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Bike share in Fargo, North Dakota: Keys to success and factors affecting ridership

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ABSTRACT

The growing popularity of bike share programs in the United States has prompted many cities to implement bike share systems to enhance mobility and health in their communities. While many of these programs have been introduced in large cities, and existing research has tended to focus on these large systems, bike share programs are becoming increasingly popular in smaller cities as well. Great Rides Bike Share launched with 11 stations and 101 bikes in 2015 in Fargo, North Dakota. This is one of the smaller systems in the United States, but it has been very successful. This study examines the ridership data for Great Rides Bike Share during its first two years of operations, investigates it keys to success, and estimates impacts of weather, temporal, and spatial variables on bike share use. In terms of trips per bike per day, bike share usage in Fargo surpasses that of the largest programs in the country. Keys to its success were the presence of a college campus and the reduced barriers to use for college students. The ridership model showed that temperatures, wind, precipitation, and the location of stations on a college campus all have significant impacts on bikes share use.

1. Introduction

Bike share programs have the potential to provide a number of benefits to their users and to communities. Benefits of bike share programs include access to a low-cost public transportation option, improved health through increased physical activity, improved connectivity, flexible mobility, emission reduction, reduced fuel usage, support for multimodal connections, and a reduction of congestion on roadways (Kisner, 2011; Shaheen, Guzman, & Zhang, 2010). By reducing automobile use, these programs can have positive environmental impacts while reducing the need to spend resources on automobile infrastructure, improving the sustainability of cities.

Because of these benefits, a number of cities across the world and in the United States have implemented bike share programs in recent years. While many of these programs have been introduced in large cities, bike share programs are becoming increasingly popular in smaller cities as well. Great Rides Bike Share launched with 11 stations and 101 bikes in 2015 in Fargo, North Dakota, a city with an estimated population of 119,000. This is one of the smaller systems in the United States.

The study assesses success based on ridership per bicycle per day, which is a measure of total use and efficiency. Ridership and efficiency are important because as these measures increase, the community experiences greater benefits from the program, such as improved health of users and reduced fuel use, emissions, and congestion. Higher ridership and efficiency could also contribute to the sustainability of the program, though having a sustainable funding mechanism is also important. While the study focuses on trips per bicycle, other measures of success could also be considered based on the goals of individual systems.

Based on trips per bicycle per day, Great Rides Bike Share has been very successful, providing as many, or more, trips per bicycle as the largest systems in the country. A number of factors could be contributing to this success, such as the location of stations on a college campus, a low barrier to entry for college students, a flat topography, population density near stations, bicycle infrastructure, and walkability. On the other hand, the colder climate in Fargo, North Dakota, could be a limiting factor, and the location of stations on a college campus creates significant seasonal patterns. This study examines these and other factors contributing to the success of the program and affecting the level of ridership. While many bike share studies have been published in recent years, there is a lack of research on systems in smaller cities.

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2. Literature review

For small cities, Cock (2016) identified the following as being primary criteria for the success of bike share programs: presence of college campuses, bicycle facilities, recreational areas, being the region's primary market, and topography. These are factors identified as likely having a positive impact on ridership. Most existing studies have focused on bike share usage of larger systems in large urban areas, though they also identify the importance of bicycle facilities and other spatial variables.

2.1. Factors impacting use of bike share or personal bicycling

Existing studies on bike share usage have focused on weather variables, temporal variables, and spatial variables. Research also shows that bike share members place an importance on convenience and value for money, which are important factors motivating the use of these programs (Fishman, Washington, & Haworth, 2013).

2.1.1. Weather

Faghih-Imani, Eluru, El-Geneidy, Rabbat, and Haq (2014) analyzed hourly station-level arrival and departure rates in Montreal and found a positive correlation between temperature and bike share use. They found that humidity had a negative impact on usage, and rainy weather had a negative impact on departure rates.

Gebhart and Noland (2014) studied the impact of weather conditions on bike share trips in Washington, DC, by analyzing Capital Bikeshare's hourly trip data and relating it to hourly weather data. The study suggested that adverse weather conditions such as cold temperatures, rain, high humidity, and increased wind speed decreased bike share activity. Similar results were also observed in a study conducted by El-Assi, Mahmoud, and Habib (2015); for a bike share system in Toronto.

Similar to other studies, Gebhart and Noland (2014) showed that trips decreased as temperatures decreased, but they also decreased above 90°. They also found that there is less usage when it is dark outside, independent of any temperature effects. Gebhart and Noland (2014) noted that while many of the effects were not surprising, the impacts may be less pronounced than many would assume. Their results also suggest that the availability of transit influences how potential users respond to adverse weather conditions. They found that more people will choose to bike in the rain or cold temperatures if transit is less of an option.

In addition to these studies on bike share systems, many studies have analyzed the effect of weather on bicycling in general. Precipitation, cold temperature, wind, and snow have been shown to have significant negative impacts on bicycle trips made (Hjorthol, 2016; Nosal & Miranda-Moreno, 2014; Sears, Flynn, Aultman-Hall, and Dana (2012); Spencer, Watts, Vivanco, & Flynn, 2013). Studies have found, though, that leisure trips are more sensitive to weather conditions than commute trips, and weekend trips are more sensitive to weather conditions than weekday trips (Miranda-Moreno & Nosal, 2011; Nosal & Miranda-Moreno, 2014). Sears et al. (2012) studied bicycle commuting in Vermont and found that the likelihood of biking increased by 5% with a 1 mph decrease in wind speed and by 3% with every 1 °F increase in morning temperature, and the likelihood of bike commuting more than doubled on days with no morning precipitation.

2.1.2. Temporal variables

Bike share usage can vary based on time of day, day of week, or time of year. Analysis by Faghih-Imani et al. (2014) in Montreal regarding time-of-day variations found 1) usage is greater during the afternoon/evening hours, 2) there is a higher concentration of arrival rates in the central business district (CBD) in the morning peak hour, suggesting use for daily commute, and 3) bike flows are more spatially widespread in the evening peak compared to the morning peak. Faghih-Imani et al. (2014) also found that people were more likely to bike on the weekdays than the weekends, and usage increased on Friday and Saturday nights. Faghih-Imani, Hampshire, Marla, and Eluru (2017) also showed time-of-day variations in Barcelona and Seville, Spain, and Gebhart and Noland (2014) found differences between peak and non-peak periods within the day for bike share use in Washington, DC, as well as seasonal variations after accounting for weather and darkness effects.

2.1.3. Spatial variables

Spatial variables such as bicycle infrastructure and land-use/built environment variables can have significant impacts on bike share use. A number of studies, including research in Montreal, Toronto, Minneapolis-St. Paul, Washington, DC, Denver, and Australia, have found these variables to be important. These studies found the presence of bicycle infrastructure to be crucial. Bike share usage has increased when there are more bicycle facilities, such as bicycle lanes, paths, etc. (El-Assi et al., 2015; Faghih-Imani et al., 2014; Fishman et al., 2014; Rixey, 2013; Wang, Lindsey, Schoner, & Harrison, 2016).

Population density, job density, and access to restaurants and other commercial activity have been shown to have positive impacts on bike share use (Faghih-Imani et al., 2014; Faghih-Imani et al., 2017; Rixey, 2013; Wang et al., 2016). Wang et al. (2016) concluded that, in general, bike share programs are best suited for locations with higher population densities which have the scope to access a higher number of destinations. Distance to the CBD has been shown to have a negative effect on station usage (Faghih-Imani et al., 2014; Wang et al., 2016). Faghih-Imani et al. (2014) and El-Assi et al. (2015) both found that stations located near university campuses had increased demand, as did stations located near a transit station. Station density and the proximity to a network of other bike share stations have also been shown to have positive impacts on usage (Faghih-Imani et al., 2017; Rixey, 2013; Wang et al., 2016), as has the walkability of the neighborhood (Faghih-Imani et al., 2014). Faghih-Imani and Eluru (2016b) improved upon previous work to incorporate the impacts of interactions between spatial and temporal variables on system demand.

Several studies have found that increasing the number of stations within an area and the capacity of the stations increases usage, but as Faghih-Imani and Eluru (2016a) argued, the number of stations installed in an area and the capacity of those stations is based on the operator's expectation of system usage. Therefore, the unobserved factors influencing bike share usage also influence the installation of bike share infrastructure, and they found that previous models overestimated the impacts of these variables.

2.2. Bike share in smaller cities

The studies cited in the previous section were all conducted of large bike share systems in larger urban areas. There is a lack of research on systems in smaller cities such as Fargo. While it is likely that many factors that influence bike share use in large urban areas would also be important in smaller cities, some factors may become more important given the different geographic characteristics. Small cities may lack the density of population and commercial activity or presence of high-quality transit found in large urban areas. Therefore, the factors identified by Cock (2016), including the presence of college campuses, bicycle facilities, recreational areas, being the region's primary market, and topography, could be more important for small cities. Other factors not identified in the literature could also be important, such as reduced barriers to use and a sustainable funding mechanism.

3. Great rides bike share

Great Rides Bike Share launched in Fargo, North Dakota, in March 2015. It is a BCycle system managed by Great Rides Inc., a non-profit organization. The system was funded through a partnership with North Dakota State University. The NDSU student government voted to allow