Exploring the Role of Cost-Benefit Analysis In the Evaluation of Urban Cycling

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ABSTRACT

This work provides insight into the evaluation of urban cycling through the use of cost-benefit analysis. The goal of the work is to develop a cost-benefit analysis, specifically, for the evaluation of public bicycle projects that support urban cycling. After an in depth review of the literature a cost-benefit analysis framework is developed and presented. The framework incorporates several factors of particular importance when discussing the benefits and costs of cycling.

INTRODUCTION

In recent years, cities have identified urban cycling as an alternative means of transportation worth investment .City governments and researchers have found that cycling, as a means of "active transport", carries many benefits. Cities, such as Copenhagen, Amsterdam, and Portland, are promoting urban cycling because of its benefits. Due to this new growth in urban cycling, there is increasing demand for a method of evaluating cycling. The lack of data on significant external impacts created by cycling makes the standard CBA framework ineffective. Here we investigate how to build an effective CBA framework for evaluating cycling projects.

RATES OF CYCLING

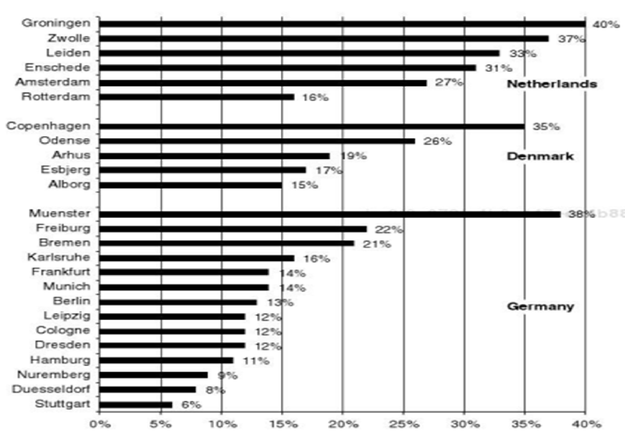

Figure 2.2
Bike share of trips in selected cities in the Netherlands, Denmark, and Germany, 2000–2009. *Sources:* ECMT 2004; City of Berlin 2010; Dutch Bicycle Council 2006, 2010; Socialdata 2009; HWWI 2010.

Literature Review

An in depth literature review was conducted in preparation for the development of the cost-benefit analysis. Research has analyzed cycling from many different perspectives. However, the background research for this study consists exclusively of studies that take on the functional lens. The functional lens applies directly to urban cycling. Within this current literature there is a trend towards cost-benefit analyses. Identifying this trend led to the decision to use cost-benefit analysis as the analytical tool used in this work. While applying cost-benefit analysis many of the studies worked to determine the impacts of cycling. In doing so several factors were identified as key factors that should be included in every analysis. Other potential factors were also identified as being tied to urban cycling. The literature also indicated best practices for calculating the effect of these factors. Unfortunately, the impact of some factors were difficult to realize with standard market prices. This was largely due to the existence of externalities. These externalities had been found to be a major obstacle in cycling research. Many studies called for further research on internalizing these externalities. Researchers also requested the generation of more cycling data, which could be used for benchmarking and additional research.

Table 2.1 Assessing the traffic effects of cycle initiatives

Effect for the economic CBA	Methodology to quantify traffic effects	Data requirement
Vehicle operating costs	Change in vehicle kilometre by mode, i.e. for different motorized vehicles, public transportation and bicycles.	Traffic counts and/or modelling.
Time costs	Change in transport time by transport mode.	Traffic counts and/or modelling.
Accident costs	Change in the number of accidents with and without bicycles involved.	Accident registrations, traffic counts and/or modelling.
Pollution and externalities	Change in vehicle kilometres for each mode of transportation.	Traffic counts and/or modelling.
Recreational value	Change in cycle kilometres and cyclists' statements.	Interviews and traffic counts and/or modelling.
Health benefits	Change in cycle kilometres.	Traffic counts and/or modelling.
Safety	Change in the number of accidents, cyclist statements and change in cycle kilometres.	Accident registrations, interviews and traffic counts and/or modelling
Discomfort	Change in cycle kilometres.	Traffic counts and/or modelling.
Branding value	Not a traffic effect.	-
Value for urban open spaces	Not a traffic effect.	-
System benefits	Change in cycle kilometres.	Traffic counts and/or modelling.

RESULTS: CBA FRAMEWORK

The results of this study offer a standardized model of a cost-benefit analysis specifically designed for urban cycling. This model indicates the key factors that must be addressed in any evaluation of urban cycling. Each factor is paired with the best practice for quantifying the factors impact and the data required in order to properly evaluate the factors impact. Using this framework will allow for consistency throughout the field of research.

The results of this study also provide a short list of best practices that can be implemented to promote urban cycling.

This cost-benefit analysis framework and the best practices for the development of urban cycling areas are based off of the most current research.

Effect for the Economic CBA	Methodology to quantify effect	Data requirement
Initial costs	Engineering cost estimates	Land acquisition, design project costs, construction
Upkeep costs	Engineering cost estimates	Overhead
Health	HEAT Assessment	HEAT inputs
Safety	Bicycle trip replacement rate multiplied by cost	Costs attributed to accidents
Insecurity	Stated preference	Survey data
Time	Bicycle trip replacement rate multiplied by cost	Travel time change and average wage
Congestion	Bicycle trip replacement rate multiplied by cost	Travel time change and average wage
Economic	Bicycle trip replacement rate multiplied by cost	Motor vehicle and bicycle operating costs
Social	Stated preference, or willingness to pay models	Survey data
Noise	Hedonic pricing	Real estate values
Air pollution	Bicycle trip replacement rate multiplied by cost	Unit prices on health cost determined by WHO
Climate Change	Bicycle trip replacement rate multiplied by cost	Travel time change and average wage

CONCLUSIONS

In review this study has addressed the difficulties that urban cycling research faces and how it can overcome these challenges. The first major challenge is the lack in availability of cycling data that can be used for benchmarking and research. This is a major issue that needs to be addressed in order for urban cycling to succeed. Another major issue that was addressed in this work is the lack of a standardized practice in the evaluation of cycling projects. This study and several of the studies referenced throughout are attempting to apply cost-benefit analysis to cycling projects. Applying cost-benefit analysis as a general practice will bring the evaluation of urban cycling in line with the methods used to analyze other forms of transportation. Lastly, there is a significant number of externalities that need to be internalized. This needs to occur before researchers can properly evaluate the true impact of cycling. By focusing on these major conclusions we can better inform cities and broader governments about the benefits of investing in cycling infrastructure and the promotion of urban cycling.

Table 6.1
Dutch bicycle facility selection matrix

Lane configuration	Average daily traffic (vehicles/day)	Street type and speed limit: Urban local street 30 km/h (19 mph)	Urban through street 50 km/h (31 mph)	Rural local road 60 km/h (37 mph)	Fast traffic road 70+ km/h (44+ mph)
Two-way traffic with no centerline	*<2500*	Mixed traffic[a]	Bike lane[b] or cycletrack[c]	Advisory bike lane[d]	Cycle track or low-speed service road
	2000–3000			Bike lane[b] or cycle track[e]	
	3000–5000				
	>4000	Bike lane or cycle track	Bike lane or cycle track[c]		
Two lanes (1 + 1)	*any*	Bike lane or cycle track	Bike lane or cycle track[c]		
Four lanes (2 + 2) or more	*any*	(Does not exist)	Cycle track or low-speed service road		

Source: CROW 2007.
[a]For designated bike routes, a bike lane or advisory bike lane is optional.
[b]May be an advisory bike lane on road sections with no centerline.
[c]Cycle track is preferred if there is parking; cycle track is recommended for designated bike routes.
[d]Although CROW (2007) gives "mixed traffic" for this cell, the default layout for roads in this category is to mark advisory bike lanes.
[e]Cycle track is preferred for designated bike routes.

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