EXPLORING DOCKLESS BIKESHARE USAGE:
A Case Study of Beijing, China

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ABSTRACT

The rapid emergence of dockless bikeshare systems has had a considerable influence on individuals' daily mobility patterns. However, information is still limited regarding the role that sociodemographics, social environments, travel attitudes and the built environment play on the adoption and usage of dockless bikeshare systems.

The puspose is: **to assess whether and to what extent sociodemographics, social environments, travel attitudes and the built environment influence individuals' initial adoption and frequency of dockless bikeshare usage for work or education commuting, sports and leisure, grocery shopping, and recreational activities.**

The results of this study reveal that 1) dockless bikeshare systems appear to be gender-independent; 2) the total length of cycling roads does not influence dockless bikeshare adoption; 3) pro-bicycle attitudes play a positive role in adopting dockless bikeshare initially; 4) pro-bicycle attitudes are less important in determining users' frequency of usage.

DATA

Research subjects: residents of Beijing who are above 16 years old

Data Collection:

1) Spatial data on built environment:

- Land use dataset of China including the Points-of-Interest (POIs) and road networks from the OpenStreetMap (OSM) updated in September 2018
- Public transit dataset of Beijing in November 2017 compiled by Urban Data Party (www.udparty.com)

2) Online dockless bikeshare usage survey:

- The data collection process was completed between August 7, 2018 and November 31, 2018. This period gives us sufficient variety across weather conditions.
- 606 usable surveys collected.

SUMMARY STATISTICS

Gender:
Female 51%
Male 49%

Age categories:
16-30 years old 59.9%
31-45 years old 32.7%
46-64 years old 7.4%

Car access:
Yes 72.1%

Self-reported health:
Fair and below 37.5%
Good 34.7%
Very good and above 27.9%

Dockless bikeshare usage:
Users 80.7%
Nousers 19.3%

Education:
High school/Secondary technical school and below 5%
University/College Bachelors' degree 72%
Master's degree and above 23%

Hosehold income:
Low income 31%
Median income 36%
High income 33%

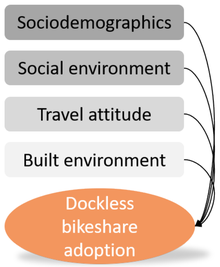
Employment:
Full time employment 73%
Part-time employment, students, etc. 27%

Dockless bikeshare usage purposes among users:

- Work or education commuting: 72.4%
- Sports and leisure: 46.6%
- Grocery shopping: 51.1%
- Recreational activities: 53.8%

APPROACH

Binary logistic regression



Hurdle Negative Binominal Models: to assess the frequencies of travel with dockless shared bikes for four different daily trip purposes

PCA: Travel Attitude
Pro-car; pro-ebikes/escooters; pro-public transportation; pro-bicycles; pro-walking; pro-environment/health; anti-public transportation; anti-travelling

DESCRIPTIVE RESULTS

- Dockless bikeshare systems are largely used for work or education commuting by our respondents.
- The average cycling frequency for commuting is **5.4 trips** per week, **4 times** higher than for other purposes.
- Users with a low education level use dockless shared bikes an average of **8 times for commuting and 4 times for recreational activities** per week, while users with a Masters' degree or higher only use them **4.8 times for commuting and 2.2 times for recreational activities** per week on average.

MODELLING RESULTS

Model 1: Binary logistic regression

The adoption of dockless bikeshare systems	Model 1 OR	
(Intercept)	**0.005**	***
Age	**0.950**	**
Education (ref=high school equivalent and below)		
University/college Bachelors' degree	**5.173**	**
Masters' degree and above	**4.464**	*
Household income (ref=low income)		
Median income	**2.092**	*
High income	1.471	
Employment (ref=part-time employment, students, etc.)		
Full-time employment	**3.590**	***
Social environment	**3.218**	***
Travel attitude		
Pro-public transportation	**1.300**	.
Pro-bicycles	**2.729**	***
Pro-walking	**0.746**	*
Spatial variables		
Design		
The length of all roads in the neighborhood (km)	**1.111**	**
The length of bicycle roads in the neighborhood (km)	0.938	
Distance to transit		
Distance to closest bus stop (km)	**0.397**	*
Distance to closest subway stop (km)	**0.948**	*
Signif code: '***'P<0.001, '**'p<0.01, '*'p<0.05 '.'p<0.1	N=606	
	McFadden R^2=0.381	
	Nagelkerke R^2=0.499	
	ROC=0.897	

Model 2: Hurdle negative binominal models for various purposes

	Model 2.1: Work or education commuting		Model 2.2: Sports and leisure	
	Count	Zero	Count	Zero
(Intercept)	**0.765** .	-1.227	**-1.198** *	**-3.197** **
Age	-0.001	**-0.036** *	0.002	-0.017
Education				
University/college Bachelors' degree	**-0.291** .	-0.348	-0.124	**1.338** *
Masters' degree and above	**-0.528** **	-0.385	-0.411	**1.103** .
Employment				
Full-time employment	**-0.235** *	0.184	-0.202	**0.659** *
Car ownership (yes)	0.061	0.373	**0.296** *	**0.523** *
Social environment	**0.302** ***	**0.805** ***	**0.444** ***	**0.531** **
Travel attitude				
Pro-car	**-0.134** ***	**-0.287** *	-0.022	0.099
Pro-e-bikes/e-scooters	-0.001	**0.246** *	0.065	0.001
Pro-bicycles	**0.120** *	0.188	0.020	0.187
Pro-environment/health	-0.031	**0.221** .	-0.018	**0.274** *
Anti-travelling	**-0.062** .	-0.039	**-0.123** *	**-0.262** *
Spatial variables				
Number of grocery stores	**0.039** *	-0.015		
Distance to closest bus stop	-0.129	-0.059	-0.168	-0.486
Distance to closest subway stop	**-0.016** *	**-0.034** .	**-0.026** .	-0.004
Log(theta)	**1.553** ***		**2.346** ***	
N of cases	489		489	
AIC	2320.88		1644.77	

Sociodemographics

- Youger and higher educationed individuals and those with a median income have higher odds to adopt dockless bikeshare systems.
- Higher educatied and full-time employed users tend to use dockless bikeshare less often for commuting, but they have a higer likelihood to use bikeshare for sports and leisure.
- Social environment displays a strong positive association in both models.

Travel attitude

- Having a pro-bicycle attitude is strongly associated with higher odds to be a user.
- Users with a pro-car attitide are less likely to use dockless bikeshare for commuting and also use them less often.
- Having a pro-environment/health attitude tends to have possitive association with frequent usage.

Built environment

- A higher total length of all roads within the residential neihgborhood is associated with higher odds to adopt dockless bikeshare.
- Greater distance to transit is associated with lower odds of being a dockless bikeshare user.
- Higher distance to subway station is associated with a lower use frequency for work or education commuting & sports and leisure.

CONCLUSION

Membership vs. use frequency:

- A preference for bicycles can be a good intention to become a dockless bikeshare user, but to become loyal to using the systems requries **higher commitment**.

Usage for different purposes:

- Sociodemogrpahics, social environment, travel attitude and built environment assiciate with dockless bikeshare usage differnetltly **according to travel puroposes**.
- **Grocery shopping** is least likely associatted with all explannatory variables.

Future studies should:

- Incorporate spatial data of GPS trajectories.
- Investigate travel satisifaction of this mode to help ecouraging the adoption and usage.

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