



The effect of transport cost on housing affordability: Experiences from the Bandung Metropolitan Area, Indonesia



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ABSTRACT

Transport and housing costs are interrelated due to their substantial share of household budgets. In many cases, households are making trade-offs by either spending more on housing in the inner city with lower transport costs or choosing more affordable housing in suburban areas, with higher commuting cost. This paper aims to examine housing and transport affordability by exploring middle to low-income household's transport and housing expenses in the Bandung Metropolitan Area (BMA), Indonesia. Households in nine locations within BMA with various housing type and spatial characteristics were surveyed. Collected data from 405 households are used to measure variables including fuel, parking, maintenance cost, public transport fares spent by households, rent and 'owner equivalent rent'. This study proposes the data envelopment analysis (DEA) method to measure affordability. The analysis measures each housing location's performance in terms of housing and transport affordability. The results indicate that the overall affordability is affected by housing type, choice of transport modes and distance to work and school. This study contributes to the growing literature of both transport and housing affordability and has implications for policy in the urban, housing, and transport sectors in Indonesia.

1. Introduction

Housing affordability remains a major concern for housing studies and practice worldwide. Limited land supply for housing in urban areas and the rapid growth of urban population causes a tightening of affordable housing supply. This induces a rise in housing prices and decreasing affordability, particularly for low-income households. Cities tend towards urban spatial expansion to the periphery where housing costs tend to be lower but transport costs are often higher.

US research indicates that housing and transport are two major expenses for most households (CTOD and CNT, 2006; Haas et al., 2006; Lipman, 2006). To cover both needs, households make trade-offs by spending more on housing located close to jobs and other facilities in the inner city or choosing more affordable housing in the suburban area with higher commuting cost. Typically, the affordability of housing is measured by relating housing cost to household income. This leads to a perception that renting or buying a house in suburban areas is more affordable. However, any decision on housing location affects a resident's travel behaviour. As commuting cost generally increases with the distance from employment and the city centre, at some point, savings from housing cost are outweighed by increasing transport cost (Isalou et al., 2014; Kellet et al., 2015; Litman, 2014; Mattingly and

Morrissey, 2014). Therefore, overall affordability requires affordable housing measured by combined housing and transport expenses.

Previous studies suggested that incorporating transport cost into housing affordability calculations can reveal a different pattern of affordability, particularly in less accessible locations. The spatial configuration of housing stress inside and outside the city centre areas alters when transport costs are included in the calculation. Residential areas with higher transport cost, mostly outside of the city centre, become less affordable (Guerra and Kirschen, 2016; Isalou et al., 2014; Vidyattama et al., 2012). A location's affordability level is associated with proximity to employment centres and other urban services and facilities (Mattingly and Morrissey, 2014; Mulliner et al., 2013) tenureship (Vidyattama et al., 2012) and a household's choice of transport modes (Kellet et al., 2015).

This paper aims to add the literature on the link between housing and transport cost by exploring the effect of transport cost on housing affordability in various combinations of housing type and residential location, in the Bandung Metropolitan Area, Indonesia. This research proposes the data envelopment analysis (DEA) method to examine the affordability of each residential area. Three research questions are posed: (1) How does housing affordability vary due to its location and housing type? (2) How does the measured housing affordability differ

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when transport cost is incorporated? (3) What are the factors that influence the level of combined housing and transport affordability including their implications for policy? By calculating the overall efficiency using the DEA method, the research shows how transport cost effects vary due to spatial and dwelling characteristics.

The paper is structured into five sections. Section 2 provides a summary of previous studies on combined housing and transport affordability. Section 3 contains the explanation of the methods. Section 4 provides the results and discussions. Section 5 presents the conclusions, research limitations and avenues for future research.

2. Literature review

2.1. Housing affordability

The term housing affordability has received considerable attention both in academic and policy debates, yet there is no single agreed definition and measure (Ndubueze, 2007; Nelson et al., 2004; Stone, 2006). Generally, the term depicts the relationship of housing expenses and household income indicated by the maximum amount of income that most likely should be paid by households, both renters and owner-occupants, which does not impose an excessive burden on their incomes (Gabriel et al., 2005). Benchmark values of housing affordability are used to provide meaningful information for policy making internationally. A benchmark for the maximum amount to be spent is generally 25–30% of household income, however, some have proposed higher values. For example, the European Union has an official indicator of “housing costs overburden” as 40% of income (Eurostat, 2014) and studies in the US and Australia have employed 50% of income as the “housing stress” benchmark (Gabriel et al., 2005; Kutty, 2005).

However, the need for a broader understanding of housing affordability is also recognised (Gabriel et al., 2005; Haas et al., 2006; Stone, 2006). As Yates and Gabriel (2006) suggest, while a ratio approach is the first step in calculating the cost component of housing affordability, one should proceed with efforts to make such measures more sensitive to other aspects, such as spatial variation. Accordingly, incorporating non-shelter cost in the calculation will provide a greater picture of housing affordability in terms of the trade-offs between housing costs and household consumption of other goods and services, such as transport.

2.2. Combined housing and transport affordability

Since the early 1980s, researchers have explored factors that influence housing affordability, particularly transport cost. In the US, research on combined housing and transport burden on working families in 28 metropolitan areas (Haas et al., 2006) showed that transport cost in many areas is as high or higher than housing, and low-income households are more likely to live in high transport cost areas. In order to provide a more comprehensive measure of affordability based on location, the Center for Neighborhood Technology (CNT) introduced the Housing + Transportation (H + T) Affordability Index to incorporate the interaction of housing and transportation costs. CNT has found that 15% of income is an achievable goal for transport affordability. Combined with 30% of housing affordability this results in a 45% benchmark for housing and transport affordability (CTOD and CNT, 2006). In a specific application of the H + T Index in the greater Washington DC, they showed that even though housing affordability in an area was predominantly 35% or less of total household income, when combined with transport cost the combined H + T burden rose above 45% in most areas (CNT, 2010).

The inclusion of a transport component in housing affordability measurement has also emerged outside the US. A number of recent studies have either applied the H + T Affordability Index or modified it based on country or local context. In Australia, a study by Vidyattama

et al. (2012) looked not only at capital cities but also in the areas outside in ‘balance of state’ areas. They found that the impact of transport costs on housing stress is greater for those living in the outside areas than the capital city areas. A recent study in the Melbourne metropolitan area proposed an improved measure of the H + T affordability index by using a more detailed estimation of transport costs. Vehicle operational and ownership cost, and public transit usage expenses, for both work and non-work trips, on weekdays and weekend, were used. The results confirm that once transport costs are included, the outer suburbs become less affordable than the inner areas (Saberi et al., 2017). Several studies from European countries provide similar results of the importance of incorporating location to reveal more appropriate measures of housing affordability. In many cases, the location affordability concept is often associated with transport disadvantage and oil vulnerability issue. Using the monocentric model of urban economics, a study in the Paris region examined the effect of transport costs on prudential measures in housing access from the lender's point of view (Coulombel, 2018). The study showed that integrating transport costs within prudential ratios induces households to live in a central area with low H + T burdens and protects low-income households' solvency, especially from increased fuel price. Cao and Hickman (2017) developed a composite index to measure car dependence and housing affordability in Greater London to address the vulnerability of neighbourhoods in relation to the rising oil prices and housing prices. The application of the index revealed that the outer suburbs were more vulnerable than other parts of Greater London, due to higher levels of car-dependence, longer distance to work and lower access to public transport, which influenced the overall vulnerability.

In the developing cities context, the application of H + T index has been tested in only few countries. Data availability and variation in context are challenges, which then results in contextual modifications on the concept's application (Guerra and Kirschen, 2016). The CNT's H + T index uses publicly available data to estimate housing and transport costs, which most likely come in different forms in each country, if available. The housing and transport system also vary between countries, even between regions within a country. A study in Qom City, Iran conducted a survey to collect housing and transport costs data to examine the H + T affordability. The results indicated that households in the suburban and central area spent 33.9% and 37.2% of their income on housing, respectively, which rose to 57.8% and 44.7% when transport expenditure was included (Isalou et al., 2014). In Mexico, Guerra and Kirschen (2016) applied the CNT's H + T Index to the Mexico City metropolitan area, but limited the transport analysis to non-driving households, since most households in Mexico city travel by public transit. Using data from household travel survey, the results support the centre-periphery assumption that the inclusion of transport costs flips the geography of affordability. Acolin and Green (2017) added the estimation of owners' housing costs and including both monetary and time costs of commuting to the H + T indices in their case study of the Sao Paulo metropolitan region. This study showed that for the lowest income quintile the combined H + T burden rose considerably from only 49.4% to 73.9% when transport costs are included; for the highest income quintile the increase is insubstantial, from 2.8% to 2.9%. Together these studies provide evidence that the combined housing and transport affordability concept has potential if applied in other developing countries, including Indonesia, subject to adaptation that is built on local conditions.

Indonesian cities certainly have specific local conditions. Most metropolitan regions feature Indonesia's version of urban sprawl, characterised by leap-frog out-of-sequence development, lower-density housing and a mostly single-use development pattern in newer suburban areas. Many metropolitan regions are monocentric, though Jakarta is so large as to have multiple centres. Urban areas sprawl into their peripheries, where the land is relatively cheap and available to accommodate increasing urban populations. Indonesian cities also have low motorisation rates when compared with American, Australian,

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