

Supplementary Material

S1. Zoning

The **modifiable areal unit problem** is typical for urban studies using spatial data and may affect the generalizability of findings (Hu & Wang, 2016). In this study, we adopted a uniform grid system (Zhou & Long, 2016), rather than administrative units, **for** the following reasons: (1) the consistent shape and size of grid cells **render** them more statistically comparable, especially for the diversity measures; (2) grid cells do not change over time **and enable** statistical time series, **which is** especially **useful for analyzing** rapidly developing areas **such as** China; **and** (3) grid data can, if needed, be further aggregated into administrative units. **The** Klasovsky 1940 Albers **projection** was selected as the coordinate system for the **grids** to ensure that each grid has the same area.

Table S1. Descriptive statistics for the candidate explanatory variables for modeling urban vibrancy

Candidate Explanatory Variables	Minimum	Mean	Maximum	Std. Deviation
Building density	0.00	0.04	0.66	0.06
Density of urban functions	0.00	0.02	0.13	0.02
Mean building height	2.00	10.59	44.00	5.72
Diversity of urban functions	0.56	1.87	2.32	0.29
Diversity of building height	957	10693	69984	8325
Diversity of building age	0.24	5.29	33.15	4.48
Diversity of house prices	0.11	5.03	37.52	3.85
Mean house price	11530	46371	158006	19070
Mean building age	2.00	27.97	131.00	19.44
Density of road junctions	3.00	49.69	187.00	29.85
Accessibility by public transportation	0.00	23.59	112.00	19.22
Distance to city center	306	7708	18390	3963

* N=741 (grid cells with less than 5 data records were excluded)

Table S2. A survey of the results of quantitative studies on urban vibrancy and UBEs

UBE indicators	De Nadai <i>et al.</i> (2016)	Yue <i>et al.</i> (2017)	Long and Huang (2017)
POI density	Significant	Not significant	0.052*
POI diversity	Not significant	Significant ¹	0.110*
Intersection density	0.191*	N/A	0.266*
Height of buildings	0.185*		N/A
Aging buildings	Not significant		N/A
Locational factor	Proximity to highway	N/A	Access to transit
Other significant UBE indicators	3 rd places ³	N/A	Amenities
Other significant factors	Employment density	Demographics	City-level attributes
Study area	Italian Cities	Chinese cities	
Measure of vibrancy	Mobile phone data	Mobile phone data	Economic vitality: Dianping reviews

* $p < 0.005$

¹ Yue *et al.* (2017) included unstandardized coefficients in the manuscript; thus, the actual number is not listed here.