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Land development impacts of BRT in a sample of stops in Quito and Bogotá

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ABSTRACT

Despite the growing popularity of bus rapid transit (BRT), little is known about its impacts on land development. In this paper we examine the land development impacts of BRT in Bogotá and Quito, two cities that have made a variety of BRT investments over the last two decades and with Curitiba, they have been world pioneers of BRT. Relying on 10 years of data, we use a quasi-experimental research design to quantitatively examine changes in land development in both cities. Outcomes include land market characteristics such as built area added per year (both cities), units added (Quito), building permits issued (Bogotá), changes in land use (Bogotá), and property price changes (Quito). We compare how outcomes vary over time for treatment corridors – those that received BRT service at various points throughout the decade, relative to control corridors in both cities, and in Bogotá also relative to a road-expansion corridor. In Bogotá, control corridors were corridors slated to get BRT but that had not received any BRT service yet, whereas in Quito they are adjoining areas. Results reveal heterogeneous impacts in both cities. Although increased building activity tends to concentrate in treatment areas, comparisons with controls suggest that the impacts are context dependent. Some stations showed very high development activity and others less so. Development induced along the road extension in Bogotá was considerable. In both cities, the strongest effects appear to concentrate in end-of-line terminals and stops built in the early 2000s. Whether BRT stimulates land development depends on institutional factors such as developer appetite, market conditions, land availability, and land regulations.

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1. Introduction

Bus rapid transit (BRT) has emerged as an innovative solution to the mobility needs of world cities. As with other mass transit alternatives, BRT can increase the attractiveness of transit, may help mitigate CO_2 emissions, and can be a catalyst for transit service reorganization. The success of BRT is largely the result of its cost-effectiveness and relative flexibility. BRTs often can carry as many passengers as most conventional light rail systems at a fraction of the cost. In coordination with supportive urban development, BRT can also decrease motorization (Combs and Rodriguez, 2014). In addition, when development along a BRT corridor is supportive of mass transit, other transit benefits can be attained. For example, the flow of passengers is balanced out and neighborhoods are reinvigorated.

As with rail systems, however, the operating cost-effectiveness of BRT hinges on the ability to have demand concentrated along system corridors (Dimitriou and Gakenheimer, 2011). Therefore, in most cases BRTs have been built in corridors with proven demand. This approach is naturally consistent with the view that travel is derived from the need to access destinations. Under the prevailing view, the transportation system is subservient to and conditioned by the existing spatial structure. Yet, a different paradigm in planning for mass transit is emerging. This new paradigm leverages the ability of mass transit to shape urban development. It focuses on using mass transit to stimulate land development that is intimately linked to the transit system and mutually beneficial. For the last four decades such paradigm has been actively practiced by cities like Stockholm and Copenhagen around their rail investments (Cervero and Kockelman, 1997) and is now being used to invigorate and regenerate well-located parts of the city (Knowles, 2012).

The use of mass transit as an instrument to shape land development is not limited to rail, but can also include BRT. As shown by the case of Curitiba (Gakenheimer et al., 2011), BRTs may also attract dense development that will in turn benefit the BRT system

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in the future. Notwithstanding Curitiba, and despite the importance of future land development as a strategy that can complement and build on the strengths of BRT, there is limited empirical evidence regarding the development impacts that BRT investments cause. The land development and redevelopment impacts of BRT investments are the focus of this study. We examine Bogotá and Quito, two cities that have made important BRT investments over the last two decades. Together with Curitiba, Quito and Bogotá have been world pioneers of BRT. In the next section of the paper we review the literature on the land development impacts of BRT. Then, we summarize the methodology used, present and discuss our main findings, and conclude.

2. BRT impacts on land development: Evidence to date

The virtuous cycle between transit investments and land development describes how infrastructure investments create accessibility benefits for dwellers and land owners. Because the number of parcels benefiting from enhanced access is finite, and assuming that access is a scarce good, households and firms valuing such benefits in a competitive market are expected to be willing to pay more for properties with good access over other properties, all else held equal. As a result the access benefits provided by a transportation investment are expected to be capitalized into property prices (Fig. 1). This capitalization frequently has three expected effects. First, developers will be more likely to invest in the property as their expected returns are higher than property investments elsewhere. Second, as a result of higher expected returns, investors are likely to acquire land in anticipation of the BRT investments. And third, developers will seek to amortize the higher property costs by building up. This virtuous cycle supports the potential of BRT to spur development around stations and along corridors. Because planning terminology has specific connotations in different cities, we understand land development as development of parcels, blocks, or larger urban areas that include public spaces such as streets, plazas, and parks. It refers to a broad range of urban processes such as greenfield development, redevelopment, revitalization, regeneration, and even renewal.

In Curitiba, BRT has been used as a tool to spur development that is considered transit friendly and mutually reinforcing. Development is considered transit-friendly or transit oriented when it has a strong pedestrian orientation that supports passenger access, it prioritizes pedestrian safety, is dense and with a mixture of land uses, has a variety of residential, office, and retail options, and encourages multimodal transportation. Curitiba's development around BRT stations has some, but not all, of these characteristics (Rodriguez and Vergel, 2013). Notably absent are the pedestrian orientation of development and the prioritization of pedestrian environments around the stations.

Despite Curitiba's experience, there is little research supporting the relationship between BRT investments and changes in urban development. Furthermore, little is known about the planning, institutional and market characteristics that spur built environment changes around BRT stations. This is an important gap given the immense popularity of BRT—156 cities have introduced BRT elements into their transit network (GlobalBRTData, 2015), the strategic and operating importance of BRT's potential to guide development, and its impacts on transit demand, societal equity, the environment, and public health.

The majority of research on BRT and development has focused on examining associations between access to BRT stations and property values, although the evidence is equivocal. In Latin America, the relationship between residential property values and distance to BRT corridors and feeder routes in Bogotá (Colombia) has been examined (Munoz-Raskin, 2010; Perdomo and Mendieta, 2007; Rodriguez and Targa, 2004). Studies using quasi-experimental research designs have produced inconsistent findings, with some studies finding property price increases of between 15% and 20% (Rodríguez and Mojica, 2009) and others finding null results (Perdomo, 2011). In Ecatepec (Mexico), the announcement of a BRT corridor had no impact on property values (Flores-Dewey, 2011).

In east Asia, two studies of China's first BRT, the Southern Axis in Beijing, found no significant associations (Ma et al., 2013; Zhang and Wang, 2013) while one study found that properties within 300 m of a BRT station had a 7.4% higher value than those within 300–500 m, and 15% higher than those within 500–1000 m of the station (Deng and Nelson, 2010). For the city of Guangzhou, also in China, a study found that proximity to the BRT corridor increased used apartment values up to a point (at around 1–2 km) and then began to decrease presumably due to the deleterious effects of corridor activity (Salon et al., 2014). In Seoul, Korea BRT investments were associated with residential property price increases of between 5% and 10% for residences within 300 m of BRT stations and between 3% and 26% for retail and other non-residential uses within 150 m (Cervero and Kang, 2011), while also in Seoul Jun (2012) found limited effects of BRT on residential property values within the influence area of the system.

Emerging research has examined actual development outcomes around BRT corridors, BRT stations, and in the influence area of BRT feeder routes. In Bogotá the expansion of the BRT was associated with increases in urban density but not changes in land uses (Bocarejo et al., 2012). Cervero and Dai (2014) suggest that in Bogotá's case, the mobility functions of BRT superseded its placemaking functions, yielding a cost-effective mobility system in the short term but with disappointing city-shaping impacts. In Beijing, six years after its inauguration, planners and real estate experts were decidedly positive about the impact of the Southern Axis BRT on high density residential development and real estate activity (Deng and Nelson, 2013). By contrast, in Jinan (China), the oversupply of auto-oriented land uses, midblock crossings on the corridor, lack of pedestrian infrastructure and connectivity, and parking issues were barriers to the introduction of BRT-oriented development (Thomas and Deakin, 2008). Finally, in Seoul (Korea), the BRT contributed to increases in development density in urban centers (Jun, 2012).

Relative to rail, BRT is perceived to have several disadvantages in stimulating urban development. First, BRT's ability to stimulate economic development may be limited because of its limited locational rigidity and permanence (Dittmar and Poticha, 2004). Accordingly, developers and firms are assumed to be more likely to locate residential, commercial and office developments along a rail line than along a BRT line. Hensher (1999) finds this reasoning unconvincing and for proof suggests that only one BRT line (in Australia) has been taken away. Furthermore, the disappearance of rail in the US and Australia during the last century is also a

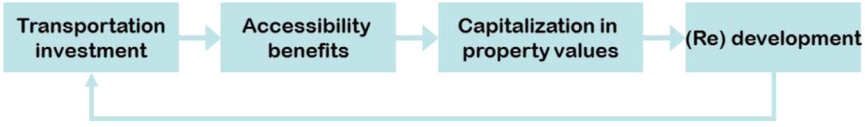

Fig. 1. The virtuous cycle of property development and redevelopment.