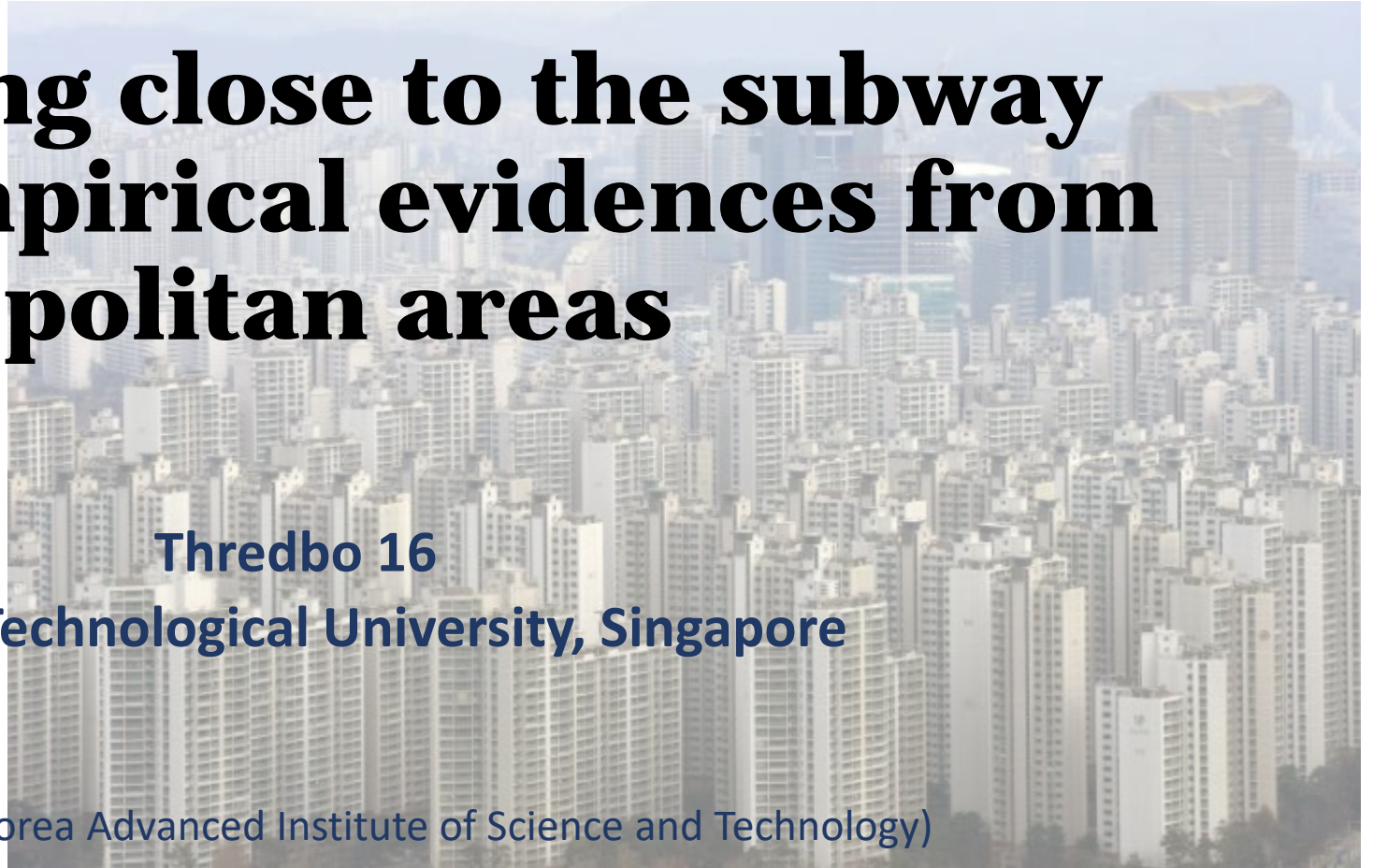




Benefit of being close to the subway networks? Empirical evidences from Korean metropolitan areas



Thredbo 16

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Public transportation in a metropolitan area

- Public transportation

- : shared passenger transport services available for use by the general public

- : crucial element for the development and growth of a metropolitan area

- : a social tool that would benefit the disadvantaged groups or minorities



Condominiums in Korea

- Condominiums

- : the most dominant housing type in Korea

- : multiple attached units in a multiple story building and usually built in multi-block complexes

- : separate ownership of each unit

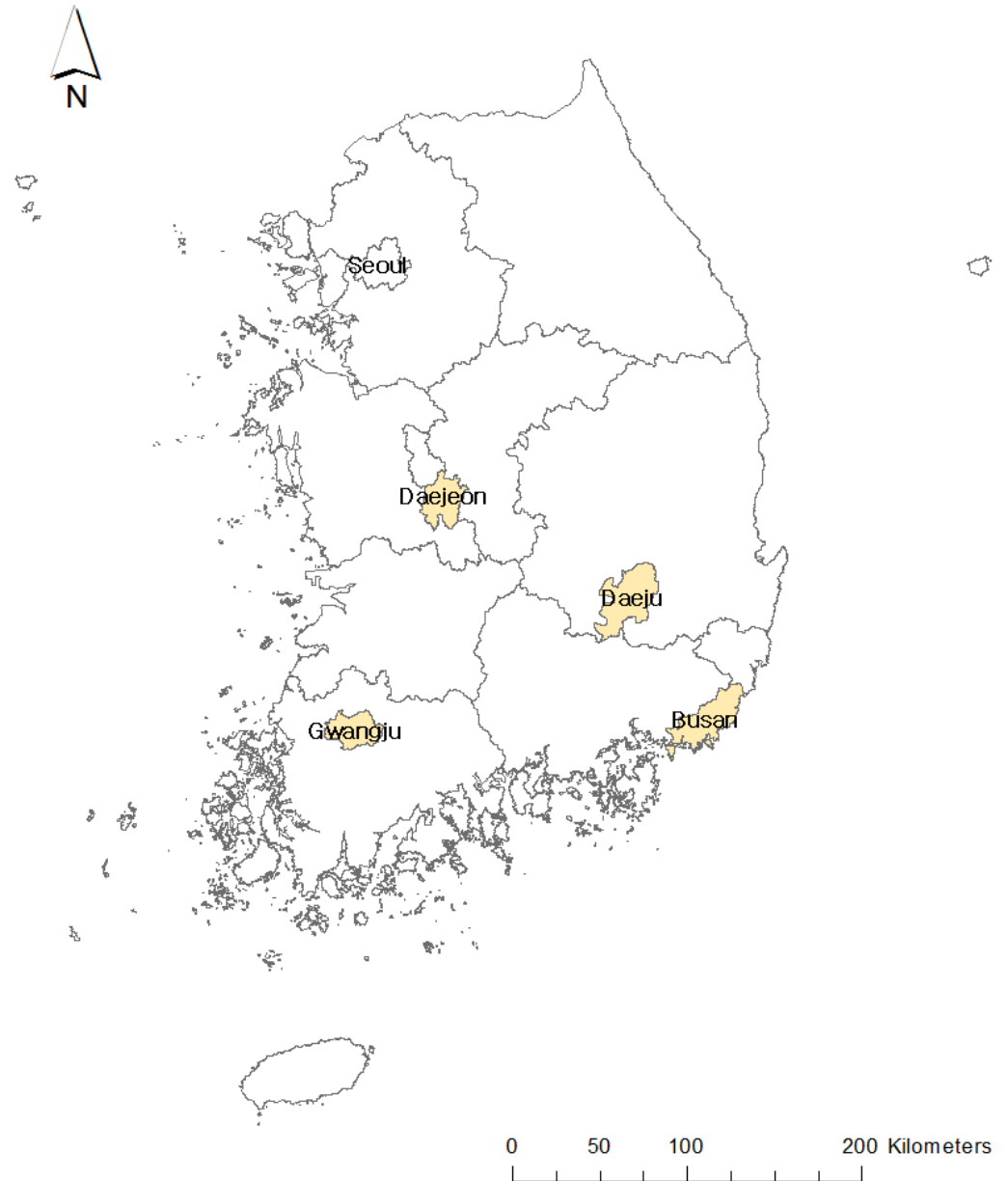


This research

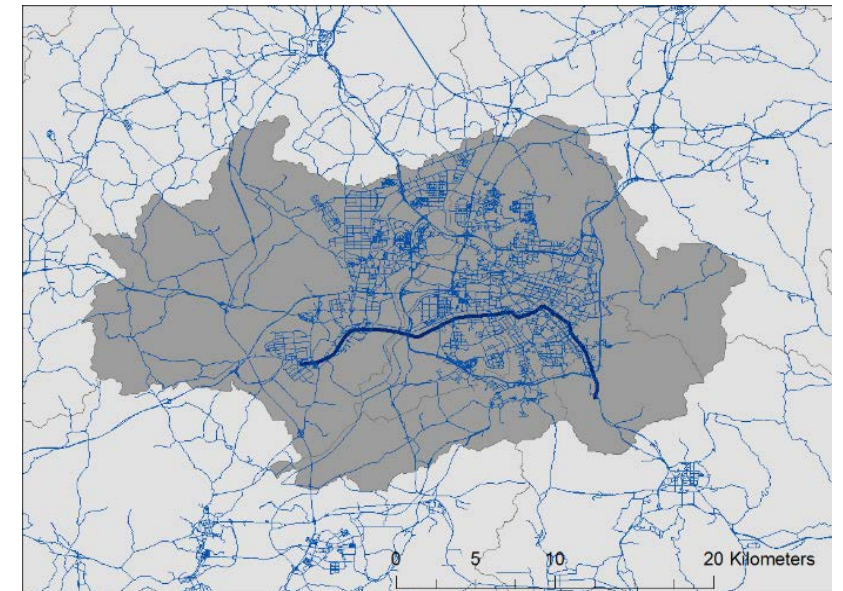
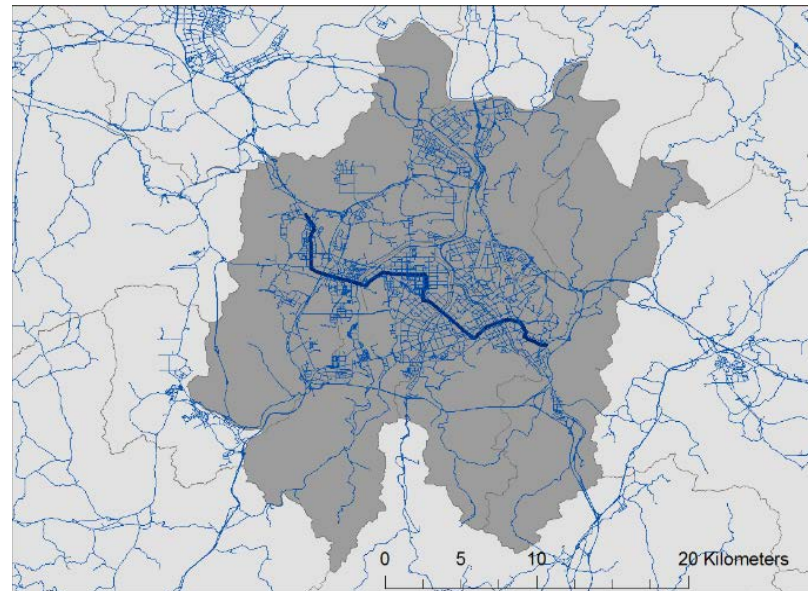
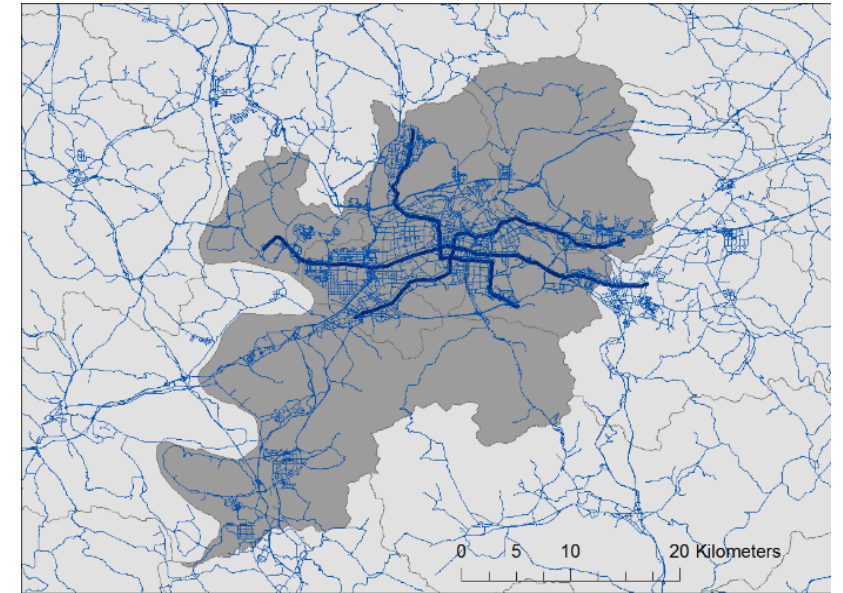
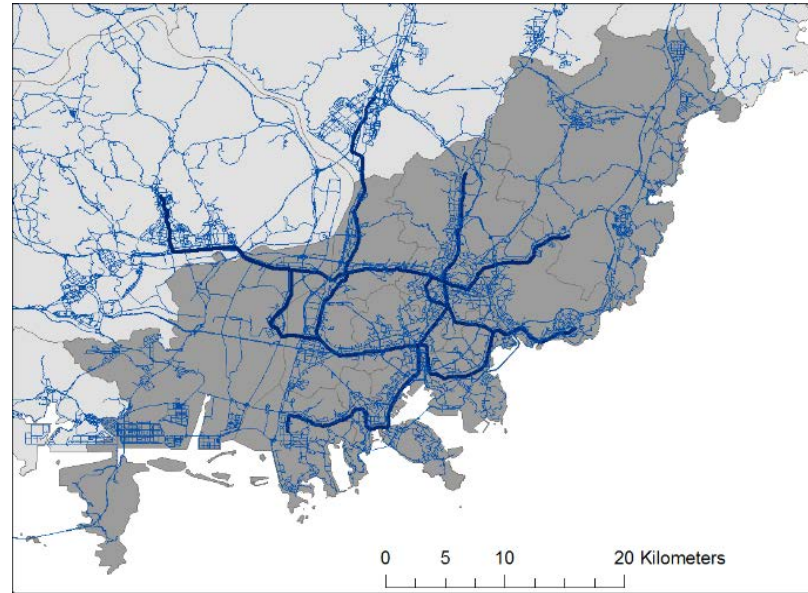
- Focuses on the economic impacts of subway network
 - Larger investment than local bus
 - Longer and higher impacts on local landscape and economy
 - Further, local buses cover most of the urbanized areas in Korean metropolitan areas
- Focuses on the apartment transaction prices
 - Apartment (or condominium) is the single most dominant housing type in Korea
 - Reliable official data available
- Focuses on metropolitan areas far out of Seoul
 - Lack of evidence

 **Economic impacts of the convenient access to subway stations**

Case study



Case study



Road and subway networks in
the case study areas
(clockwise: Busan, Daegu, Gwangju,
Daejeon)

Case study: subway

Current subway systems and modal shares in selected metropolitan areas of Korea (2015)

	Subway		Mode share				
	Operation begins	Total length	Bus	Subway	Private car/van	Taxi	Others
Busan	1985	132 km	25.9	17.8	32.7	12	11.6
Deagu	1997	81 km	21.5	7.9	49.3	11.2	10.1
Deajeon	2006	23 km	24.6	4.0	56.5	9.2	5.7
Gwangju	2004	20 km	35.0	3.3	40.3	13.8	7.6
Seoul	1974	332 km	27.4	38.2	23.1	6.9	4.4
Korea	-	-	25.9	3.0	53.6	10.4	8.0

Case study: price data

Condominium transaction and demographic characteristics of case study sites (2015)

	Average transaction price (1,000 won)	Average transaction price per 1 m ² (won)	Number of transactions	Population	Population density (persons/km ²)	Number of households
Busan	243,017	3,000,177	62,780	3,448,737	4,484	1,348,315
Daegu	259,678	3,184,114	32,672	2,466,052	2,794	937,574
Daejeon	195,547	2,559,106	21,211	1,538,394	2,748	588,395
Gwangju	170,078	2,277,243	26,024	1,502,881	3,005	573,181
All	226,472	2,844,875	142,687	8,956,064	3,303	3,447,465

Our approaches: model

The Basic idea

price per square meters
 $= f(\text{Housing properties, Local amenities, Local demographic characteristics, sales season})$

Hedonic model

$$\ln p_i = \alpha_0 + \sum_{k=1}^K x_{ki} \beta_k + \sum_{l=1}^3 Q_{li} \theta_l + e_i$$

where the logarithm of the individual house i 's per-square-meter price p_i is a function of a number of variables, namely k as well as the seasonal sale dummy variable (e.g., spring, fall, winter), Q_{li} . The error term, e_i , accounts for unknown effects of potentially omitted variables.

Spatial lag regression

$$y = \rho W y + X \beta + \epsilon \quad \Rightarrow \quad (I - \rho W) y = X \beta + \epsilon.$$

where y is an $n \times 1$ vector of house price in each site; W is an $n \times n$ spatial weights matrix, which is typically used in the row-standardized form; ρ is the spatial autoregressive parameter; X is an $n \times k$ matrix of the observations of the exogenous hedonic variables, with an associated $k \times 1$ vector of hedonic characteristics coefficients β ; and ϵ is a vector of i.i.d. error, which is assumed to be normally distributed, homoscedastic, and independent across observations.

Our approaches: variables

Type		Variables
Housing properties	Unit related	Size of unit, Floor
	Complex related	Number of households, Number of condominium buildings, Parking space per household, Highest floor, Construction year, Heating type ^d
Local amenities	Transit related	Network distance to nearest subway station, Crow-fly distance to nearest subway station, Number of bus stops ¹
	Others	Network distance to nearest waterfront ² , Network distance to nearest greenspace ³ , Network distance to CBD, Number of top university entrants ⁴ , Number of high schools ⁵
Local demographic characteristics		Population, Population density, Ratio of adults with higher degrees ⁶ , Young population ratio ⁷ , Old population ratio ⁸ , Medium age, Sex ratio
Control of sales period		Spring ^d , Fall ^d , Winter ^d

^d Dummy variable: city gas 0, others 1

¹ Number of bus stops within 400 m radius from the condominium

² Network distance to the nearest river, stream, pond, or seashore

³ Network distance to the nearest park, hill, or mountain

⁴ Number of Seoul National University entrants from the high schools within 5 km radius

⁵ Number of high schools within 5 km radius

⁶ Number of people with higher degrees/number of population aged 15 years old or over

⁷ Number of population aged less than 15 years old/ total population

⁸ Number of population aged 65 years old or over/ total population

Analysis results

	Busan		Daegu		Daejeon		Gwangju	
	n=62,780		n=32,672		n=21,211		n=26,024	
	OLS	Spatial lag	OLS	Spatial lag	OLS	Spatial lag	OLS	Spatial lag
Housing characteristics								
Area	-0.002 [‡]	-0.002 [‡]	-0.002 [‡]	-0.002 [‡]	-0.002 [‡]	-0.002 [‡]	-0.001 [‡]	-0.001 [‡]
Floor	0.005 [‡]	0.005 [‡]	0.004 [‡]	0.005 [‡]	0.004 [‡]	0.004 [‡]	0.004 [‡]	0.004 [‡]
Year	0.011 [‡]	0.011 [‡]	0.013 [‡]	0.013 [‡]	0.019 [‡]	0.018 [‡]	0.017 [‡]	0.017 [‡]
Households	5.4E-05 [‡]	5.4E-05 [‡]	5.9E-05 [‡]	6.0E-05 [‡]	7.0E-05 [‡]	7.1E-05 [‡]	1.2E-04 [‡]	1.1E-04 [‡]
Parking	0.168 [‡]	0.168 [‡]	0.051 [‡]	0.050 [‡]	0.098 [‡]	0.094 [‡]	0.179 [‡]	0.180 [‡]
Heating	-0.009 [‡]	-0.007 [‡]	0.009 [‡]	0.010 [‡]	-0.071 [‡]	-0.047 [‡]	-0.051 [‡]	-0.047 [‡]
Local amenities								
Dist. Subway	-0.016 [‡]	-0.016 [‡]	-0.008 [‡]	-0.006 [‡]	-0.025 [‡]	-0.016 [‡]	0.038 [‡]	0.036 [‡]
Bus stops	5.8E-4 [‡]	5.7E-4 [‡]	-4.1E-4 [‡]	-9.2E-4 [‡]	1.6E-3 [‡]	1.8E-3 [‡]	-3.7E-3 [‡]	-3.8E-3 [‡]
Dist. CBD	-1.0E-5 [‡]	-1.0E-5 [‡]	-1.0E-6 [‡]	-1.0E-6 [‡]	-1.4E-5 [‡]	-1.2E-5 [‡]	-3.0E-6 [‡]	-2.9E-6 [‡]
Top. Uni.	-0.006 [‡]	-0.006 [‡]	0.006 [‡]	0.006 [‡]	-1.5E-3 [‡]	-8.9E-4 [‡]	-0.006 [‡]	-0.005 [‡]
Dist. Green	0.030 [‡]	0.031 [‡]	0.012 [‡]	0.011 [‡]	0.018 [‡]	0.020 [‡]	0.030 [‡]	0.030 [‡]
Dist. Water	-0.020 [‡]	-0.020 [‡]	0.013 [‡]	0.013 [‡]	0.010 [‡]	0.022 [‡]	0.021 [‡]	0.022 [‡]
Local demographic characteristics								
Pop. Density	2.0E-6 [‡]	2.0E-6 [‡]	3.0E-6 [‡]	3.0E-6 [‡]	-1.0E-6 [‡]	-7.5E-7 [‡]	4.0E-6 [‡]	4.1E-6 [‡]
Higher degree	0.011 [‡]	0.011 [‡]	0.013 [‡]	0.013 [‡]	0.006 [‡]	0.004 [‡]	0.010 [‡]	0.009 [‡]
Season control								
Spring	-0.030 [‡]	-.0.30 [‡]	-0.050 [‡]	-0.051 [‡]	-0.012 [‡]	-0.011 [‡]	-0.046 [‡]	-0.046 [‡]
Fall	0.021 [‡]	0.022 [‡]	0.015 [‡]	0.015 [‡]	0.006	0.005	-0.007 [*]	-0.006
Winter	-0.026 [‡]	-0.026 [‡]	-0.078 [‡]	-0.078 [‡]	0.004	0.003	-0.051 [‡]	-0.050 [‡]
Constant	-7.818 [‡]	-8.146 [‡]	-11.951 [‡]	-12.374 [‡]	-23.840 [‡]	-25.319 [‡]	-21.094 [‡]	-21.383 [‡]
F-value	6760 [‡]	6620 [‡]	2780 [‡]	2710 [‡]	1960 [‡]	1660 [‡]	1920 [‡]	1870 [‡]
Adjusted R ²	0.658	0.654	0.599	0.593	0.623	0.583	0.566	0.559

Things to think about

- Our key variable 'Distance to the nearest subway station'

: ***significant and negative in all cities except Gwangju***

→ positive monetary effects of subway accessibility after controlling for other aspects, *in general*

→ Gwangju as a special case which has low subway dependency with poorly designed subway lane

⇒ **House prices near subway networks cannot be generalized.**

Things to think about

- Unexpected signs with statistical significance
: *top university entrants*

→ Educational environment is not important?

No, but **school assignment system** based on student preferences and introduction of **highschools for gifted students** may explain.



Things to think about

- Unexpected signs with statistical significance

: ***distance to green space, distance to waterfront***

→ “**Green**” in our analysis means “not urbanized but with some plants” so it can be parks, mountains, or farms.

→ Busan’s waterfront was the only exception. Seashore is financially valued but not other types of waterfront after controlling other factors.

Many thanks and...



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