Transportation Research Part A 70 (2014) 135–148

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

An ex-post CBA for the Stockholm Metro

Maria Börjesson *, R. Daniel Jonsson, Mattias Lundberg

Centre for Transport Studies, KTH, Royal Institute of Technology, Teknikringen 14, SE-100 44 Stockholm, Sweden

ARTICLE INFO

Article history:
Received 6 December 2013
Received in revised form 8 September 2014
Accepted 13 October 2014

Keywords:
Ex-post evaluation
Cost-benefit analysis
Appraisal
Land-use modeling
Metro
Wider economic impacts

ABSTRACT

This paper performs an ex-post cost-benefit analysis (CBA) of the Metro system in Stockholm built in the 1950s. We find that the Metro was socially beneficial and that the largest benefit of the Metro is its capacity, making it possible for many people to travel to and from the city center. We also assess the significance of the wider economic impacts due to labor market distortions and the land-use effects in the case of the Stockholm Metro. The wider economic impacts increase the consumer surplus with 48%, and the yearly income in the county with 1.5%. A land-use model is used to simulate how the land-use has been influenced by the Metro over the years 1956–2006. This simulation indicates that the historical centralized planning of housing along transit corridors has developed the region into a more dispersed region than if the market forces had ruled. The simulation also suggests that the land-use impact from the investment itself is small, but that the land-use impact from the planning accompanying the decision to build the Metro has been substantial.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Anyone who works with cost-benefit analysis of transport investments will recognize statements such as: "Cost-benefit analysis cannot be used to evaluate large transformative (rail) investments. Simplifying assumptions and omitted effects imply that such investments never pass a cost-benefit analysis."[1] Examples vary between countries, but in Sweden there is the anecdote that "the Stockholm Metro would not have passed a CBA when it was built in the 1950s."[2] However, the full costs and benefits of the Stockholm Metro were not assessed at the time nor have they been since.

The anecdote aims at discrediting standard cost-benefit analysis (CBA), but it is still true that applied CBA is relying on simplifying assumptions and omits effects that are difficult to measure. In many cases such simplifications and omissions will be irrelevant, but in some cases – typically large projects in urban regions – they might have a significant impact (De Palma, 2011; Worsley, 2011). Baum-Snow and Kahn (2005) even argue that evaluating the impact of investments such as the Washington Metro with marginal analysis is nearly impossible.

The first objective of this paper is to perform an ex-post cost-benefit analysis of the metro system in Stockholm. Standard CBA omits two potentially important effects: wider economic impacts due to labor market distortions and the land-use effects. A second objective of this paper is to assess the significance of these effects in the case of the Stockholm Metro. The difficulties and method of assessing these are not specific to Metro systems but apply to most large urban transport investments.

* Corresponding author. Tel.: +46 702 58 32 66; fax: +46 8 790 60 10.
E-mail address: maria.borjesson@abe.kth.se (M. Börjesson).

[1] Peter Eriksson och Karin Svensson Smith (both Green Party), svenska dagbladet, Brännpunkt 21 maj 2010.

[2] Stig Dingertz (M), intervju publicerad på www.stockholm.se/-/Nyheter/Om-Stockholm/Hans-sparvagside-blev-succe/ Maria Nygren (TransportGruppen), www.transportfakta.se/Debatt/?date=2009-10-01.

http://dx.doi.org/10.1016/j.tra.2014.10.006
0965-8564/© 2014 Elsevier Ltd. All rights reserved.

We use standard Swedish CBA guidelines and models to perform a CBA for the 1950s and we analyses how the land-use has been influenced by the Metro over the years 1956–2006, using a LUTI model. A hypothetical land-use is simulated under the assumption that the Metro system was not built in the 1950s.

Ex-post analyses are rare but rewarding, in this case displaying both costs and benefits of the Stockholm Metro as well as general methodological issues relating to transport modeling and scenario assumptions. Exposing merits, shortcomings and limitations of the CBA framework is a contribution of this paper. This paper also contributes to the literature by demonstrating the magnitude of different costs and benefits of a large-scale urban transit investment. The uncertainties with regard to benefit and cost estimates are in general smaller in an ex-post analysis than in standard ex-ante analyses. First, at least one of the infrastructure scenarios is not a hypothetical construct. Second, many exogenous factors, such as economic growth, population growth and different societal trends, including preferences of individuals and firms, are uncertain in an ex-ante analysis but are known in an ex-post analysis. Third, an ex-post analysis will not be used as a decision support, so it does not run the risk of being biased due to a strong political pressure, as is sometimes the case (Flyvbjerg et al., 2005).

Section 2 refer sets the stage by referring the existing literature. Section 3 describes the Stockholm Metro and Section 4 describes the method of analysis, including scenario development, CBA parameters, the method of assessing wider economic impacts and effects on land-use. Section 5 describes the transport and LUTI models. Section 6 presents results, including traffic effects, the CBA, the wider economic impacts and land-use impacts. Section 7 concludes.

2. Literature

Wider economic impacts due to labor market distortions, such as income taxation and agglomeration effects, have been subject to considerable attention and debate from researchers and policy-makers (Graham & van Dender, 2011; Lakshmanan, 2008; Venables, 2007). Such benefits are not regularly considered in Swedish transport CBA because the quantification of them is regarded to be too uncertain. An estimate of these benefits is, however, often added as a sensitivity analysis, using an estimated relationship between wages and workplace accessibility computed by the transport model (Anderstig et al., 2012). In this paper we use this relationship to assess the wider economic impacts of the Metro. It is similar to the relationships estimated between productivity and effective density reported in the literature (Rice et al., 2006; Ciccone and Hall, 1996; Combes et al., 2010), but the accessibility measure is more consistent with the CBA framework since it is computed directly in the transport model.

Long-term location responses to accessibility changes may help investments to create their own demand. Such responses are well established (Litman, 2007; SACTRA, 1999; Goodwin and Noland, 2003; Hills, 1996; Noland, 2001) but are seldom taken into account in appraisal. Advocates of Smart Growth argue that transit investments can help achieve higher density, while new highway investments tend to lead to the opposite, i.e. more urban sprawl (Bernick and Cervero, 1997; Newman and Kenworthy, 1989). If this is the case, induced land-used effects will also affect the CBA outcome due to increased positive or negative externalities such as congestion and pollution as well as increased optimal service frequency of transit (Mohring, 1972). Geurs et al. (2010) show how benefits from land-use changes can add a substantial benefit to a CBA, employing a Land-Use and Transport Interaction (LUTI) model.

Taking land-use effects into account in project appraisal may be particularly important in cases where the investment and land-use policy are integrated, as they were in the case of the Stockholm Metro. Land-use at a regional scale is an important determinant for public transit patronage (Taylor et al., 2009). The Metro was accompanied by a planning strategy to locate housing along transit corridors (Cervero, 1995). At the beginning of the 1950s, the inhabitants of Stockholm suffered from low housing standards and severe crowding due to a rapid increase in population. The centralized housing planning was also made possible because the Stockholm City Council had pursued a policy of acquiring land since 1904, and in 1980 owned 70% of land within its borders (Cervero, 1995). The basic planning strategy of developing residential areas along transit corridors has prevailed in the region since the 1950s.

One of the first systematic theory- and statistics-based studies in economic history using a counterfactual scenario was Fogel (1964). He attempted to quantify the effect on American economic growth of the railroads built up until 1890, finding that removing all railroads in 1890 would have decreased the GNP of year 1890 by 4.7% (Fogel, 1964, p. 234). The main conclusion was thus that "no single innovation was vital for the economic growth during the nineteenth century". While this study launched heated discussions over methods and in particular the use of a counterfactual scenario (Fremdling, 1977; McClelland, 1968; Redlich, 1965), few question its merit as a systematic and quantitative study. In more recent years, the bulk of ex-post analyses are primarily comparing forecasts of transport demand and construction costs with outcomes, occasionally updating earlier cost benefit analyses (e.g. Flyvbjerg et al., 2003, 2005). A similar approach to ours can be found in Geurs and van Wee (2006) who study the impact of compact town planning in the Netherlands, although not with the focus on CBA.

3. The Metro

The first part of the Stockholm Metro was opened in 1950 and most of the system was completed by 1960, although further parts were added until the middle of the 1970s. The present track length is 105 km, of which 62 km are in tunnels, with a total of 100 stations spread over three lines, see Fig. 1. The decision to build the Metro was taken by the Stockholm City

Download English Version:

https://daneshyari.com/en/article/6781419

Download Persian Version:

https://daneshyari.com/article/6781419

Daneshyari.com