.4	40.6	_	-	_	_	39.4	40.6

Table D.1: Aggregate Effects of the Metro and Land Use Policies (No FAR Limits)

FAR = floor-to-area ratio, ORR = outer ring road.

Note: Panel A shows the counterfactual changes in employment, wages, prices, and welfare. Panel B shows commuting patterns. Column (0) shows results for the benchmark economy. Other columns show counterfactual results. The header indicates which of the four adjustments are considered in a given counterfactual. "% chg" refers to percentage changes, and "p.p. chg" refers to percentage point changes. Values for columns (2)–(5) are missing because FAR limits are never binding and changing them will not change the effects of the metro. See the text for more details. Source: Authors' estimates.

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark
Increase FAR next to stations:	_	_	\checkmark	\checkmark	_	_	_	_
Increase FAR within the ORR:	_	_	_	_	\checkmark	\checkmark	_	_
2031 land use plan:	_	-	_	_	_	_	\checkmark	\checkmark
Panel A: Employment, wages, prices, and welfare								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Residents, % chg		7.0	7.0	15.7	6.5	14.1	-22.5	-17.2
low-skilled		6.9	5.9	14.6	5.6	13.2	-22.7	-17.3
high-skilled		7.0	8.4	17.1	7.6	15.3	-22.4	-17.2
Shares, p.p. chg								
residents within ORR		-2.3	5.4	1.7	6.5	3.6	5.8	3.8
jobs within ORR		-2.0	5.7	2.4	6.5	4.0	-3.5	-5.9
residents next to stations		1.5	3.6	5.9	-1.2	0.4	-3.5	-1.6
jobs next to stations		0.7	4.5	5.6	-0.3	0.3	6.8	7.7
Wages, % chg		0.0	3.2	3.1	2.6	2.5	-7.5	-7.4
low-skilled		0.1	2.7	2.9	2.3	2.4	-7.8	-7.4
high-skilled		-0.1	2.9	2.7	2.4	2.2	-7.4	-7.4
Residential floorspace prices, % chg		1.7	7.3	7.7	6.9	7.8	17.9	17.4
Commercial floorspace prices, % chg		3.4	-0.7	1.0	0.3	3.0	32.0	34.3
Land prices, % chg		7.0	10.4	19.3	9.3	17.0	2.8	9.9
Welfare, % chg		2.3	2.3	5.0	2.2	4.5	-8.2	-6.1
low-skilled		2.2	1.9	4.6	1.8	4.2	-8.2	-6.1
high-skilled		2.3	2.7	5.4	2.5	4.9	-8.1	-6.1
Panel	B: Cor	nmuting	patterr	ıs				
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean time to work, min.	22.7	23.4	21.8	23.5	21.9	23.6	22.0	23.5
Private mode use, %	60.4	59.3	60.3	59.2	60.4	59.3	60.2	59.2
Transit use, %	39.6	40.7	39.7	40.8	39.6	40.7	39.8	40.8
bus	39.6	24.7	39.7	24.1	39.6	24.6	39.8	24.5
metro	0.0	16.0	0.0	16.6	0.0	16.1	0.0	16.3
low-skilled	39.8	40.9	39.9	40.9	39.8	40.8	39.9	40.9
high-skilled	39.4	40.6	39.5	40.6	39.4	40.6	39.6	40.7

Table D.2: Aggregate Effects of Metro and Land Use Policies (Endogenous Amenities)

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark	
Increase FAR next to stations:	_	_	\checkmark	\checkmark	_	_	_	_	
Increase FAR within the ORR:	_	_	_	_	\checkmark	\checkmark	_	_	
2031 land use plan:	-	-	_	_	_	_	\checkmark	\checkmark	
Panel A: Employment, wages, prices, and welfare									
	-	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Residents, % chg		6.6	5.8	13.4	5.5	12.4	-18.5	-12.3	
low-skilled		6.6	4.8	12.5	4.8	11.7	-18.3	-12.1	
high-skilled		6.7	6.9	14.5	6.3	13.2	-18.7	-12.5	
Shares, p.p. chg									
residents within ORR		-1.1	2.0	0.5	2.7	1.5	-4.5	-6.0	
jobs within ORR		-1.6	4.0	1.8	4.7	3.2	-8.9	-11.0	
residents next to stations		0.7	1.7	2.7	-0.5	0.2	0.4	1.2	
jobs next to stations		0.7	3.7	4.9	-0.4	0.3	6.2	6.9	
Wages, % chg		-0.1	2.9	2.8	2.5	2.4	-7.7	-7.7	
low-skilled		0.0	2.4	2.5	2.2	2.2	-7.9	-7.7	
high-skilled		-0.1	2.8	2.6	2.4	2.2	-7.4	-7.5	
Residential floorspace prices, % chg		3.3	0.5	3.2	0.6	3.8	-12.5	-11.1	
Commercial floorspace prices, % chg		3.6	-2.7	-0.5	-2.5	0.9	29.9	33.9	
Land prices, % chg		6.6	8.8	16.6	8.1	15.1	7.9	16.2	
Welfare, % chg		2.2	1.9	4.3	1.8	4.0	-6.6	-4.3	
low-skilled		2.2	1.6	4.0	1.6	3.8	-6.5	-4.2	
high-skilled		2.2	2.2	4.6	2.1	4.2	-6.7	-4.4	
Pane	I B: Con	nmuting	patterr	าร					
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Mean time to work, min.	22.7	23.4	21.8	23.5	21.8	23.5	22.0	23.8	
Private mode use, %	60.4	58.4	60.3	58.3	60.4	58.4	60.3	58.3	
Transit use, %	39.6	41.6	39.7	41.7	39.6	41.6	39.7	41.7	
bus	39.6	24.5	39.7	24.2	39.6	24.4	39.7	24.2	
metro	0.0	17.1	0.0	17.5	0.0	17.2	0.0	17.4	
low-skilled	39.8	41.8	39.9	41.8	39.8	41.8	39.9	41.8	
high-skilled	39.4	41.5	39.5	41.5	39.4	41.5	39.4	41.5	

Table D.3: Aggregate Effects of the Metro and Land Use Policies (Extra Utility of Metro)

Introduce metro:	-	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark
Increase FAR next to stations:	-	-	\checkmark	\checkmark	-	_	_	-
Increase FAR within the ORR:	-	-	-	-	\checkmark	\checkmark	_	-
2031 land use plan:	-	-	_	-	-	_	\checkmark	\checkmark
Panel A: Emplo	yment,	wages,	prices,	and we	lfare			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Residents, % chg		0.0	0.0	0.0	0.0	0.0	0.0	0.0
low-skilled		0.0	0.0	0.0	0.0	0.0	0.0	0.0
high-skilled		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shares, p.p. chg								
residents within ORR		-0.2	2.8	2.3	3.3	2.9	-7.0	-7.1
jobs within ORR		-0.4	4.9	4.1	5.5	5.1	-11.9	-12.5
residents next to stations		0.4	1.6	2.2	-0.6	-0.1	0.8	1.0
jobs next to stations		0.5	3.7	4.4	-0.4	-0.1	6.0	6.4
Wages, % chg		0.2	3.0	3.2	2.6	2.9	-8.4	-8.2
low-skilled		0.2	2.2	2.5	2.1	2.3	-8.5	-8.2
high-skilled		0.2	3.5	3.7	3.0	3.2	-8.4	-8.1
Residential floorspace prices, % chg		-0.5	-2.7	-3.8	-2.6	-3.2	-4.1	-4.6
Commercial floorspace prices, % chg		0.4	-6.6	-7.1	-6.0	-5.7	47.1	46.5
Land prices, % chg		0.2	3.0	3.2	2.7	2.9	31.3	31.7
Welfare, % chg		2.0	2.8	5.0	2.7	4.7	-9.3	-7.5
low-skilled		1.8	2.0	4.1	2.1	4.0	-9.0	-7.3
high-skilled		2.1	3.6	6.0	3.3	5.5	-9.7	-7.7
Panel	B: Con	nmuting	patterr	IS				
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean time to work, min.	22.7	23.4	21.8	23.4	21.8	23.5	21.9	23.7
Private mode use, %	60.4	59.3	60.3	59.2	60.4	59.3	60.4	59.2
Transit use, %	39.6	40.7	39.7	40.8	39.6	40.7	39.6	40.8
bus	39.6	25.0	39.7	24.7	39.6	24.9	39.6	24.8
metro	0.0	15.8	0.0	16.1	0.0	15.8	0.0	16.0
low-skilled	39.8	40.9	39.9	40.9	39.8	40.8	39.9	40.9
high-skilled	39.4	40.6	39.5	40.6	39.4	40.6	39.4	40.6

Table D.4: Aggregate Effects of the Metro and Land Use Policies (No Migration)

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark
Increase FAR next to stations:	_	_	\checkmark	\checkmark	_	_	_	_
Increase FAR within the ORR:	_	_	_	_	\checkmark	\checkmark	_	_
2031 land use plan:	_	-	_	_	_	_	\checkmark	\checkmark
Panel A: Employ	yment,	wages,	prices,	and we	lfare			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Residents, % chg		3.4	5.3	9.4	5.2	8.8	-18.9	-15.8
low-skilled		3.3	4.7	8.6	4.7	8.2	-18.4	-15.5
high-skilled		3.5	6.1	10.2	5.8	9.4	-19.4	-16.2
Shares, p.p. chg								
residents within ORR		-0.5	1.9	1.0	2.4	1.8	-5.1	-5.7
jobs within ORR		-0.6	2.8	1.7	3.3	2.7	-10.2	-11.0
residents next to stations		0.4	1.6	2.1	-0.5	-0.1	1.0	1.1
jobs next to stations		0.2	2.7	3.3	-0.3	-0.1	5.1	5.3
Wages, % chg		-0.3	2.2	1.9	2.0	1.7	-9.4	-9.7
low-skilled		-0.3	1.8	1.7	1.8	1.5	-9.6	-9.8
high-skilled		-0.4	2.1	1.7	1.9	1.5	-9.0	-9.4
Residential floorspace prices, % chg		1.5	-0.6	0.5	-0.4	1.0	-16.6	-15.8
Commercial floorspace prices, % chg		2.2	-5.7	-4.5	-5.6	-3.5	47.8	51.0
Land prices, % chg		3.1	7.6	11.5	7.3	10.6	5.4	9.1
Welfare, % chg		1.1	1.8	3.1	1.7	2.9	-6.8	-5.6
low-skilled		1.1	1.5	2.8	1.6	2.7	-6.6	-5.4
high-skilled		1.2	2.0	3.3	1.9	3.1	-6.9	-5.7
Panel	B: Con	nmuting	patterr	IS				
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean time to work, min.	22.7	23.3	21.7	23.4	21.7	23.4	21.6	23.4
Private mode use, %	60.4	59.3	60.3	59.2	60.4	59.3	60.4	59.2
Transit use, %	39.6	40.7	39.7	40.8	39.6	40.7	39.6	40.8
bus	39.6	25.1	39.7	24.8	39.6	25.1	39.6	24.9
metro	0.0	15.7	0.0	15.9	0.0	15.7	0.0	15.9
low-skilled	39.8	40.9	39.9	40.9	39.8	40.9	39.9	40.9
high-skilled	39.4	40.6	39.4	40.6	39.4	40.6	39.3	40.6

Table D.5: Aggregate Effects of the Metro and Land Use Policies (Fixed Productivity)

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark		
Increase FAR next to stations:	_	-	\checkmark	\checkmark	_	_	_	_		
Increase FAR within the ORR:	_	-	_	_	\checkmark	\checkmark	_	_		
2031 land use plan:	-	-	_	_	-	_	\checkmark	\checkmark		
Panel A: Emplo	yment,	wages,	prices,	and we	lfare					
		(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Residents, % chg		4.1	5.7	10.5	5.4	9.7	-18.4	-14.6		
low-skilled		4.0	4.5	9.3	4.6	8.8	-18.2	-14.2		
high-skilled		4.1	7.1	11.9	6.4	10.7	-18.8	-15.0		
Shares, p.p. chg										
residents within ORR		-0.7	2.0	1.0	2.7	1.9	-4.5	-5.5		
jobs within ORR		-1.0	4.0	2.4	4.7	3.7	-8.9	-10.4		
residents next to stations		0.5	1.7	2.5	-0.5	0.0	0.4	0.9		
jobs next to stations		0.5	3.7	4.7	-0.4	0.0	6.2	6.6		
Wages, % chg		0.0	3.0	3.0	2.6	2.6	-7.7	-7.6		
low-skilled		0.1	2.3	2.5	2.1	2.3	-7.9	-7.6		
high-skilled		-0.1	2.8	2.8	2.4	2.4	-7.4	-7.5		
Residential floorspace prices, % chg		1.9	0.5	2.0	0.6	2.5	-12.5	-11.9		
Commercial floorspace prices, % chg		2.8	-2.8	-1.4	-2.6	0.0	29.9	32.8		
Land prices, % chg		4.1	8.8	13.8	8.1	12.5	7.9	13.2		
Welfare, % chg		1.3	1.9	3.4	1.8	3.2	-6.6	-5.1		
low-skilled		1.3	1.5	3.0	1.5	2.9	-6.5	-5.0		
high-skilled		1.4	2.3	3.8	2.1	3.5	-6.7	-5.3		
Panel	Panel B: Commuting patterns									
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Mean time to work, min.	22.7	23.4	21.8	23.4	21.8	23.5	22.0	23.7		
Private mode use, %	60.4	59.3	60.3	59.2	60.4	59.3	60.3	59.2		
Transit use, %	39.6	40.7	39.7	40.8	39.6	40.7	39.7	40.8		
bus	39.6	25.0	39.7	24.7	39.6	25.0	39.7	24.7		
metro	0.0	15.7	0.0	16.1	0.0	15.8	0.0	16.0		
low-skilled	39.8	40.9	39.9	40.9	39.8	40.9	39.9	40.9		
high-skilled	39.4	40.6	39.5	40.6	39.4	40.6	39.4	40.6		

Table D.6: Aggregate Effects of the Metro and Land Use Policies (Lower Skill Substitution)

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark	
Increase FAR next to stations:	_	_	\checkmark	\checkmark	_	-	_	_	
Increase FAR within the ORR:	_	-	_	_	\checkmark	\checkmark	_	_	
2031 land use plan:	-	-	-	-	_	_	\checkmark	\checkmark	
Panel A: Emplo	yment,	wages,	prices,	and we	lfare				
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Residents, % chg		6.7	6.3	14.0	6.1	13.1	-20.8	-15.2	
low-skilled		6.9	5.6	13.6	5.6	12.8	-20.7	-14.9	
high-skilled		6.4	7.2	14.4	6.7	13.3	-20.8	-15.6	
Shares, p.p. chg									
residents within ORR		-1.0	1.1	-0.2	1.6	0.6	-2.7	-3.7	
jobs within ORR		-1.5	2.5	0.5	3.0	1.5	-6.4	-8.1	
residents next to stations		0.5	1.3	2.0	-0.3	0.2	0.2	1.0	
jobs next to stations		0.4	2.5	3.2	-0.2	0.1	4.9	5.3	
Wages, % chg		-0.2	2.7	2.6	2.5	2.2	-8.8	-9.0	
low-skilled		-0.1	2.3	2.4	2.2	2.1	-9.1	-9.1	
high-skilled		-0.2	2.6	2.5	2.4	2.2	-8.5	-8.7	
Residential floorspace prices, % chg		3.2	-0.6	2.3	-0.3	2.9	-14.0	-11.8	
Commercial floorspace prices, % chg		3.1	-4.7	-2.5	-4.7	-1.7	54.6	59.1	
Land prices, % chg		6.5	9.2	16.9	8.7	15.5	3.4	10.3	
Welfare, % chg		2.2	2.1	4.5	2.0	4.2	-7.5	-5.4	
low-skilled		2.3	1.8	4.3	1.8	4.1	-7.4	-5.2	
high-skilled		2.1	2.3	4.6	2.2	4.3	-7.5	-5.5	
Panel B: Commuting patterns									
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Mean time to work, min.	33.8	33.5	31.8	33.4	31.9	33.4	32.0	33.6	
Private mode use, %	60.4	58.3	60.3	58.2	60.3	58.3	60.3	58.2	
Transit use, %	39.6	41.7	39.7	41.8	39.7	41.7	39.7	41.8	
bus	39.6	20.5	39.7	20.4	39.7	20.6	39.7	20.4	
metro	0.0	21.2	0.0	21.4	0.0	21.2	0.0	21.4	
low-skilled	39.6	41.8	39.7	41.8	39.7	41.8	39.6	41.8	
high-skilled	39.6	41.7	39.8	41.8	39.7	41.7	39.7	41.7	

Table D.7: Aggregate Effects of the Metro and Land Use Policies (Lower ϵ)

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark	
Increase FAR next to stations:	_	-	\checkmark	\checkmark	_	_	_	_	
Increase FAR within the ORR:	_	-	_	_	\checkmark	\checkmark	_	_	
2031 land use plan:	-	_	_	_	_	_	\checkmark	\checkmark	
Panel A: Employ	/ment,	wages,	prices,	and we	lfare				
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Residents, % chg		3.8	5.8	10.3	5.5	9.5	-18.5	-14.8	
low-skilled		3.7	4.8	9.3	4.8	8.7	-18.3	-14.7	
high-skilled		4.0	6.9	11.5	6.3	10.4	-18.7	-15.0	
Shares, p.p. chg									
residents within ORR		-0.6	2.0	1.1	2.7	2.0	-4.5	-5.4	
jobs within ORR		-0.9	4.0	2.5	4.7	3.8	-9.0	-10.3	
residents next to stations		0.5	1.7	2.4	-0.5	0.0	0.4	0.8	
jobs next to stations		0.4	3.7	4.7	-0.4	0.0	6.2	6.6	
Wages, % chg		0.0	2.9	3.0	2.5	2.5	-7.7	-7.6	
low-skilled		0.1	2.4	2.6	2.2	2.3	-7.9	-7.7	
high-skilled		0.0	2.8	2.8	2.4	2.3	-7.4	-7.4	
Residential floorspace prices, % chg		1.9	0.5	2.0	0.6	2.5	-12.4	-11.8	
Commercial floorspace prices, % chg		2.6	-2.7	-1.5	-2.5	0.0	29.9	32.6	
Land prices, % chg		3.9	8.8	13.6	8.1	12.3	7.9	12.9	
Welfare, % chg		1.3	1.9	3.4	1.8	3.1	-6.6	-5.2	
low-skilled		1.2	1.6	3.0	1.6	2.8	-6.5	-5.1	
high-skilled		1.3	2.2	3.7	2.1	3.4	-6.7	-5.3	
Panel B: Commuting patterns									
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Mean time to work, min.	22.5	23.2	21.6	23.3	21.7	23.3	21.9	23.6	
Private mode use, %	60.4	58.5	60.3	58.4	60.4	58.5	60.3	58.4	
Transit use, %	39.6	41.5	39.7	41.6	39.6	41.5	39.7	41.6	
bus	39.6	25.7	39.7	25.4	39.6	25.6	39.7	25.4	
metro	0.0	15.8	0.0	16.2	0.0	15.9	0.0	16.1	
low-skilled	40.0	41.7	40.0	41.8	39.9	41.7	40.0	41.8	
high-skilled	39.2	41.2	39.4	41.3	39.3	41.2	39.2	41.3	

Table D.8: Aggregate Effects of the Metro and Land Use Policies (Higher σ)

Table D.9: Aggregate Effects of the Metro and Land Use Policies (Lower Housing Sup	ply
Elasticity)	

Introduce metro:	_	\checkmark	_	\checkmark	_	\checkmark	_	\checkmark	
Increase FAR next to stations:	-	-	\checkmark	\checkmark	-	-	-	_	
Increase FAR within the ORR:	-	-	-	-	\checkmark	\checkmark	-	_	
2031 land use plan:	-	-	_	-	_	_	\checkmark	\checkmark	
Panel A: Employment, wages, prices, and welfare									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Residents, % chg		3.8	5.4	10.1	5.4	9.4	-19.1	-15.9	
low-skilled		3.7	4.5	9.0	4.7	8.5	-19.1	-16.0	
high-skilled		3.9	6.6	11.4	6.3	10.4	-19.1	-15.8	
Shares, p.p. chg									
residents within ORR		-0.5	2.0	1.2	2.5	1.9	-4.9	-5.6	
jobs within ORR		-0.8	3.6	2.3	4.3	3.6	-7.5	-8.4	
residents next to stations		0.4	1.5	2.2	-0.5	-0.1	0.6	1.1	
jobs next to stations		0.4	3.5	4.5	-0.4	-0.1	6.4	6.8	
Wages, % chg		0.0	2.8	3.0	2.6	2.5	-8.4	-8.4	
low-skilled		0.0	2.3	2.6	2.2	2.2	-8.8	-8.6	
high-skilled		-0.1	2.7	2.7	2.4	2.3	-8.1	-8.2	
Residential floorspace prices, % chg		2.1	0.7	2.6	0.7	2.8	-15.9	-14.7	
Commercial floorspace prices, % chg		3.0	-2.3	-1.2	-2.4	0.4	37.5	40.7	
Land prices, % chg		3.7	8.4	13.3	8.1	12.1	6.3	10.6	
Welfare, % chg		1.2	1.8	3.3	1.8	3.1	-6.8	-5.6	
low-skilled		1.2	1.5	2.9	1.5	2.8	-6.8	-5.6	
high-skilled		1.3	2.2	3.7	2.1	3.3	-6.8	-5.6	
Pane	Panel B: Commuting patterns								
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Mean time to work, min.	22.7	23.3	21.8	23.4	21.8	23.4	22.1	23.8	
Private mode use, %	60.4	59.3	60.3	59.2	60.4	59.3	60.4	59.2	
Transit use, %	39.6	40.7	39.7	40.8	39.6	40.7	39.6	40.8	
bus	39.6	25.0	39.7	24.7	39.6	25.0	39.6	24.7	
metro	0.0	15.7	0.0	16.1	0.0	15.7	0.0	16.1	
low-skilled	39.8	40.9	39.9	40.9	39.8	40.9	39.9	40.9	
high-skilled	39.4	40.6	39.5	40.6	39.4	40.6	39.4	40.6	